

# **People Analytics**

## **Project Report**

at the Faculty of Business, Economics, and Law  
Friedrich-Alexander-Universität Erlangen-Nürnberg  
Schöller Endowed Chair for Information Systems  
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## **1 Personnel Planning**

### **1.1 Future workforce needs (4 Points)**

1. Strategic direction – FAU Bank’s long-term goal is to open a physical branch in a strategic location with a focus on efficiency and cost-effectiveness. The objective of hiring new bank tellers by following various recruiting strategies. Having the goals, objectives and strategies set out the further process can be proceeded successfully.
2. Internal / External environment – Factors like digitalization in banking, fintech, adoption of AI, location of the new branch, skill shortage in the domain impact the planning process.
3. Current Workforce – FAU Bank may want to conduct an internal workforce assessment so that they can consider the possibility of relocation of a few existing employees to the new location by incentivizing them. This can reduce the costs of the process.
4. Access future needs – Future skills and competencies like AI, Fintech, digitalization could be changing how bank tellers work and therefore the hiring process should be ready to meet the challenges of changing workforce demands.
5. Identify gaps – As it wants to open a new branch, the gap is very big which needs to be filled via the recruitment process.
6. Gap-closing strategies – FAU bank may want to close this gap by recruiting new bank tellers  
Along with the HR staffing model and steps of workforce planning, FAU bank can identify the future workforce needs.

### **1.2 Recruiting new hires (4 Points)**

Passive recruiting refers to a process where candidates search for job postings which are published by the organizations whereas in active sourcing candidates publish their profiles which are searched by the organizations. In passive recruiting organizations drive the process via job posting while in active sourcing candidates drive the process via their profiles.

FAU Bank should follow active sourcing as it needs to proactively hire bank tellers for its new physical branch. It can use online platforms like LinkedIn, Xing or employee referral programs to motivate existing employees to participate in the hiring process. It can even use SaaS platforms like HRForecast to gain insight into job profiles and ease up the process.

### 1.3 Employee Need (5 Points)

FAU Bank needs 6 workers for the 1st shift and 4 workers for the 2<sup>nd</sup> shift respectively.

The result is optimal. (Refer to notebook - fau\_bank\_shifts.ipynb ; uses - fau\_bank\_shifts.csv)

By following the given example, this can be solved by sampling extending the idea that instead of using 6 days, we can only use 1 day. This implies that there is no need for individual avg columns, date range changes from (1, 7) to (0, 1) only for one day. Adding a few print statements in the middle helped in debugging the steps. Now it has changed to an LP problem with only two variables.

```
print(prob)

scheduling_workers:
MINIMIZE
16*num_workers_0_0 + 14*num_workers_0_1 + 0
VARIABLES
0 <= num_workers_0_0 Integer
0 <= num_workers_0_1 Integer
```

The service level had to be hard coded to 0.125 (1 worker can serve 8 customers resulting in 1/8). This was achieved by using NumPy 2d array. The wage rate, columns and other variables are adjusted as per the need.

As one employee can provide customer service for up to 8 customers per hour, 46 is the maximum avg customer number in shift 1, so 6 workers can handle them ( $8 * 6$  is less than 46). Likewise in shift 2, we have a maximum of 32 customers on average, so having 4 workers should be sufficient to assist all the customers ( $8 * 4$  is less than or equal to 32).

```
# solve the problem

prob.solve()
print("Status:", lpStatus[prob.status])

Status: Optimal

# print the results

for index in num_workers:
    index_parts = index.split('_')
    day_of_week = int(index_parts[0])
    shift = index_parts[1]
    print(
        f"The number of workers needed for shift {shift} is {int(num_workers[index].value())} workers"
    )

The number of workers needed for shift 0 is 6 workers
The number of workers needed for shift 1 is 4 workers
```

---

#### **1.4 Digital Proficiency Enhancement (5 Points)**

FAU Bank is experiencing a potential skill gap in their workforce in relation to digitalization. This may be caused by ageing employees and rapidly changing technologies.

