Group Number:	7
Assignment Title:	Group Assignment 3
Course Code:	RSM8411
Instructor Name:	Gerhard Trippen

In submitting this **group** work for grading, we confirm:

- That the work is original, and due credit is given to others where appropriate.
- That all members have contributed substantially and proportionally to each group assignment.
- That all members have sufficient familiarity with the entire contents of the group assignment so as to be able to sign off on them as original work.
- Acceptance and acknowledgement that assignments found to be plagiarized in any way will be subject to sanctions under the University's Code of Behaviour on Academic Matters.

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Executive Summary

BioPhirma is an innovative healthcare leader in drug discovery and treatments for a wide array of human and animal conditions. BioPhirma is a global company headquartered in Atlanta, Georgia with more than 25,000 employees worldwide.

To facilitate the purchase of items required, BioPhirma has issued purchase cards (P-cards) to various individuals. Recently, an anonymous tip suggested that some P-card holders may have been violating BioPhirma's policies and fraud may have been committed.

We have conducted an analysis, and to prevent any future violation, our main recommendations are:

- Notification system for red flags employees to be implemented based on multiple violation criteria.
- Continuously use selected keywords as KPI to track potential violations before they occur. This can be used to determine how widespread violations are.
- Issue monthly notifications with the top 20 vendors to emphasize P-card policies. If continuous top 20 placements occur, escalate to meetings discussing SLAs
- Implement policy where transactions are not approved until comments are made. Comments can be flagged to identify potential violations beforehand.

Introduction

Business Overview

BioPhirma has issued P-cards to its employees at each lab to facilitate the necessary purchases for each department. Employees who are designated as cardholders can make purchases following BioPhirma's P-card policies. After each transaction, the employees are required to go into the system to sign off that the charge is valid and acknowledge that they made the purchase and enter a detailed purchase description. After the employee signs off, a notification is sent to the supervisor to request approval. Once reviewed and approved, the supervisor accesses the system to sign off. Regardless of the sign-off by either the cardholder or the supervisor, the system automatically sends transactions in batches periodically to the Accounting Department to post to the general ledger. This posting date and time are indicated in the system. Management also conducts periodic reviews of the transactions.

Problem Statement

Management of BioPhirma has been notified that some of the cardholders may have been violating the policies and fraud may have been committed. In order to further investigate transaction violations, the management of BioPhirma has provided us with transactions made using a BioPhirma P-card during the 2019 fiscal year.

Data Source Used

Data Description

The company management team has provided a dataset containing three tables used in the

analysis: transactions (information for each transaction), users (information for each P-card user), and vendors (information for each approved vendor). Transactions table and users table are connected through employee's name; transactions table and vendors table are connected through vendor's name. To summarize, the dataset contains 79,085 transactions placed with a BioPhirma P-card during the 2019 fiscal year (from July 2018 to June 2019), with total spending for the year of $19,861,981.

Data Cleaning

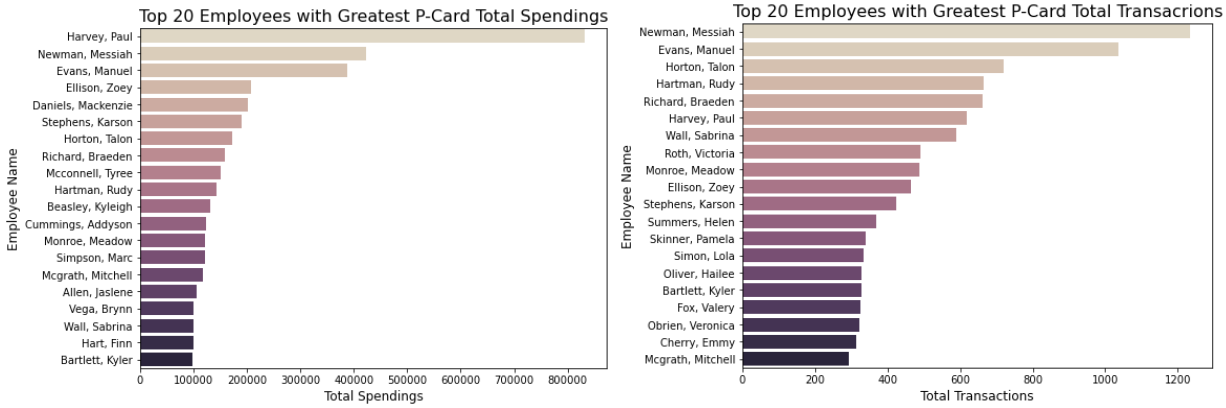
The users table and vendors table are good to use directly. And some data cleanings are performed on the transactions table since data types are not universal. The Money datatype in SQL cannot be automatically transformed into numeric values in graphical tools. We applied ::money::numeric::float8 to convert columns with Money data type into float numbers. Also, there are some missing values in the comments column. And some comments contain mostly stop words.

