

# **Problems at Wingo's Widgets: Using Data Analytics to Explore Labor Rate and Efficiency Variances for Decision Making**

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## **Abstract**

In this managerial or cost accounting case, students utilize analytical tools to investigate labor related data of a fictitious company to provide recommendations to senior management about how bonuses should be allocated. The purpose of this case study is to provide students with a real-world application of how variance analysis can help solve managerial problems and provide data needed to create ethical recommendations in business. Students will utilize Excel to interpret and visualize the data provided and then prepare recommendations for management. In addition to improving students' analytical skills and communication skills, this case requires students to utilize critical thinking to assess the ethical implications of their recommendations. Pre and post survey results agree that students utilized and improved their confidence in analytical and critical thinking abilities. Student feedback was extremely positive with students praising the practical nature of the case as well as its focus on key data analytic techniques.

**Keywords:** Data Analytics, Decision Making, Variance Analysis, Labor Rate, Labor Efficiency

## **The Case**

### ***Company Background and Management Team***

Wingo's Widgets is a large privately held company headquartered in Lincoln, Nebraska, which provides specialty widgets to companies worldwide. The company was founded in 1960 by Wingo Tillman as a family business with five employees. At year-end 2020, the company employed over 850 employees. The current CEO of the company is Charles Tillman, Wingo's grandson.

### ***AVP of Production: Tonya Griff***

Tonya Griff was hired by Charles Tillman as a consultant in 2015. The company had been experiencing a period of growing pains; leading to shortfalls in orders and a decline in revenues. The company lacked the capacity to keep up with thriving demand. Charles was impressed with Tonya's vision of decentralizing production to five strategically placed plants near the company's headquarters. This would allow the company to expand its operations and enhance its distribution channels. All five plants were operational by the end of 2017. In addition, each of the five plant locations were in similar working-class localities.

Tonya was promoted to the AVP of production and put in charge of managing all five plants. Charles gave Tonya permission to hire additional personnel to support the operations.

For several months, Tonya tried to manage all five plants herself but quickly realized that she was in over her head. Furthermore, because her office was physically located at the headquarters of Wingo, Tonya found it extremely difficult to manage the daily operations of the five plants.

In April 2018, Tonya hired five production managers to oversee each of the five locations. As shown in Exhibit 1, they report directly to her.

### ***Labor Standards and Expectations***

While Tonya was skilled at growing the business, dealing with human resources and compensation related items was not in her wheelhouse. She confided in a few of her mentors in similar industries for advice on how to manage her new direct reports. It was recommended that she construct standard labor efficiency and standard labor rates to serve as overall guidance for the production managers. These standards would serve as benchmarks to help guide managers. Tonya recommended that each manager follow the standards developed; however, she allowed each manager the flexibility to deviate from standards as they deemed appropriate.

Tonya's primary objective was to achieve her production target. In 2020, Tonya informed each manager that they were responsible for processing 20,000 widgets per month (240,000 for the year). Based on the standards, the expected labor cost for each plant would be \$480,000 for the year. See Exhibit 2 for the standards developed by Tonya and her calculation of total labor expenses.

### ***Bonus Allocations***

Wingo's Widgets was profitable for 2020. As a result, in January 2021, Charles met with Tonya and informed her that there was \$50,000 available in the bonus pool, specifically for the five production managers, leaving Tonya fully responsible for allocating the bonuses as she saw fit. Tonya recalled that each manager successfully met the goal of processing the 240,000 units requested, so she deemed it fair to reward each manager equally. She also reviewed the spending variance report and noted that direct labor had a slightly favorable variance. In her mind, each manager must have been on par with the others, and it was not worth digging into, given the small variance that existed. Tonya sent an email to the managers to inform them that they would each be receiving a check for \$10,000. See Exhibit 3 for the Spending Variance report.

**The Meeting**

Tonya received a call from the plant manager of Plant 4. Concerns were expressed about bonus allocation. The conversation went as follows:

**Plant Manager 4:** Tonya, I was pleasantly surprised that we would be receive a bonus this year. That said, I was a little surprised that money was equally split among the five of us. I don't want to come across as ungrateful, but would you be able to provide some detail as to how you landed on the equal split?

**Tonya:** You and the other plant managers worked hard throughout the year. The bonus was earned and I'm grateful to have you all on my team! I don't see your question as being ungrateful. You know that I try to be as transparent as possible with you. Regarding the allocation, I felt that since each of you met the overall output target, and the overall direct labor variance was slightly favorable, all five of you were performing on par with your peers.

**Plant Manager 4:** Tonya, I can appreciate what you said about hitting output targets, and I'm glad each of us were able to do that! However, I see a big issue with how you interpreted the favorable labor variance. The report that you are using is an aggregate of all five locations. It's extremely likely in this case that a favorable variance by one location is hiding the unfavorable variance by another.

**Tonya:** Hmm... what exactly do you mean? Can you be more specific?

**Plant Manager 4:** Well, I made changes this year in my plant. Rather than using the standard hourly wage rate of \$10, I am only paying my employees \$9 per hour. This \$1 decrease from the standard had to have a positive impact on my plants' total labor cost, and I believe is responsible for the positive variance you are seeing. In fact, the variance should probably be much higher, which means there are probably issues at other plants that you are missing. For this reason, I think my bonus should be higher than my peers. I found a way to save the company money!

**Tonya:** I didn't realize you are paying your employees less than the \$10 per hour standard rate and I can see how that might impact the total labor cost associated with your plant. I think this warrants a deeper dive into the numbers to better understand performance across each of the plants. Thank you for bringing this to my attention. I'm going to reach out to one of the financial analysts to do a deeper dive into the labor variance.