FAU Bank can choose to hire new employees or re-skill and up-skill existing employees to fill this skill gap. The better thing to do would be to retrain existing employees as it is more cost effective and boosts the morale of employees. It may face challenges due to employee motivation, stress, technology aversion and acceptance issues which need to be handled.

By addressing this problem, FAU Bank can fulfill its digital transformation initiatives and maintain a competitive advantage in the market by staying relevant with current technological advancements.

#### **1.5 Find the Best Candidate (7 Points)**

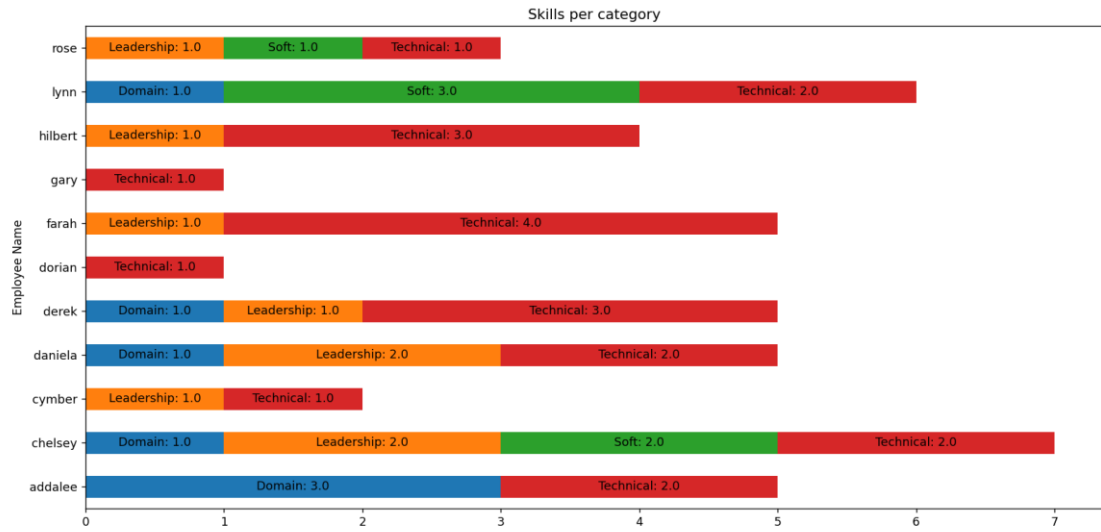
Like the set of skills provided in the skills.csv example, a similar csv file is generated with skills relevant to Digital Transformation manager in mind. The resulting skills are categorized into Technical, Leadership, Domain knowledge and soft skills.

Refer to digital-transformation-manager.csv and fau\_bank\_resume\_phrase\_matcher.py

Using the same resume zipped folder and python script from lecture materials the following skill set graph has arrived. Some code changes to python script include path changes of csv file and resume folder, installation of many python modules to run the code. Also changes to skills and phrase matching words were needed to extend it to digital transformation management skills.

Candidates Hilbert and Farah have a blend of strong technical skills but lack other skills like leadership or domain knowledge. Very few candidates have a holistic understanding of what it takes to successfully manage digital transformation.

From the graph it is more likely that candidate Chelsey may be prioritized over other candidates because they possess a balance of requirements.



## 2 Onboarding and Performance

### 2.1 A new hire (5 Points)

Onboarding can be understood as a socialization process during the first days, weeks and months of a new employee having a new occupation. Socialization helps new employees develop into effective organizational members and facilitates them becoming more productive and satisfied in their new roles. It has also been linked to increased organizational commitment, job involvement, and tenure.

According to [\(Bauer, 2010\)](#), onboarding has four distinct levels.

1. Connection - refers to the vital interpersonal relationships and information networks that new employees must establish. This can be achieved via Social Recommender Systems.
2. Clarification - make sure that employees understand their new job and all related expectations. This can be achieved via Enterprise Social Networks.
3. Culture - providing employees with a sense of organizational norms - both formal and informal. This can be achieved via Knowledge Wikis / Knowledge Systems.
4. Compliance - teaching employees basic legal and policy-related rules and regulations. This can be achieved via Knowledge Wikis / Workshops.