Key Findings

Preliminary Analysis

Employee

The following two bar graphs show the top 20 employees with the highest P-card activity based on total spending and the total number of transactions, respectively. Around half of the names do not match between the two lists. Usually, the employees with higher total spending would have a higher total number of transactions, in order to avoid violating transaction limits. Those employees who do not appear in both top lists look suspicious and may have conducted violations.

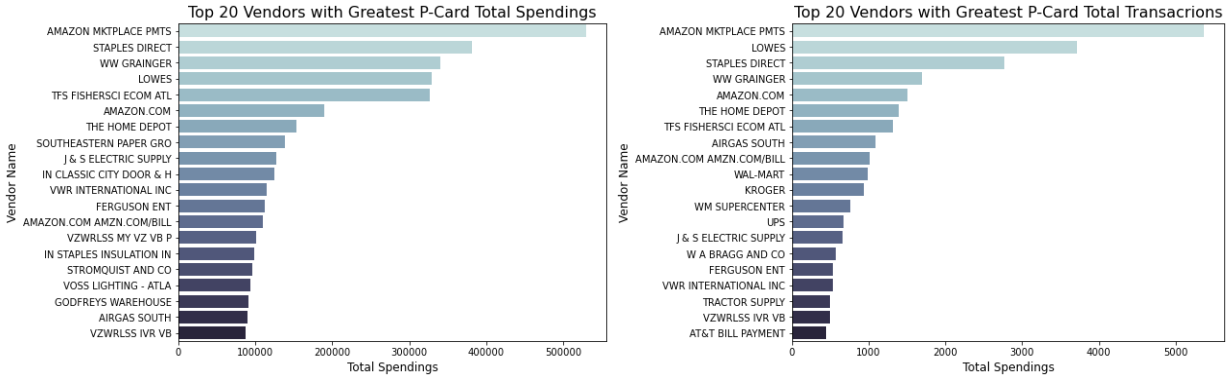


For example, Paul Harvey has the highest total spending (almost twice as large as the second-highest Messiah Newman). However, he only has a total number of 617 transactions (half of the transactions of Messiah Newman). Paul Harvey may have violated the split transactions.

Vendor

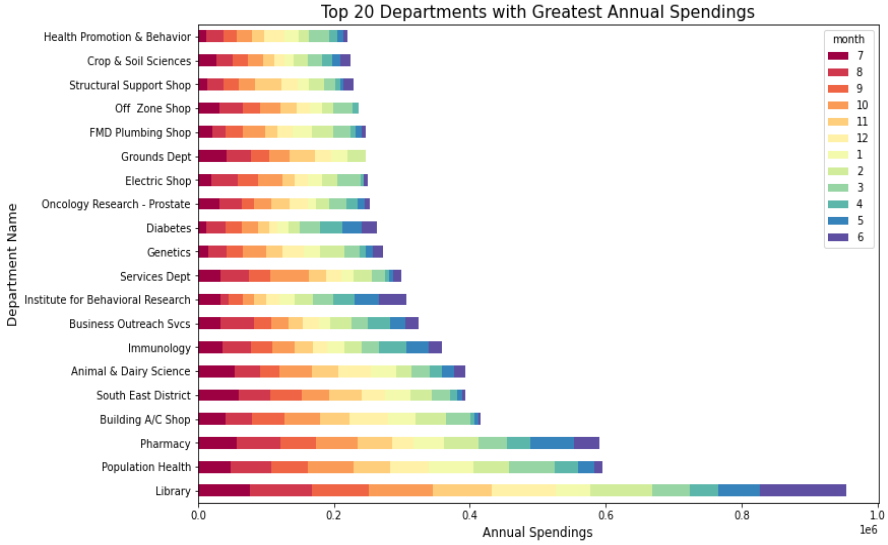
The following two bar graphs show the top 20 vendors with the highest P-card activity based on total spending and the total number of transactions, respectively. Based on them, there are no

apparent suspicions found. Most of the vendor names are the same between the two lists. The differences in vendor names may be due to the small changes between vendors in the ranking.