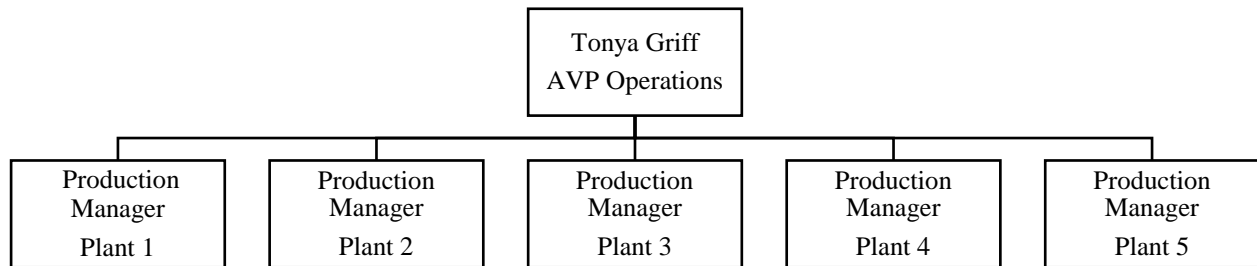
Tonya and the manager ended the call. Tonya called one of the company's leading financial analysts and explained the situation. Tonya provided the analyst with a full dataset of all the payroll and relevant information needed to perform his analysis.

**Discussion Questions**

1. Looking at Exhibit 3, which of the overall spending variances do you believe warrant further investigation by Tonya? What criteria did you use to come to that decision?
2. Use the information in the included Excel file and the information provided by Tonya to calculate the overall labor spending variance for the company.
3. Additionally, you should also calculate the labor rate and labor efficiency variances.
4. To gain further insight into the activities of each plant, calculate the overall labor spending variance, labor rate, and labor efficiency variances by plant. Provide a visualization that best portrays your findings.
5. What are the positives and negatives of paying all managers the same bonus?
6. What are some advantages and disadvantages of using a spending variance as a mechanism for performance evaluation?
7. Describe the ethical issues present in the case. What ethical issues may come to light if the bonus is paid entirely based on the overall labor spending variance? What about if it's based on the labor rate variance alone? How might management overcome the potential for people to act unethically?
8. Based on your thorough analysis of labor, what recommendations do you have for management surrounding the distribution of the bonuses? Use the calculations and the analysis you have completed thus far.

9. As a result of investigating the direct labor rate and efficiency variances for Wingo's Widgets, what has this exercise taught you about the importance of responsibility accounting in budgeting and variance analysis?

### Exhibit 1



### Exhibit 2

<b>Standards:</b>	
Standard Labor Rate Per Hour	10
Standard Hours Per Widget	0.2
<b>Expectations:</b>	
20,000 Widgets processed per month by each plant location	
<b>Calculation:</b>	
Widgets Processed (20,000 x 12 months)	240,000
Standard Hours Per Widget	<u>0.2</u>
Total Stand Hours Needed	48,000
Stand Labor Rate	<u>10</u>
Total Standard Labor Cost Per Location	480,000
Locations	<u>5</u>
Total Standard Labor Cost	2,400,000

**Exhibit 3**

Wingo's Widgets Production Department Spending Variances For Year Ended December 31, 2020 (In thousands)				
	Actual Results	Flexible Budget	Spending Variances*	
Items Processed:	1,200	1,200		
Expenses:				
Direct Materials	3,489	3,450	(39)	U
Direct Labor	2,389	2,400	11	F
Overhead	1,545	1,600	55	F
Electricity	47	55	8	F
Rent	350	325	(25)	U
Insurance	80	78	(2)	U
Misc.	<u>14</u>	<u>17</u>	<u>3</u>	F
Total Expenses:	<u>7,914</u>	<u>7,925</u>	<u>11</u>	F
<p>*The expense variances are labeled favorable (unfavorable) when the actual expense is less than (greater than) the flex budget amount.</p>				

## Introduction

This case is based upon a fictitious company, Wingo's Widgets. Students are asked to calculate, analyze, and prepare visualizations for labor rate and efficiency variances of the various segments that make up Wingo's Widgets. The purpose of this case study is to provide students with a real-world application of how variance analysis can help solve managerial problems and provide data needed to create ethical recommendations in business. The primary objective of this case is to have students evaluate the performance of different segments of a business to prepare a recommendation for awarding production managers bonuses. This case offers an opportunity for faculty to work with students on a difficult topic of variance analysis, while simultaneously demonstrating to students the importance of responsibility accounting in making management decisions. This case helps to bring home the answer to the question "why is this important?" by providing real-world problems and opportunities for ethical decision making.

## Case Learning Objectives and Implementation Guidance

### *Learning Objectives*

After completing this activity, students should be able to:

1. Calculate and interpret the overall labor spending variance, labor rate variance, and labor efficiency variance.
2. Use Excel to analyze a large data set and create a data visualization that effectively communicates the findings.
3. Discuss critical issues about accounting and managerial decisions related to variance analysis.
4. Analyze the potential for management decisions to incentivize unethical behavior and develop suggestions for management to reduce the likelihood of unethical behavior.
5. Design and support the results of an analysis clearly and effectively.
6. Understand the importance of responsibility accounting.

The learning objectives are mapped to the discussion questions in Table 1.

### *Motivation*

Data analytics can be used to collect, organize, and store diverse types of data. In addition, one of its main uses is to derive insights from data in order to drive decisions at all levels of an organization (Olavsrud, 2021). Data analytics is used in conjunction with a company's accounting and control systems in order to monitor and evaluate a company's financial controls (Blocher et al., 2021). Financial controls are utilized within companies that produce goods and services in order to compare their budgeted (standard) and actual costs. Once calculated, the differences (variances) between standard and actual costs can be assessed as either favorable or unfavorable. In relation to financial controls, favorable results are viewed as measures that are contributing to an organization's operational goals through either cost savings or increases in efficiencies (Blocher et al., 2021). Data analytics can be utilized in order to provide directors of operations and production managers with information to assess performance at the organization and segment levels. Moreover, data analytics and performance management are growing more popular across various sectors ranging from manufacturing to banking, healthcare, and education (Techlabs, 2017).