There are many socialization approaches available but as FAU Bank has hired a young and motivated employee in the marketing department, let's focus only on few approaches based on this use case.

1. Providing information – as the new hire is a young employee, it's important to create a safe environment to make sure that the employee can ask any type of question.
2. Welcome – it's very important to have a warm welcoming atmosphere within the department to ensure the new employee doesn't feel left out.
3. Guidance – as the new employee is young and motivated, having a dedicated guide to him will ensure that he gets a "hands-on," personal guide.

In the long-term a successful onboarding foster

1. Effective working relationships which allow for more efficient communication and feedback between colleagues.
2. Social relationships, which provide support and a "safe" outlet for receiving assistance and coping with the uncertainty and anxiety of organizational entry.
3. Organizational commitment, which is the level of attachment to the organization, is characterized by shared values, a desire to remain in the organization, and a willingness to exert effort on its behalf.

Employees who are clear about role expectations are more likely to perform well, and those who believe they can accomplish their tasks tend to have greater goal accomplishment. Employees who are socially accepted by peers may perform at higher levels, given that the

relationships they form with their peers may serve as social capital that facilitates their job performance. These results are also backed by many academic studies.

## 2.2 Recommender System (5 Points)

The top three employees would be employees with id 13, 19 and 29.

```
get_recommendations('emp_030', cosine_sim)

12    emp_013
18    emp_019
28    emp_029
Name: id, dtype: object
```

Given that employee 30 is from marketing department, has no published topics and likes articles on funds and hr marketing with a medium engagement. This data is used to match similarities with other employees.

From the recommendation, it is important to observe that these three employees 13, 19 and 29 are from hr department a different department than employee 30 and share the same liked articles on topic hr marketing with a medium level of engagement.

Already existing python notebook is used with minor modifications to fit the use case.

Refer to files - fau\_onboarding\_recommender.ipynb and fau\_onboarding.csv

Employee 13 in particular may be even better candidate because he is the only employee with a published topic on hr marketing which our employee 30 finds interesting.

## 2.3 Factors that affect employee performance (5 Points)

According to [Diamantidis & Chatzoglou \(2019\)](#) the factors that affect employee performance are

1. Job-related factors like environment, communication and job autonomy have the strongest impact on employee performance. These also impact employee-related factors.
2. Firm-related factors like management support, training culture, organizational climate, environmental dynamism effect the not just employee performance but also job-related and employee-related factors.



3. Employee-related factors such as proactivity, adaptability, motivation, skill flexibility, commitment and skill level also contribute towards employee performance.

FAU Bank can implement Transformational Leadership ([Paarlberg & Lavigna \(2010\)](#)) to have a positive impact on employee performance. Leadership style is the ability of a leader in directing, influencing, encouraging, and controlling subordinates to be able to do work on their awareness and volunteer in achieving a certain goal.