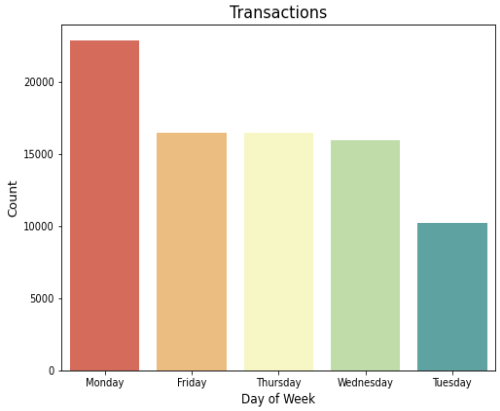
Month and Department

The following stacked bar chart shows the top 20 departments with the highest total annual spending with ordered monthly spending. It reveals that the Library department has the highest total annual spending and is much higher than the second-highest spending of the Population Health department. It looks suspicious since BioPhirma is a biomedical company. Such companies commonly would have more spending on labs, medicals, chemicals, etc. The purpose of such large spending in the Library department is not justified.



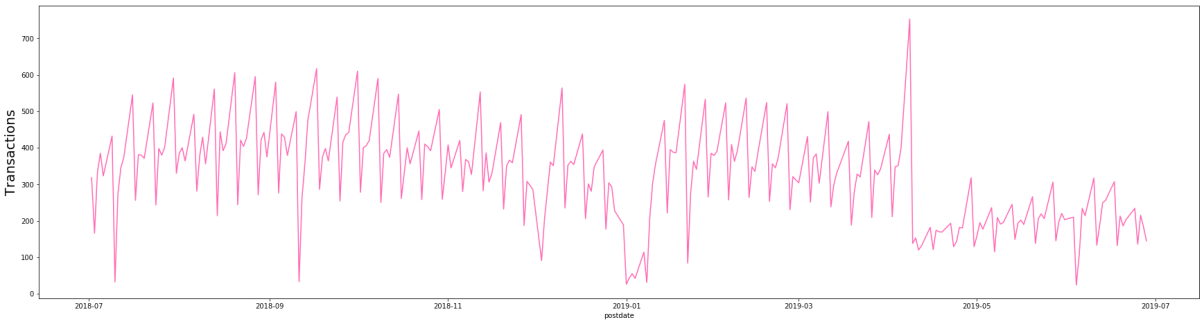
Day-of-Week

The following graph shows the total number of transactions that occurred on each day of the week. Based on the analysis, all transactions occurred during weekdays from Monday to Friday. It is normal since P-Cards should be used for work only. If transactions occur during weekends, it may look like it was used for personal purposes.



Time Series

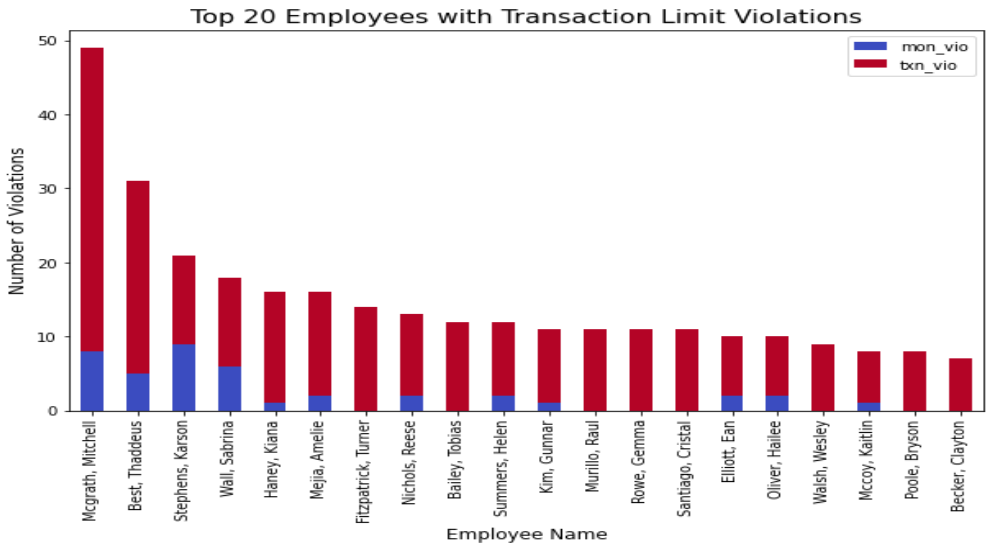
The following line chart demonstrates the transaction volume during the given period of data provided. As you can see, there seems to be a downturn in transactions during January and then April to June. It could be due to the New Year and summer season starting. Regardless of these two dips, it seems that there is a consistent volume of transactions over time with no upward or downward trend occurring. This, to an extent, allows us to conclude that there is no large-scale fraud occurring for BioPhirma.