Accounting educators need to address critical thinking and analytical thinking skills in response to industry demands. CPA Evolution updates reflect more of an emphasis on data analytics as they pertain to auditing and business environment and concepts (Dorata, 2021). In addition to changes within the CPA Exam, the Institute of Management Accountants (IMA) has also implemented changes to the Certified Management Accountant (CMA) Exam based on demand for more technology and analytical skills that are needed within various industries (Bierwirth, 2019). As the integration between business and analytics becomes more of a standard, future accounting students need to make certain that they are equipped with adequate skills in order to address these demands.

Over the last two decades, the cases and activities published in leading accounting journals covering variance analysis and responsibility accounting ask students to make basic variance calculations and recommendations (Farkas, Kersting, & Stephens, 2016; Lamberton, 2008; Vesty & Brooks, 2017), but few cases ask students to use data analytics

and perform an analysis (Convery & Swaney, 2012). While Calderon et al. (2018) and Messer (2016) cover similar topics within management accounting, they do not provide a comprehensive approach as demonstrated within the context of our case. Albritton et al. (2022) address accounting areas such as cost behavior, flexible budgeting, and responsibility accounting; however, their case does not address the area of big data, root cause analysis, and data analytic.

In direct response to new professional demands and changes to certifications, this case is the first to utilize a full dataset of financial and non-financial information to investigate direct labor rate and efficiency variances at a deeper level. Students' technology and analytical skills are developed as they merge, analyze, and interpret business data to derive meaning from various sources of information as it relates to data visualization and performance evaluation and measurement.

### ***Intended Audience and Implementation Guidance***

This case study is intended for a graduate managerial or cost accounting course and has been used in both an in-person and virtual classroom. This case should be covered after students have a foundation of planning and flexible budgeting and variance analysis. The instructor should recommend that students bring their computers to class (or group students together so at least one person per group has access to Excel) if computers are not readily available in the class.

In implementing the case, we recommend placing students in groups, having them calculate the variances on their own, and asking students to focus on a few of the discussion questions per group. This will provide them with ample time to attempt the calculations on their own while still having enough time to thoroughly develop their discussion question answers. Alternatively, students could complete the calculations on their own prior to class and spend the class period in small groups working on the discussion questions. The class can reconvene and have a valuable discussion of the calculations, the analysis, and the ethical implications of their recommendations.

Full teaching instructions are available in appendix B.

### **Evidence of Classroom Efficacy**

The case was administered in five graduate managerial accounting classes with two instructors (98 students enrolled) at a regional private university and in one graduate cost accounting course (19 students enrolled) at a regional public university. Pre- and post-case surveys were approved by the Institutional Review Board (IRB) and formatted similarly to previous cases (Dow, Watson, and Shea 2013; Cunningham & Stein, 2018). The pre-case survey was administered before the case materials were shared with the students. Students were informed that the survey would evaluate their knowledge and comfort levels with certain course-related topics. Following the completion of the study, students completed a post-case survey. This survey included the same questions as the pre-case survey, as well as additional perception-based questions to measure case effectiveness. The students were informed that completion of the surveys was both voluntary and anonymous and would have no impact on their course grade.

Of the 111 graduate students who completed the pre-survey, 103 graduate students (92.8 percent) completed the post-case survey. A portion of the drop-off in participation was attributed to the course withdrawal deadline falling close to the case conclusion and students leaving a virtual class early before the post-case survey could be administered. Table 2, Panel A presents the results of eight questions related to the key learning objectives of the case. The pre- and post-test mean values, along with their significance levels, are presented. Table 2, Panel B presents the results of the additional questions asked after completion of the study to measure students' perceptions. These questions were included only in the post-case survey.

The combined survey results in Table 2 indicate that this case was effective in achieving the desired learning objectives. Responses in Panel A were provided on a five-point Likert scale, where 1 represents "strongly disagree" and 5 represents "strongly agree". The results indicated that students' confidence significantly increased between the pre- and post-case surveys for almost all learning outcomes. More specifically, the learning objectives with some of the highest increases were questions related to students' confidence in their ability to calculate and interpret various

variances (Q1 total mean change of 0.649), confidence in their ability to analyze the potential for management decisions to incentivize unethical behavior (Q5 total mean change of 0.688), and confidence to think critically about accounting and managerial decisions (Q4 total mean change of 0.413). The results for the learning objectives related to students' confidence in their ability to use Excel to analyze large datasets (Q2 total mean change of 0.102) were marginally positive but not significant. This can be attributed to the graduate program student population having at least 7 years of industry experience and a high likelihood of familiarity with Excel.

Responses in Panel B were provided on a five-point Likert scale, where 1 represents "strongly disagree" and 5 represents "strongly agree". The survey results indicated that students thought the case was interesting (Q1 total mean of 4.64), was of appropriate difficulty (Q2 total mean of 4.55), required critical thinking (Q3 total mean of 4.68), and should continue to be included in future courses (Q7 total mean of 4.60). Aligning with the key motivations of the case, the results indicated that student knowledge of variance analysis improved (Q4 total mean of 4.51), and students felt empowered to perform similar calculations in the future (Q6 total mean of 4.24). The mean values for each of the seven questions were significantly different (p-value, 0.001) from the scale's midpoint value of 3 using one-sample t-tests, as noted in Table 2.

Qualitative responses from the students also suggested that the case had achieved the learning objectives. Students noted that they enjoyed the real-world aspects of the case as well as the transferability of skills. Several positive comments were received, including but not limited to the following:

"Great activity. I will likely use something like this in the real world and it was great to get an introduction to the topic. I recommend you continue to assign this to future students as I am sure they will also learn a lot from it."

"This project give practical experience which is awesome."

"I enjoyed this project and I feel as though it helped me better understand Spending and efficiency variances"

"This was the best exercise we've done in this course. Loved the realistic application!"

"I learned a lot about excel, especially about pivot tables. This will help me greatly in my accounting internship."

