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Activity-Based Costing as a Basis for Transfer Prices and Target Setting

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Abstract:

Purpose: The article deals with a division of a large electronics company. The division intends to improve its product profitability using Time-driven Activity-based Costing. It also aims at aligning the incentives of executives by setting feasible transfer prices and motivating targets.

Design/Methodology/Approach: The article illustrates how variance analysis and Activity-based Costing help managers to understand the different profitability of products better.

Findings: The case study can serve both as a discussion basis in class as well as an exam for students in management, operations, and accounting.

Practical Implications: Students will need to reflect on how a mechanical application of incentive systems can lead to dysfunctional decisions that run counter to a company's business model.

Originality/Value: The open questions at the end of the article serve the purpose of raising students' awareness of the limits of cash-based incentive systems.

Keywords: Product profitability, Activity-based costing, transfer prices, target setting, incentives, restructuring, shareholder value, customer satisfaction.

JEL Code: M10, M41.

Paper Type: Case study.

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1. Introduction

GRASS is a division of the large electronics corporation BOLT. GRASS manufactures two models of robotic lawn mowers. The model “JOE” is designed for grass-and-bush yards. As other models of competitors, it offers value-for-money and is competitively priced. The model “JOHN” can handle complex task in complex gardens. From an engineering perspective, it is considered the premium model in the market. Yet, the price of JOHN is several hundred EUR below the closest, but technically inferior model, of the competition.

2. Literature Review

Activity-based Costing (ABC) assigns *overhead* cost to activities that are consumed by the provision of goods and services. Thereby, it considers more costs as *direct* than traditional absorption costing does (Atkinson *et al.*, 2011; Datar and Rajan, 2018). ABC has been developed to cope with changes in modern business environments where absorption costing is an inaccurate reflection of resource consumption, such as an increase in automation, proportion of indirect cost in total cost, and a stronger reliance on research and development (Cooper and Kaplan, 1991; Kaplan and Anderson, 2007). Since ABC provides more realistic information on resource consumption in modern product and service environments, it is a preferable choice to use for decision making (*e.g.*, in *transfer pricing: Horngren et al.*, 2016) and evaluation (*e.g.*, incentive systems: Lueg and Storgaard, 2017). The downside of ABC is that the data to run it is often hard to come by (Lueg and Morratz, 2017). This article illustrates the advantages of ABC (Lueg, 2015a, 2015b; Lueg and Malmrose, 2014).

3. Activity-based Costing and Activity-based Management

GRASS has two support departments (assembly, general factory and machines). They allocate their indirect cost to the two product lines JOE and JOHN. JOE and JOHN bear the cost of the support departments according to the number of units produced and sold (note: the costs are NOT allocated based on the revenue in EUR!). The head of the division, Gwen Green, has a hunch that this volume-based costing system does not reflect the resource consumption of producing these two lawn mowers. She would like to calculate the profitability of the two products using time-driven activity based costing (TDABC). You assist Gwen in mastering this task. You have the following data (Tables 1-3):

Required

- 1) Using the current, volume-based costing system, analyze the profitability of GRASS in general and its two products in particular by calculating their revenues, contribution margins, allocated overhead cost, total profits in EUR, and return on sales (RoS).

- 2) Using TDABC, analyze the profitability of GRASS and its two products again. Specifically, calculate the cost driver rates per hour of the two support departments, the new allocated overhead cost, total profits in EUR, and return on sales (RoS).
- 3) Analyze the differences between the current cost system and TDABC. Specifically, Gwen asks you if it is possible that there is a difference in the overall profitability of GRASS when switching from volume-based costing systems to TDABC. Please elaborate.
- 4) Elaborate on three suggestions how to improve the profitability of GRASS.

Table 1. Information on the current volume-based costing system

<i>[in EUR, unless stated otherwise]</i>	JOE	JOHN	Total
Units produced and sold [in units]	80,000	20,000	100,000
Average price [per unit]	900	1,900	---
Revenue			
Direct material	19,440,000	8,360,000	27,800,000
Direct labor	16,560,000	10,640,000	27,200,000
Contribution margin			
Assembly			13,200,000
General factory and machines			30,800,000
Profit			
<i>Return on Sales [in %]</i>			

Source: Author.

Table 2. Additional information for alternative allocation with TDABC

Cost driver rates	Total cost of support departments [in EUR]	Practical capacity [in h]	Cost driver rate per hour [in EUR]
Assembly	13,200,000	275,000 labor hours	
General factory and machines	30,800,000	246,400 machine hours	

Source: Author.