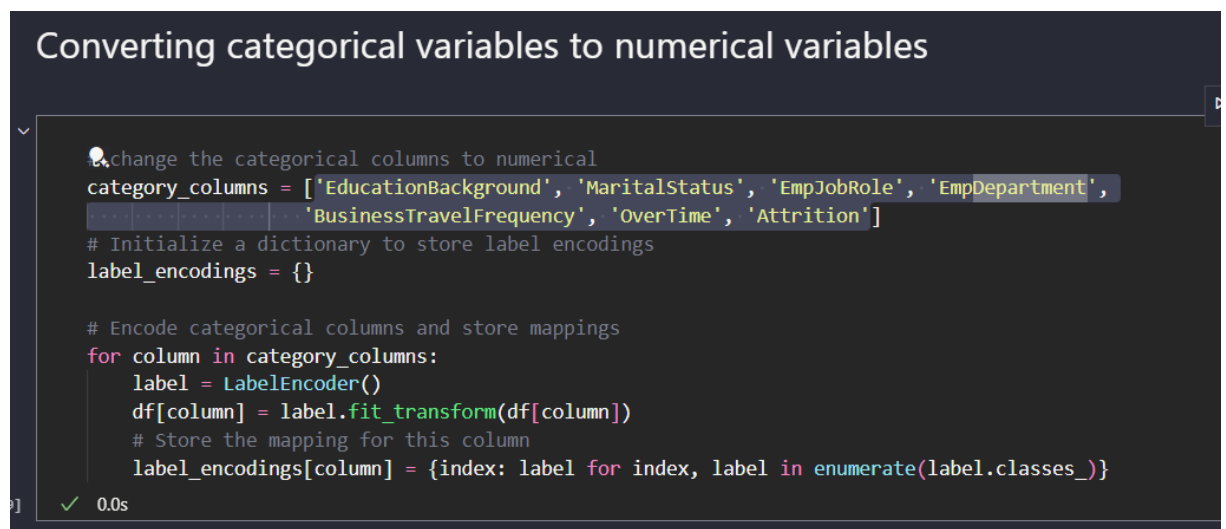
- Over the last two decades, a growing body of research has supported a positive relationship between transformational leadership and various employee performance.
- Transformational leadership is characterized by idealized influence, intellectual stimulation, and inspirational motivation ([Trottier, Van Wart, and Wang 2008](#)).
- All in all, FAU Bank can recruit / up-skill employees in leadership positions to create a shared vision, articulate clear and meaningful goals, empower employees, and to model ethical and trustworthy behavior in employees.

## 2.4 Employee performance analysis (10 Points)

Most of the exploratory data analysis part is done and available in the python notebook - `fau_bank_employee_performance.ipynb`

The dataset does not have any missing values. The columns 'EmpNumber', 'Age', 'Gender' are dropped because employee number doesn't have any impact on his performance. Age and Gender columns are removed to ensure that our model is not effected by potential biases.

Columns which are categorized are converted to numerical using sklearn preprocessing libraries – LabelEncoder.



```

Converting categorical variables to numerical variables

# Change the categorical columns to numerical
category_columns = ['EducationBackground', 'MaritalStatus', 'EmpJobRole', 'EmpDepartment',
                    'BusinessTravelFrequency', 'OverTime', 'Attrition']

# Initialize a dictionary to store label encodings
label_encodings = {}

# Encode categorical columns and store mappings
for column in category_columns:
    label = LabelEncoder()
    df[column] = label.fit_transform(df[column])
    # Store the mapping for this column
    label_encodings[column] = {index: label for index, label in enumerate(label.classes_)}
  
```

From the department wise correlation matrices we can see that although each department may appear to have different dependencies, but on a closer look it can be seen that variables –

"EmpEnvironmentSatisfaction", "EmpLastSalaryHikePercent", "EmpWorkLifeBalance" have a very high correlation with the target variable – "PerformanceRating".