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## Appendix A – Student Feedback

**Table 1**  
**Learning Objectives and Discussion Questions Mapping**

Learning Objectives	Discussion Questions
1. Calculate and interpret the overall labor spending variance, labor rate variance, and labor efficiency variance.	<p>1. Looking at Exhibit 3, which of the overall spending variances do you believe warrant further investigation by Tonya? What criteria did you use to come to that decision?</p> <p>2. Use the information in the included Excel file and the information provided by Tonya to calculate the overall labor spending variance for the company.</p> <p>3. Additionally, you should also calculate the labor rate and labor efficiency variances.</p> <p>4. To gain further insight into the activities of each plant, calculate the overall labor spending variance, labor rate, and labor efficiency variances by plant. Provide a visualization that best portrays your findings.</p>
2. Use Excel to analyze a large data set and create a data visualization that effectively communicates the findings.	<p>4. To gain further insight into the activities of each plant, calculate the overall labor spending variance, labor rate, and labor efficiency variances by plant. Provide a visualization that best portrays your findings.</p>
3. Discuss critical issues about accounting and managerial decisions related to variance analysis.	<p>1. Looking at Exhibit 3, which of the overall spending variances do you believe warrant further investigation by Tonya? What criteria did you use to come to that decision?</p> <p>5. What are the positives and negatives of paying all managers the same bonus?</p> <p>6. What are some advantages and disadvantages of using a spending variance as a mechanism for performance evaluation?</p>
4. Analyze the potential for management decisions to incentivize unethical behavior and develop suggestions for management to reduce the likelihood of unethical behavior.	<p>7. Describe the ethical issues present in the case. What ethical issues may come to light if the bonus is paid entirely based on the overall labor spending variance? What about if it's based on the labor rate variance alone? How might management overcome the potential for people to act unethically?</p>
5. Design and support the results of an analysis clearly and effectively.	<p>8. Based on your thorough analysis of labor, what recommendations do you have for management surrounding the distribution of the bonuses? Use the calculations and the analysis you have completed thus far.</p>
6. Understand the importance of responsibility accounting.	<p>9. As a result of investigating the direct labor rate and efficiency variances for Wingo's Widgets, what has this exercise taught you about the importance of responsibility accounting in budgeting and variance analysis?</p>

**Table 2**  
**Panel A: Pre- and Post-Case Questions**

	Pre case Mean (Std. Dev.) (n = 111)	Post case Mean (Std. Dev.) (n = 103)	Mean Difference
Q1: I am confident in my ability to calculate and interpret the overall labor spending variance, labor rate variance, and labor efficiency variance.	3.633 (0.892)	4.282 (0.719)	0.649***
Q2: I am confident in my ability to use Excel to analyze a large data set.	4.063 (0.866)	4.165 (0.841)	0.102
Q3: I am confident in my ability to use Excel to create a data visualization that effectively communicates the findings of my analysis.	3.738 (1.033)	4.009 (0.902)	0.271**
Q4: I am confident in my ability to think critically about accounting and managerial decisions.	3.955 (0.802)	4.368 (0.641)	0.413***
Q5: I am confident in my ability to analyze the potential for management decisions to incentivize unethical behavior.	3.729 (0.883)	4.417 (0.721)	0.688***
Q6: I am confident in my ability to develop suggestions for management to reduce the likelihood of unethical behavior	3.918 (0.905)	4.359 (0.725)	0.441***
Q7: I am confident in my ability to communicate the results of an analysis clearly and effectively.	4.027 (0.878)	4.388 (0.689)	0.361***
Q8: I understand the importance of using responsibility accounting in a business.	4.414 (0.768)	4.699 (0.501)	0.285***

\*\*denotes significance at the 1% level and \*\*\*denotes significance at the .1% level.

**Table 2**  
**Panel B: Post-Case Questions Only**

	Mean (Std. Dev.)
	<hr style="width: 100%; border: none; border-top: 1px solid black; margin-bottom: 2px;"/> (n = 103) <hr style="width: 100%; border: none; border-top: 1px solid black; margin-top: 2px;"/>
Q1: The activity was interesting.	4.640*** (0.660)
Q2: The activity was the appropriate level of difficulty for this course.	4.553*** (0.696)
Q3: The activity required me to use critical thinking skills.	4.689*** (0.505)
Q4: The activity improved my knowledge of variance analysis.	4.514*** (0.698)
Q5: This activity improved my understanding of how to perform relevant data visualizations.	4.233*** (0.782)
Q6: The activity improved my confidence in being able to perform similar calculations in the future.	4.242*** (0.845)
Q7: I would recommend this activity continue to be used in this course.	4.601*** (0.718)

\*\*\*denotes significance at the .1% level.

## Appendix B – Teaching Instructions (For Instructors Only)

The following instructions are best suited for an undergraduate classroom environment where students are working in groups to complete the case with hands-on guidance from the professor. It can be easily modified to a graduate class by removing explicit guidance and pointed questions. The instructions assume that the students have already read the case.

**Step 1.** Either as a class or in groups, students will discuss the spending variances in Exhibit 3 and the appropriateness of Tonya's decision to skip analysis of the direct labor variance given the small positive variance. Students will also discuss ethical issues that could arise by using variances to dictate bonuses, as well as paying employees more or less than the company standard.