Table 3. Resources necessary to build one lawn mower

	JOE	JOHN
Labor hours	2.00	4.50
Machine hours	1.75	5.30

Source: Author.

4. Transfer Pricing and Managerial Implications

Some weeks later, Gwen has successfully restructured GRASS, and the numbers on JOHN have improved. GRASS transfers its lawnmowers to the SALES department. SALES then sells the lawn mowers to wholesalers. Each division is evaluated based on its reported profits. Gwen uses transfer prices to calculate GRASS' profits. The

new wholesale list price of JOHN is 2,200 EUR. The transfer price from GRASS to SALES for the lawn mower JOHN are variable cost of 1,750 EUR plus 12%, so a total of 1,960 EUR per unit. SALES' distribution costs are 50 EUR per unit. JOHN now requires 5 hours of machine time. The practical capacity of the machines assigned to the production of JOHN is 100,000 hours per year and cannot increase. GRASS plans to produce and sell 20,000 units of JOHN per year.

The engineers at GRASS have developed a modification to JOHN that would allow mowing steep slopes. This enhanced version of JOHN is called RAMBO. The modification process would start with a completed unit of JOHN. GRASS would then incur additional costs of 85 EUR and 1.25 hours of extra machine time to convert JOHN into RAMBO.

Required

- 5) What range of transfer prices is feasible for JOHN? Please explain your answer (one sentence).
- 6) What should be the minimum wholesale list price for RAMBO if it was produced at the expense of JOHN?
- 7) Which main approach to transfer pricing does GRASS use? Which three other approaches do you know? Describe the basis of the transfer price in each approach (one sentence).

5. Incentive Systems

BOLT introduced a new bonus plan for its heads of divisions. BOLT considers net operating profit after tax (NOPAT) and the customers' net promoter score (NPS) vital for its long-term performance. Thus, the bonus plans award bonuses equal to 0.75% of salary for each 1% increase in NOPAT and NPS. For example, increasing NOPAT by 12% and decreasing NPS by -2% (=10% increase) will result in a bonus of 7.5% of salary (10% x 0.75). Declining NOPAT or NPS count against the bonus, but the overall bonus cannot be negative. BOLTS three gardening divisions (GRASS, FLOWER, and POND) reported the following results (Table 4):

Table 4. Incentive formula

	GRASS			FLOWER			POND		
	2017	2018	change	2017	2018	change	2017	2018	change
Net Operating Profit After Tax (NOPAT) [in mEUR]	9.2	9.7		12.0	15.0		7.0	7.1	
Net Promoter Score (NPS) [index 0 to 100]	74	76		24	22		99	98	
Sum of changes [in %]	-	-		-	-		-	-	

Bonus of salary [in %]	-	-		-	-		-	-	
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Source: Author.

Required

- 8) Determine the bonus (in % of salary) for each head of division.
- 9) Use the results in the divisions as examples to discuss two interactions between NOPAT and NPS.
- 10) The CFO of BOLT is concerned that targets in the bonus system do not align overall goals of BOLT with incentives of the heads of divisions. Elaborate on the system's three most important shortcomings.
- 11) Gwen Green likes the transparent number base of the bonus. Yet, she reckons that she would feel more motivated if the bonus took some other form than cash. Describe two alternatives to cash when awarding bonuses. Also, explain one advantage (for either the executive or the company) that each one has over a cash payment.

6. Discussion of the Case

Both instructors and students should see the case study as an opportunity to discuss solution approaches with each other, and understand different interpretations of the underlying numbers (Lueg and Lueg, 2014; 2015; Lueg *et al.*, 2016). Related instructional case studies are available (Lueg, 2019a; 2019b; Lueg and Lueg, 2013; Malmlose and Lueg, 2014). Approaches to the problems and possible answers are numbered according to the questions above.

- 1) **Absorption costing:** Students should multiply the average price with the number of units to get the revenue. Deducting the direct cost gives the contribution margin. Since JOE makes up 80% of the sales (80,000 units of a total of 100,000), it absorbs 80% of the cost of Assembly (80% x 13.2 mEUR = 10.56 mEUR). JOHN absorbs the rest. Dividing the resulting profit by the respective revenues yields the RoS (Table 5):

Table 5. Solution absorption costing

<i>[in EUR, unless stated otherwise]</i>	JOE	JOHN	Total
Units produced and sold [in units]	80,000	20,000	100,000
Average price [per unit]	900	1,900	---
Revenue	72,000,000	38,000,000	110,000,000
Direct material	19,440,000	8,360,000	27,800,000
Direct labor	16,560,000	10,640,000	27,200,000
Contribution margin	36,000,000	19,000,000	55,000,000
Assembly	10,560,000	2,640,000	13,200,000
General factory and machines	24,640,000	6,160,000	30,800,000
Profit	800,000	10,200,000	11,000,000
<i>Return on sales [in %]</i>	<i>1.1%</i>	<i>26.8%</i>	<i>10.0%</i>

Source: Author.