Violation Analysis

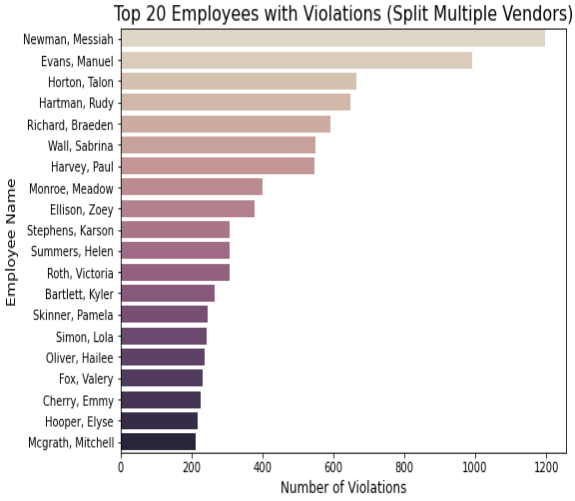
Transaction Limits

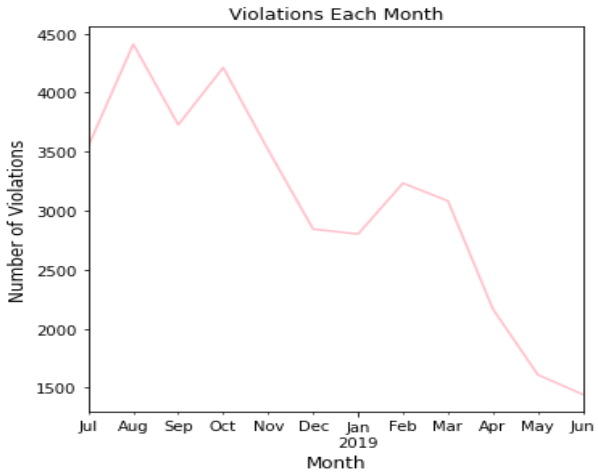
The graph shows the top 20 employees with the highest number of violations on single transaction limit and monthly transaction limit. We can see that more violations on Single Transaction Limit would result in more violations on Monthly Transaction Limit. Some of these employees also appear on the top 20 lists shown in the top spending and transactions, which makes sense as large transactions can be indicative of large numbers of violations.



Split Transactions

The number of violations each month for transactions potentially split between two or more employees with the same vendor on the same day is gradually decreasing from the beginning of the fiscal year to the end. It shows a promising trend. Employees who potentially split between two or more transactions with the same vendor on the same date would also potentially split between two or more vendors by one employee on the same day. More than half of the employees appear in both top 20 lists and some of them also appear on the lists from the previous analyses. It confirms that these employees are under suspicion of P-card usage violations and frauds.