Potential questions to ask students with potential responses as sub bullets include:

- If you were in Tonya's position, which variances would you prioritize to review first? Why? (Consider variance size, favorability, time available).
  - Overhead variance should be analyzed first as it is the largest, followed by Direct Materials and Rent. Students tend to ignore favorable variances; however, without knowing what is causing the variance, it is possible to swing in a future period.
- What are some drawbacks of only focusing on negative variances or large variances?
  - Ignoring large positive variances might lead to future issues down the road. A large positive variance could easily become a large negative variance in a subsequent period if a root cause analysis is not performed. Small variances also have potential to become large variances.
- What are the advantages and disadvantages of using spending variances as the sole mechanism for performance evaluation?
  - Variances are only a single input. Focusing solely on a spending variance ignores other qualitative and quantitative factors.
- What ethical issues may come to light if the bonus is paid entirely based on the overall labor spending variance? What about if it's based on the labor rate variance alone?
  - If bonus is paid solely on the spending variance, it could incentive managers to hire the cheapest labor possible without regard to skill level and experience. If the bonus is paid solely on labor rate variance alone, it could incentivize managers to not reward deserving employees with raises. Managers also might lowball qualified employees who are desperate for a job.
- How might management overcome the potential for individuals to act unethically?
- Plant Manager 4 paid his employees less than standard, which saved the company money. Senior management should develop policies and procedures around sensitive items such as wage rates that require review and approval when deviations occur. Decisions should be made at a central office by independent parties to avoid conflicts of interest or potential unintended consequences. What are the ethical implications of Plant Manager 4's decision to pay his employees less than the \$10 standard rate suggested by the company in order to achieve a favorable rate variance?
  - Companies develop standards as benchmarks. While a deviation from a standard is warranted, it would be appropriate to offer employees more or less than the standard rate based on their prior work experience and skill level. Offering below the standard rate to boost a personal bonus is self-serving. In addition, it could also negatively impact the company as potential qualified employers might reject a job offer.

**Step 2.** Either as a class or in groups, students will discuss the positives and negatives of paying all the managers the same bonus amount and how the decision might impact motivation.

Potential questions to ask students with potential responses as sub bullets include:

- Put yourself in the shoes of Plant Manager 4. If you believed that you were outperforming your peers, how would you react to the news that everyone was receiving the same bonus?
  - Individuals might react negatively to this news as they feel their extra work effort / “going above and beyond” was for naught. It is also possible that managers who are more “team oriented” might not really care at all.
- How might that news impact your future motivation? Do you feel like you are being incentivized to work hard?
  - In this situation, managers might feel unmotivated as they went above and beyond and were not rewarded for it.

**Step 3.** Prior to analyzing the raw data provided, students will make a preliminary recommendation on how they would allocate bonuses. Would they allocate bonuses equally? Would they favor one manager over another? Ask students to explain their reasoning. Potential responses as sub bullets include:

- Some students will opt to allocate bonuses equally and trust in the decision made by Tonya.
- Some students will argue that Plant Manager 4 is warranted a larger bonus, while others will argue he deserves less due to his unethical behavior.
- Other students will allocate bonuses equally as they don’t feel they have enough information to do otherwise. However, they will want to investigate further and let future findings influence their decisions.

**Step 4.** Either individually or in a group, the students will recreate Exhibit 2 of the case and calculate the company’s standard labor cost based on the standard labor rate and labor hours presented in the case facts.

Optional: Professors can choose to withhold the original calculation (Exhibit 2) from the students and have them create it on their own.

Packages	1,200,000	20K packages * 5 location * 12 months		
per hour	0.2			
Total Hour	240,000			
wage rate	10			
Budget	2,400,000			

**Step 5.** Now that the standard labor cost is calculated, the professor will introduce the dataset to the students. The dataset is the actual payroll data of the plant workers and contains key information such as hours worked and pay rate per period. These data points are utilized to calculate paycheck amounts.

The professor will demonstrate to students how to utilize a pivot table to summarize the data for the entire company and verify that the spending variances reported in Exhibit 3 are as reported. Utilizing the “Payroll” tab of the excel workbook, the professor will insert a pivot table, ensuring that all columns and rows are selected. The fields *Total\_Hours* and *Hourly\_Rate* should be added to the Values section of the pivot table as shown.

The pivot table below summarizes data and shows the company’s actual total hours spent on labor as well as the average hourly labor wage paid. Students will multiply the total hours and average hour rate together which will give them the actual direct labor cost of the company. This should agree with the amount presented in Exhibit 2 (rounded). Students will subtract the actual from the standard presented and arrive at the labor variance of roughly 11K.

Budget Spend	2,400,000
Actual Spend	2,389,150
	10,850

**Step 6:** Students will draw on their existing knowledge of revenue and spending variances and manually calculate the labor rate and labor efficiency variances for the company utilizing either the 3-bucket approach or formula method (whichever they were taught). The results are the same regardless of the approach. The professor can choose the level of guidance provided to the students based on their level of comfort with the calculations.

- Bucket Approach:

AH * AR	AH * SR	SH * SR
239,682 * 9.968	239,682 * 10	240,000 * 10
2,389,150	2,396,820	2,400,000
	7,670	3,180
	Favorable	Favorable
	Labor Rate Variance	Labor Efficiency Variance

- Formulas Approach:

Labor Rate:  $AH(AR - SR) = 239,682 (9.968 - 10) = -7,670$  – Favorable

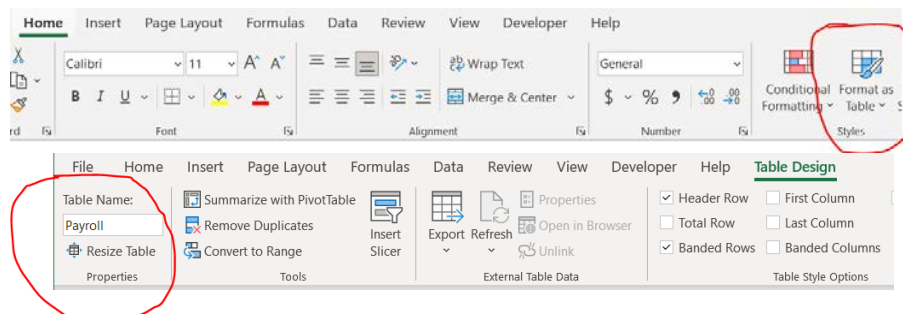
Labor Efficiency:  $SR(AH - SH) = 10 (239,682 - 240,000) = -3,180$  – Favorable

**Step 7.** The professor will remind the students of their ultimate task: Calculate the labor rate and labor efficiency variances for each of the five locations. The professor will ask students what modifications could be made to the pivot table in order to see the data in a more useful way. The correct answer is that location related information is needed, and at this point that field is not on the “Payroll” tab of the data.