- 2) **TDABC:** The alternative allocation of TDABC requires cost driver rates (Cooper & Kaplan, 1991; R. Lueg, 2015a; R. Lueg & Malmrose, 2014; R. Lueg & Morratz, 2017; R. Lueg & Storgaard, 2017). For Assembly, this is 13.2 mEUR: 275,000 labor hours = 48 EUR/h. For GF&M, this is 30.8 mEUR: 246,600 machine hours = 125 EUR/h. These rates are multiplied by the required times the number of units produced. Example: For allocating Assembly costs to JOE, this means 2h x 48 EUR/h x 80,000 units = 7.68 mEUR. Alternative calculation of profitability using TDABC (Table 6):

Table 6. Solution time-driven activity-based costing

	JOE	JOHN	Total
Contribution margin	36,000,000	19,000,000	55,000,000
Assembly	7,680,000	4,320,000	12,000,000
General factory and machines	17,500,000	13,250,000	30,750,000
Profit	10,820,000	1,430,000	12,250,000
<i>Return on sales [in %]</i>	<i>15.0%</i>	<i>3.8%</i>	<i>11.1%</i>

Source: Author.

3) Analysis:

- To answer the **general** questions first: it is very likely that the overall profitability of the division changes, since TDABC only allocates costs of resources that were actually used.
- There is little idle time in the **machining** department with 400 idle hours (= 246,600h [practical capacity] – 1.75h x 80,000 units [JOE] – 5.3h x 20,000 units [JOHN]). There is a danger that this department becomes a bottleneck. The cost of idle capacity is negligible with 50,000 EUR (=125 EUR/h x 400h)
- The **assembly** department has 25,000 hours of idle capacity (=275,000h [practical capacity] – 2h x 80,000 units [JOE] – 4.5h x 20,000 units [JOHN]). Multiplied with the CDR of 48 EUR, the cost of idle capacity is 1.2 mEUR.
- The RoS of GRASS as a whole has **increased** from 10% to 11.1%. This is because cost of idle capacity is not allocated to the products. They need to be dealt with at another level than operations (i.e., Gwen needs to deal with these costs), since the operations managers can most likely not alter capacities.

4) Discussion: Students may elaborate on three of these issues (or others of their choice)

- A main problem of the overall profitability is the low profitability of JOHN. As stated, JOHN is a differentiated product in quantity competition that appears to be **underpriced** by several hundred EUR. Simply raising the price will boost profitability. This might require a marketing campaign.
- Gwen should find out what the variance in the price is for JOHN. It only states that the “average” price is 1,900 EUR. What is the list price, and who

- is being given **discounts** for what reason? Consequently, pricing might be further refined by the cost-to-serve different customer types.
- Gwen must find out why there is **idle time** of 25,000 labor hours in the assembly department. Reasons may be that the machining department is (almost!) a bottleneck, seasonality, shared resources, labor policies, rework, or a high rate of sick leaves. Possibly, a cultural change relating to morale is necessary. In a last step, Gwen needs to check if these human resources can be redeployed (Halkjær and Lueg, 2017).
 - Gwen should check if **operations** need to be fine-tuned. The direct cost for the two lawn mowers appear to be almost identical, they comprise 50% of the sales price (450 EUR for JOE, 950 EUR for JOHN). How come that the overhead cost are 3.75h of support for JOE, but JOHN needs 9.8h? This might be caused by batch sizes, number of setups, or sustaining costs for JOHN, which is produced in smaller quantities.
 - **Bottleneck:** Alternatively, the machining department is almost a bottleneck with only 400 free hours per year. Maybe this is the reason the assembly workers cannot do any more work. Gwen could check if the machining department can add a shift.
- 5) Transfer prices (TPs) must be in a range that allows each division to make profits (Atkinson *et al.*, 2011). This way, managers exchange resources and maximize the profit of the entire company. The minimum TP must be the variable cost of GRASS (so $TP_{min} = 1,750$ EUR p.u.), so GRASS does not incur a loss. The maximum TP must not exceed the list price (2,200 EUR) less the cost (50 EUR) incurred by SALES (so $TP_{max} = 2,150$ EUR). Thus, sensible TPs range from 1,750 EUR to 2,150 EUR.
- 6) Since GRASS is at full capacity, RAMBO needs to be manufactured at the expense of JOHN (opportunity cost). GRASS will be willing to produce RAMBO if it incurs the same profit that JOHN would provide (Kaplan and Anderson, 2007; Lueg, 2015b):
- JOHN has a contribution margin of 400 EUR, which is 2,200 EUR [list price] – 1,750 EUR [variable cost] – 50 EUR [distribution cost]. Multiplied with 20,000 units made and sold, this gives a total profit of 8 mEUR.
 - Alternatively, GRASS can only manufacture 16,000 units of RAMBO (=100,000 units [practical capacity] : 6.25 h/unit). If GRASS wants to have the same profit of 8 mEUR from these 16,000 units, RAMBO's contribution margin per unit must be 500 EUR. This is 100 EUR more than JOHN's. In addition, GRASS incurs an additional cost of 85 EUR/unit of RAMBO. Hence, the list price of RAMBO must exceed JOHN's list price of 2,200 EUR by 185 EUR, which yields a list price of 2,385 EUR per unit of RAMBO.
- 7) The four approaches to transfer pricing are (Horngren *et al.*, 2016):