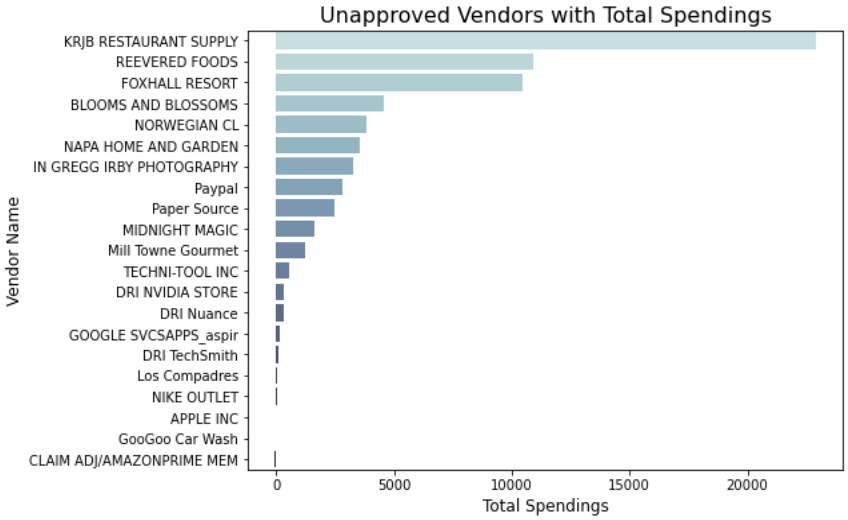


Unapproved Vendors

From our analysis, we identified 21 unapproved vendors. The highest amount spent at unapproved vendors was $22,912 at KRJB Restaurant Supply which was purchased by Reeves, Kyra. She only provided the comment ‘Special Fees’ so we need more explanation as this is an unapproved vendor. Also, the lowest amount was (-$60) at CLAIM ADJ/AMAZON PRIME MEM which indicates the vendor returned money to the P-card holder.

Two employees were refunded by the vendor: Vaughn Preston, Case Matteo.

- Vaughn’s comment for this transaction was ‘fraud’ which implies a resolved case of identity theft hence the refund provided after this was identified.
- Case Mateo commented on a purchase error by Amazon which implies his P-card was already set up for Amazon before this wrong charge. Other amazon purchases were identified so we need to confirm that all these purchases are not violations.

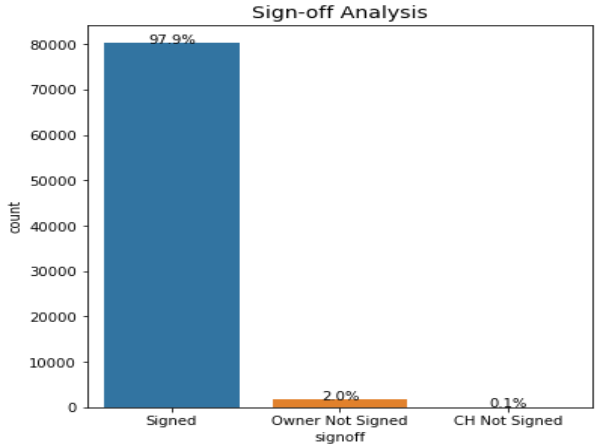


We should talk to all the employees that shopped at these vendors and justify if the vendors should become approved in the future or if it's a complete violation.

Signoff Analysis

After examining the sign-off data, we got the following findings:

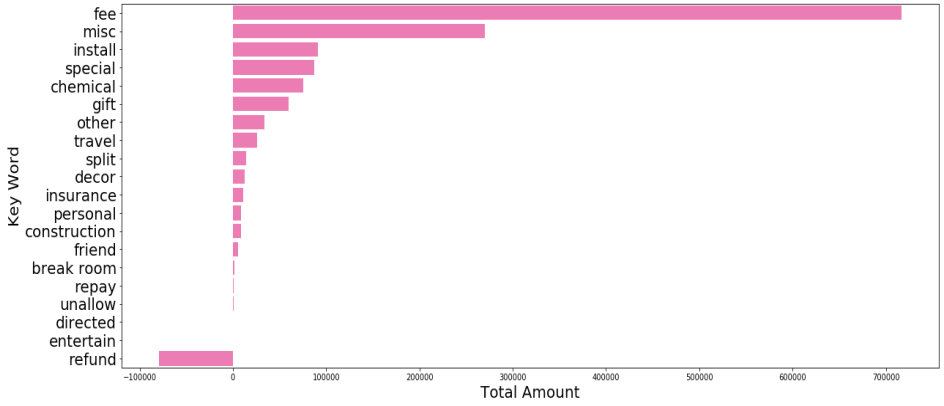
- Cardholder not signed and Owner signed: 0 transactions
- Department Supervisor (Owner) only not signed: 1,650 transactions
- Both Cardholder and Supervisor not signed: 42 transactions
- Signed by both: 77,393 transactions



It makes sense that there were 0 cases where the cardholder had not signed but the supervisor had signed because the cardholder always has to sign first before the supervisor can sign. Also, there are a lot of cases with Cardholder signing and supervisor not signing so we should set a time limit for supervisors to sign after cardholders to reduce this.