The professor will discuss that data is not always presented in the way we need it in order to run analytics, and modifications and additional steps might need to be taken to prepare data for analysis. This is in line with working with data in the real-world, where data preparation is a fundamental component of data analysis.

Specific to this case, the data required is on 2 separate tabs of the workbook. The data will need to be combined so all pertinent fields become available. The professor should ask students to identify methods they are aware of to accomplish the task. The easiest way is by utilizing the XLOOKUP or VLOOKUP function in Excel to bring the “location” column on the HR Data tab into the payroll table. Steps are as follows:

- Ensure you are on the payroll tab of the workbook. On the “home” tab of Excel, select “Format as Table”. On the “Table Design” tab, rename the table “Payroll”.



- Rename column K “location”. In cell K2, perform a XLOOKUP or VLOOKUP to pull the location field from the HR data and pull it into the Payroll Table. The result should now show the state of each employee's HR record.
  - XLOOKUP: = XLOOKUP([@[EMP\_ID]],'HR Data'!A:A,'HR Data'!E:E,0)
  - VLOOKUP: = VLOOKUP([@[EMP\_ID]],'HR Data'!A:E,5,FALSE)

H	I	J	K
<b>FED_TAX</b>	<b>OTHER_TAX</b>	<b>NET_PAY</b>	<b>LOCATION</b>
\$ 191.26	\$ 72.60	\$ 546.14	Plant 2
\$ 159.00	\$ 60.35	\$ 585.65	Plant 2
\$ 193.56	\$ 73.47	\$ 542.97	Plant 2
\$ 154.39	\$ 58.60	\$ 592.01	Plant 2
\$ 182.04	\$ 69.10	\$ 558.86	Plant 2
\$ 152.09	\$ 57.73	\$ 610.18	Plant 2
\$ 162.61	\$ 62.10	\$ 594.70	Plant 2

Optional: Professor can either guide the students through the V/XLOOKUP as a demonstration or demonstrate a V/XLOOKUP on a different dataset. Students can then take the skills learned and apply them to this case.

**Step 8.** Utilizing the dataset with the included “plant” field, the professor will direct students to recreate the pivot table they originally created, but now at the plant level. Have the students save the average hourly rate (AR) and total hours (AH) of each location to the template provided and complete the efficiency and rate variances using the formula method. The easiest way to accomplish this is to copy the data in the pivot table and paste it in the template as “values” and then perform the calculations. The formulas are provided to the students in the template as a reminder.

Row Labels	Average of HOURLY_RATE	Sum of TOTAL_HOURS
Plant 1	10.250	46,302
Plant 2	10.000	48,450
Plant 3	11.000	38,400
Plant 4	9.000	57,780
Plant 5	10.000	48,750
<b>Grand Total</b>	<b>9.968</b>	<b>239,682</b>

Drag fields between areas below:

**Filters**

**Columns**

Σ Values

**Rows**

LOCATION

**Values**

Average of HOURLY\_RATE

Sum of TOTAL\_HOURS

Optional: The professor can either demonstrate the pivot table creation right away or can give the students time to attempt the pivot table on their own. If the latter method is chosen, the professor should remind the students of the goal: to identify the average rate and total hours by location so a variance analysis can be performed for each location.

Optional: Professor may opt to not provide the students with the template and have the students calculate the labor rate and efficiency variances on their own.

Blank Template:

Location	AH	AR	SH	SR
Plant 1			48,000	10
Plant 2			48,000	10
Plant 3			48,000	10
Plant 4			48,000	10
Plant 5			48,000	10

AH (AR - SR)	SR (AH - SH)
Labor Rate Var	Labor Efficiency Var
-	-

Completed Template

Location	AH	AR	SH	SR
Plant 1	46,302	10.25	48,000	10
Plant 2	48,450	10.00	48,000	10
Plant 3	38,400	11.00	48,000	10
Plant 4	57,780	9.00	48,000	10
Plant 5	48,750	10.00	48,000	10

AH (AR - SR)	SR (AH - SH)
L - Rate Var	L - Efficiency Var
11,576	(16,980)
-	4,500
38,400	(96,000)
(57,780)	97,800
-	7,500
(7,805)	(3,180)

Complete formulas for the labor rate variance for each plant are as follows. The calculations are the actual hours (AH) multiplied by the actual rate (AR) less the standard rate (SR)

- Plant 1:  $46,302 * (10.25 - 10) = 11,576$  (Unfavorable)
- Plant 2:  $48,450 * (10.00 - 10) = 0$
- Plant 3:  $38,400 * (11.00 - 10) = 38,400$  (Unfavorable)
- Plant 4:  $57,780 * (9.00 - 10) = -57,780$  (Favorable)
- Plant 5:  $48,740 * (10 - 10) = 0$
- Total of all plants:  $11,576 + 38,400 - 57,780 = -7,805$  (Favorable)

Complete formulas for the labor efficiency variance for each plant are as follows. The calculations are the standard rate (SR) multiplied by the actual hours (AH) less the standard hours (SH)

- Plant 1:  $10 * (46,302 - 48,000) = -16,980$  (Favorable)
- Plant 2:  $10 * (48,450 - 48,000) = 4,500$  (Unfavorable)
- Plant 3:  $10 * (38,400 - 48,000) = -96,000$  (Favorable)
- Plant 4:  $10 * (57,780 - 48,000) = 97,800$  (Unfavorable)
- Plant 5:  $10 * (48,750 - 48,000) = 7,500$  (Unfavorable)
- Total of all plants:  $-16,980 + 4,500 - 96,000 + 97,800 + 7,500 = -3,180$  (Favorable)

**Step 9.** In groups, the professor will direct students to create useful visualizations for the labor rate variance, labor efficiency variance, and overall labor spending variance for each location to get better insights into performance and determine who was ultimately responsible for the favorable variances at the company level.