- The market-based approach uses costing information that is publicly available from comparable transactions
- The cost-based approach (what GRASS uses) uses internal costing information as a basis
- The negotiation-based approach uses the agreement of two internal managers as a basis
- The administered approach lacks information and is simply determined by a top manager

8) The bonuses in % are as follows (Table 7):

Table 7. Solution incentives

	GRASS			FLOWER			POND		
	2017	2018	change	2017	2018	change	2017	2018	change
Net Operating Profit After Tax (NOPAT) [in million EUR]	9.2	9.7	5.4%	12.0	15.0	25.0%	7.0	7.1	1.4%
Net Promoter Score (NPS) [indexed 0 to 100]	74	76	2.7%	24	22	-8.3%	99	98	-1.0%
Sum of changes [in %]	-	-	8.1%	-	-	16.7%	-	-	0.4%
Bonus [in %] of salary	-	-	6.1%	-	-	12.5%	-	-	0.3%

Source: Author.

- 9) Students may elaborate on two of these issues (or others of their choice):
- There seems to be an inverse relationship between NOPAT and NPS. Strong increases in NOPAT appear to have negative effects on NPS (cf. FLOWER).
 - Some divisions might be harvesting NOPAT today at the expense of NPS. Such a business is not sustainable for a long time (cf. the low NPS for FLOWER).
 - Some units might be over-investing into NPS to a point where it does not pay off anymore (cf. POND) (R. Lueg & Nørreklit, 2012).
 - From these few data, a relationship is hard to see, anyway. Investments into the NPS might exhibit a lagged effect on performance (Albertsen and Lueg, 2014; Jakobsen and Lueg, 2012; Nielsen *et al.*, 2019).
- 10) Students may elaborate on three of these issues (or others of their choice):
- It is questionable to reward changes in existing levels, especially in NPS. Divisions with a high levels cannot improve further.
 - The overall size of the bonus might be too small to encourage aligned behavior.

- All targets are global (common measure bias) and not tailored to the divisions.
- Targets have no benchmarks, like the general market development. This allows for windfall profits, or punishes a well-performing manager in a downturn economy.
- Overall, there cannot be negative consequences from the bonus. This encourages “big bath” behavior.
- There are only stretch targets, but no base targets of minimally acceptable performance. For instance, a very low NPS score should not be acceptable at all (Lueg *et al.*, 2015; Lueg and Radlach, 2016).
- Two targets might be too narrow. While NPS is a comprehensive, leading measure, customers cannot judge the technical capabilities per se that will ensure a sustainable development of the divisions. At least one additional goal on learning, research, development, and quality might be appropriate.
- The targets do not account for synergies between the gardening divisions and might encourage competitive behavior.
- The targets encourage myopic behavior, since they only reflect the past year.

11) Students may elaborate on three of these issues (or others of their choice):

- Stock options: support long-term view of executives; cheap for the company if issued “out of the money” (Burkert and Lueg, 2013)
- Bonus banks: company defers payment; executive might get extra gain depending on the interest rate (Lueg, 2008; 2010)
- External perquisites (e.g., insurance; company car; memberships): company might be able to strike an outstanding deal that would not be available to the executive in the free market (Atkinson *et al.*, 2011).
- Internal perquisites (e.g., parking space; award): adds meaning for the executive; free for the company (Datar and Rajan, 2018).
- Promotions/grooming programs: long-term effect for the executive; company can keep the best talent.

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