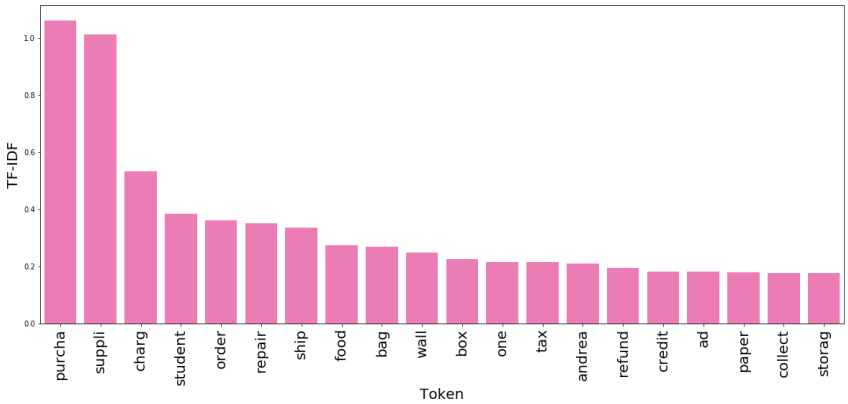
Text Analysis

After conducting text analysis and using the allowable and unallowable purchases table, we derived multiple keywords shown in the graph below. The presence of these words can be indicative of potential violations occurring. The graph below also demonstrates to an extent how hurtful these words are in terms of monetary value, with each word's representative item total being shown.

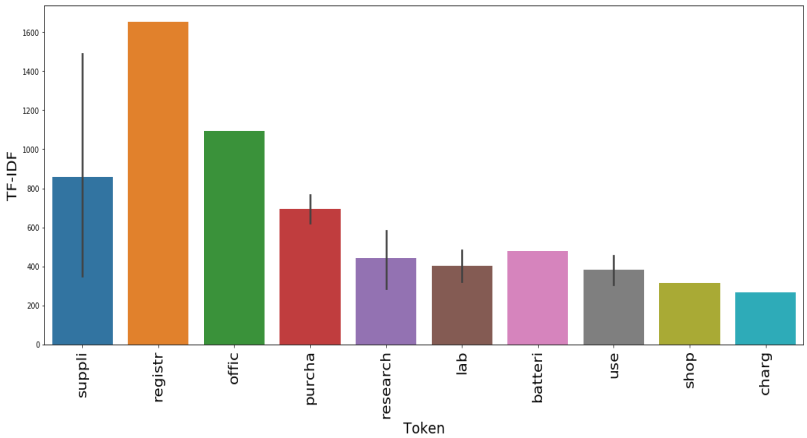


After conducting keyword analysis, we decided to use the TF-IDF metric as a way to identify rare terms presented in documents. In this case documents mean employees. Below is the TF-IDF of Manuel Evans, which can be used to determine what key terms they were looking at. In this case you can see several keywords like food and refund with high TF-IDF values, which may be of interest for further investigation.

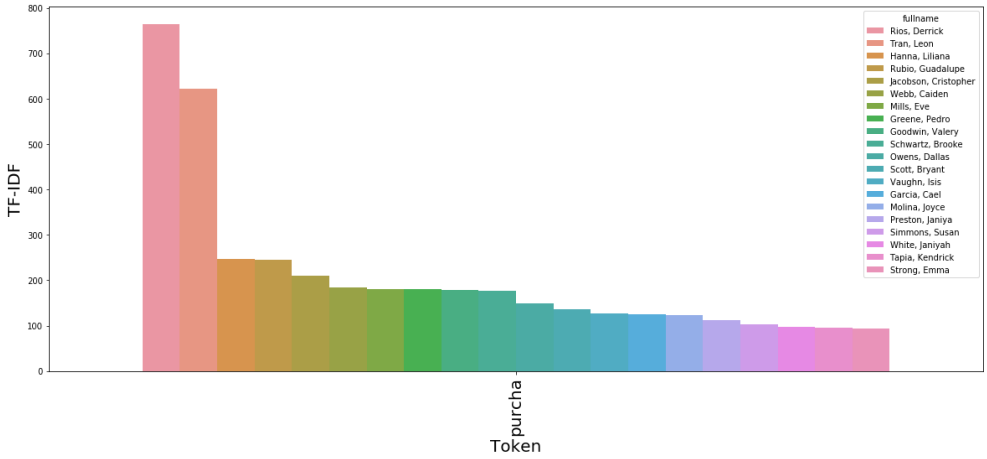
TF-IDF for Evans, Manuel



The graph below also demonstrates the tokens with the highest TF-IDF scores. This can be used as a metric to determine what words are the most important and special.