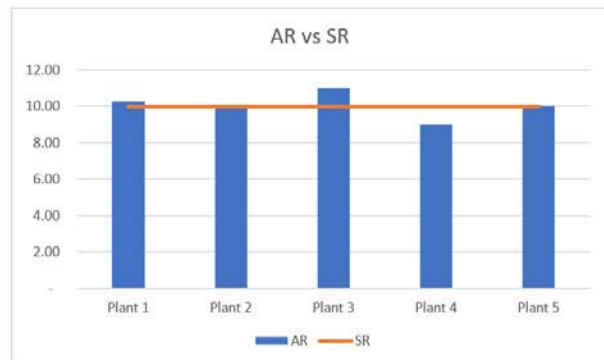
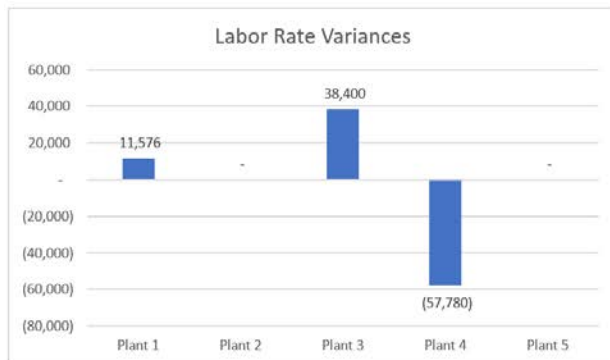
The professor will ask the students to review each location and discuss what the visualizations are showing them based on rate, efficiency, and overall. The professor should ask the students to recall the argument made by the plant manager at location 4 and why he should have received a higher bonus than his peers. Ask students to assess the merits of his argument based on what they know now. Some specific questions with potential responses as sub bullets include:

- Ask students how they would allocate bonuses?
  - If the analysis is done correctly, students should notice that the plant manager at location 4 has the worst overall labor spending variance. While he saved the company money by paying his employees less per hour, his employees worked significantly more hours to get the work done. Students who are in favor of using bonuses as a reward mechanism should opt to give this manager a lower bonus compared to his peers. Some students will still argue to pay bonuses equally as one data point should not be the sole reason for awarding bonuses. Other factors should be considered.
- Who should be rewarded?
  - Students who are in favor using the bonus to reward the plant managers will opt to give larger bonuses to plant manager 3 and plant manager 1.
- Are you in favor of equal bonuses across the board?
  - Similar to above, some students will still remain in favor of equal bonuses across the board. They will hold firm that other factors should be considered when allocating bonuses.
- What takeaways would you report back to management regarding their standards?
  - Students might recommend that the company require their hiring teams to use fair labor practices across all of the plants. Deviation from standards should require appropriate rationale that is reviewed and approved by multiple individuals to remove any unethical behavior. Students might also suggest that the variables considered to allocate bonuses are documented and shared with the staff. That way everyone knows exactly how they are being measured ahead of time.

Optional: The following charts are suggestions of items that can be built directly with the students or shown to the students after they are given an opportunity to try to build meaningful visualizations on their own. If the professor decides to build the visualizations with the students directly, students can still be put in groups to discuss the implications and the above questions. If the professor decides to let the students make their own visualizations, the following can be shared with the students after group discussions.

**Labor Rate Visualizations**

- Plant 4 has a positive (or favorable) labor rate variance that saved the company approximately \$57K, and we can see it is due to the actual labor rate being less than the standard rate.



**Instructions:**

- Highlight the following cells from the template, insert a clustered column

Location	AH	AR	SH	SR
Plant 1	46,302	10.25	48,000	10
Plant 2	48,450	10.00	48,000	10
Plant 3	38,400	11.00	48,000	10
Plant 4	57,780	9.00	48,000	10
Plant 5	48,750	10.00	48,000	10

AH (AR - SR)
L - Rate Var
11,576
-
38,400
(57,780)
-
(7,805)

Change Chart Type

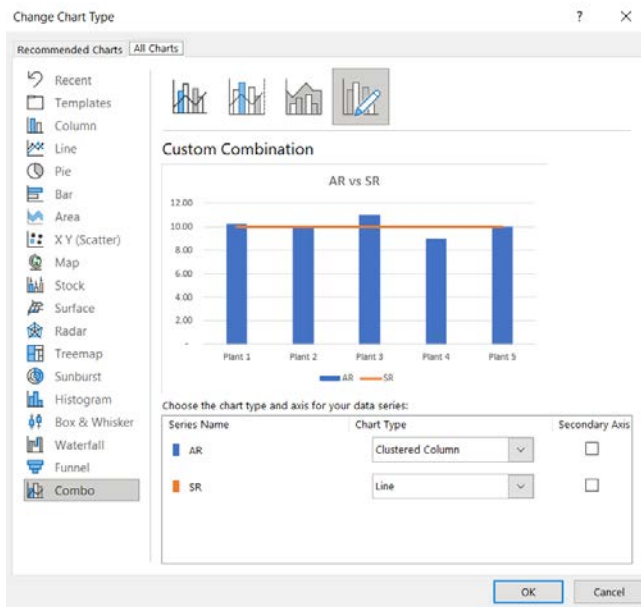
Recommended Charts | All Charts

- Recent
- Templates
- Column
- Line
- Pie
- Bar
- Area
- XY (Scatter)
- Map
- Stock
- Surface

Clustered Column

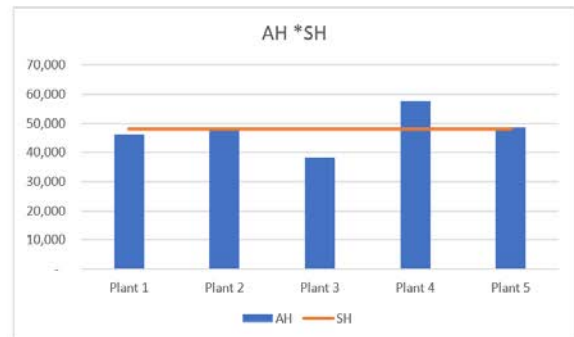
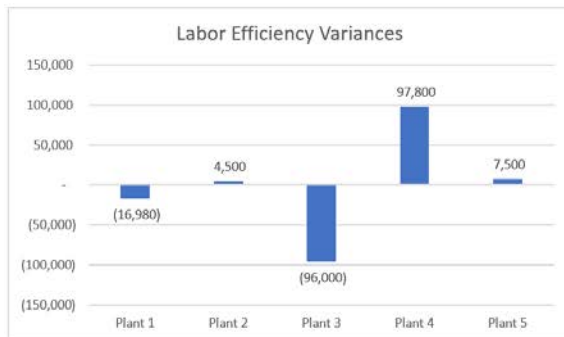
Labor Rate Variances

- Select the Location, AR, and SR columns, insert a combo chart



**Labor Efficiency Visualizations**

- Plant 3 has a positive (or favorable) labor efficiency variance that saved the company approximately \$96K, and we can see it is due to the actual labor hours being less than the standard hours. On the other hand, Plant 4 used more hours than they should have, which ultimately cost the company an extra \$97K.

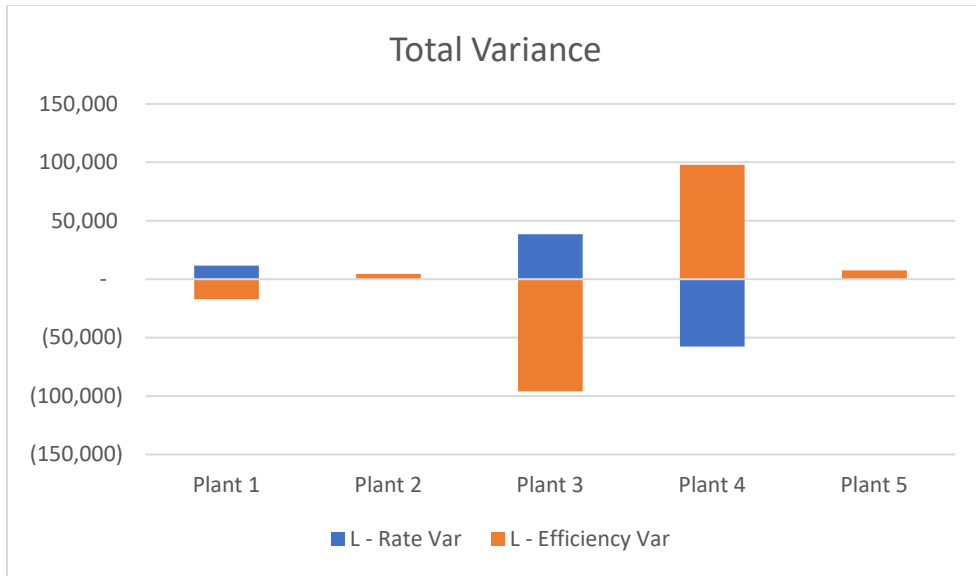


**Instructions:**

- Same as the labor rate instructions, just highlight efficiency data and hours instead of rate data.

**Total Variance Visualizations**

- Combining the rate and efficiency variances illustrates that while plant 4 is saving the company on labor rate variance, it is costing the company more than it is saving because of the negative efficiency variance. On the other hand, Plant 3 is the exact opposite. While they might be losing the company money from a rate variance perspective, they are saving even more on efficiency.



**Instructions:**

- o Highlight the plant, labor rate, and labor efficiency variance data. Select stacked column.

Location	AH	AR	SH	SR
Plant 1	46,302	10.25	48,000	10
Plant 2	48,450	10.00	48,000	10
Plant 3	38,400	11.00	48,000	10
Plant 4	57,780	9.00	48,000	10
Plant 5	48,750	10.00	48,000	10

AH (AR - SR)	SR (AH - SH)
L - Rate Var	L - Efficiency Var
11,576	(16,980)
-	4,500
38,400	(96,000)
(57,780)	97,800
-	7,500
(7,805)	(3,180)

Change Chart Type

Recommended Charts | All Charts

- Recent
- Templates
- Column
- Line
- Pie
- Bar
- Area
- X Y (Scatter)
- Map
- Stock
- Surface

Stacked Column

**Step 10:** Together as a class, the professor will show the graphs on the screen and ask groups to share their results and findings. At this point, the professor can make certain the students were correct with their visualizations and coach the students to appropriately interpret the results.

The professor should highlight that Plan Manager 4 underpaid his employees, which led to a favorable rate variance. However, the employees were less efficient, which resulted in a negative spending variance. The opposite occurred in plant 3. They paid their employees an above average wage rate, which resulted in efficiency gains that outweighed the cost of increased wages. We can see the same benefit for plant 1 that raised their rate over the year from \$10 to \$10.50 (\$10.25 yearly average).

Modifications: In the above instructions, the case was solved by the students and discussed as a class. The professor has the option to have students formally present their visualizations or findings to the class, or perhaps submit a formal written memo to management that highlights the results of their work.

**Bonus Analytic:** Have the students utilize the HR Data tab of the excel workbook and create a pivot that shows the number of employees by status based on the rate paid. Create a graph of the results.

The results show that the locations that paid the lowest hourly rate had a much higher turnover than other locations. This could have a variety of negative implications on the organization as turnover could have led to increased onboarding costs, training costs, loss of efficiency or slowdowns, or lack of mentors.

Prct Turnover is calculated by dividing the number of terminated individuals by the total number of individuals. For example, there were 49 total employees who earned a \$9 per hour rate. 19 of those employees were terminated.  $19 / 49 = 38.7\%$