The bar plot below demonstrates the top 20 employees in terms of TF-IDF score for a certain key term. This once again can be utilized as a method to track individuals who are using key terms that correlate to potential violations.



Suspicious Employees

<u>Criteria</u>

Red flags employees are filtered by different behaviors that may potentially lead to violations of

P-card policy and frauds. These criteria include P-card usage, transaction limit, split transaction, and no comments. For each criterion, a top 20 employee list is developed. Only employees in one of the top 20 lists are considered. Then the rank in each list and the number of times an employee is in the top 20 lists are considered together to determine the most suspicious employees. The top 5 suspicious employees are identified with their suspicious behaviors in the top 20 lists below.

Top 5 Employees

Evans, Manuel

- Number 2 in Monthly Transaction Limit Violations
- Number 1 in no comments per transaction
- Number 1 in no comments by total amounts
- Number 2 in potentially split between two or more vendors by one employee on the same day
- Number 2 in P-card spending; Number 3 in Number of P-card transactions
- Number 5 in potentially split between two or more transactions by one employee with the same vendor on the same date

Newman, Massisah

- Number 4 in violations of Monthly Transaction Limit
- Number 1 in potentially split between two or more transactions by one employee with the same vendor on the same day
- Number 1 in potentially split between two or more vendors by one employee on the same day
- Number 2 in P-card spending; Number 1 in Number of P-card transactions

Horton, Talon

- Number 3 in potentially split between two or more vendors by one employee on the same day
- Number 2 in potentially split between two or more transactions by one employee with the same vendor on the same day
- Number 8 in Violations of the Monthly Transaction Limit Policy
- Number 7 in P-card spending; Number 3 in Number of P-card transactions

Mcgrath Mitchell

- Number 1 in Single and Monthly Transaction Limit Violations
- Number 20 in potentially split between two or more vendors by one employee on the same day
- Number 15 in P-card spending; Number 20 in number of P-card transactions

Harvey, Paul

- Number 9 in no comments by total amounts
- Number 7 in potentially split between two or more vendors by one employee on the same day

- Number 11 in potentially split between two or more transactions by one employee with the same vendor on the same date
- Number 1 in P-card spending; Number 6 in Number of P-card transactions

Recommendations

By the end of our analysis, we had identified some possible cases of violating activities and allowing for these violations is costing the company money as well as opening them up to litigation liability. Therefore, we have a few recommendations to protect BioPhirma from the risks to its P-card System.

- First, the company should make continuous use of selected keywords as KPI to track potential violations before they occur. They can be used to determine how widespread violations are.
- They should have monthly notifications with the top 20 vendors to emphasize P-card policies. If continuous top 20 placements occur, escalate to meetings to discuss current Service Level Agreements (SLAs). If continuous placement occurs, it potentially leads to the termination of the contract.
- Contact top the 20 red flags employees judged by various violation criteria and remind them of P-card policies.
    - Employment violations notice to be issued If violations are repeated by the identified employees.
    - A process implemented on a rolling monthly basis, with a three-strike policy leading to termination.
- Implement policy where transactions are not approved until comments are made.
    - These comments can be flagged to identify potential violations beforehand and can be synergized with the first recommendation.

Limitations and Future Considerations

To improve upon our investigation for potential violations new information is needed. The data provided did not provide information about an employee's position or how long they have been working at the company. Additionally, the transactions made did not provide details on what category they were in. More data on both these two variables can lead to a better understanding of what type of fraud is occurring if there is any and how to handle the issue given the employee's position. For example, a new graduate committing fraud and an executive committing fraud requires two different types of responses.

Information on the security measures for the P-card would also be helpful, as there were cases of identity theft reported from the data provided. The data provided was useful in terms of determining if fraud had occurred, but the severity and details of the fraud are not known. This information can help us in determining better policies and punishments to implement.

Final Page

Grade: _____