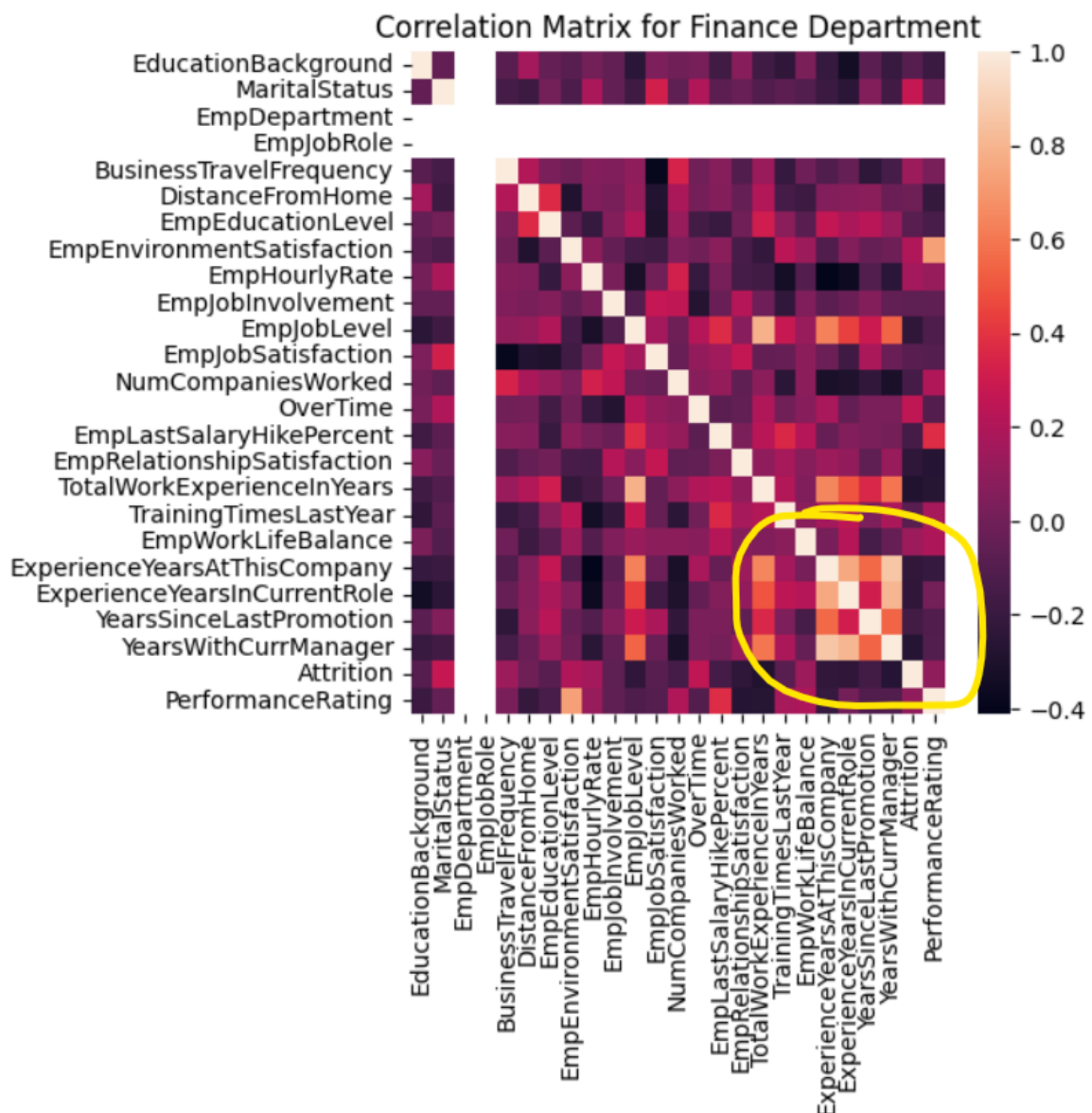
```
important_columns = ['EmpEnvironmentSatisfaction', 'EmpLastSalaryHikePercent', 'EmpWorkLifeBalance']

x = df[important_columns]
y = df['PerformanceRating']

✓ 0.0s
```

Also another interesting insight to look for is the fact that irrespective of the department, the following factors have a very high correlation among themselves ( highlighted below as a square ) "ExperienceYearsAtThisCompany", "ExperienceYearsInCurrentRole", "YearsSinceLastPromotion", "YearsWithCurrManager".

T



A machine learning model based on Random Forest is designed to predict the outcome of employee performance based on three features mentioned above. Random Forest is used because the target variable is a discrete variable and from boxplots it is evident that only performance ratings 2, 3 and 4 are present. Also random forest is a good choice for our data because it is an ensemble method and chooses the rating selected by most trees.

With an accuracy of close to 80%, our model is decent. The final model evaluation as below :

```
from sklearn.metrics import accuracy_score
accuracy = accuracy_score(y_test, y_pred)
print(accuracy)

from sklearn.metrics import confusion_matrix
confusion_matrix = confusion_matrix(y_test, y_pred)
print(confusion_matrix)

from sklearn.metrics import classification_report
print(classification_report(y_test, y_pred))
```

✓ 0.0s

0.7933333333333333

```
[[ 15  25   2]
 [ 26 193   4]
 [   1   4 30]]
```

	precision	recall	f1-score	support
2	0.36	0.36	0.36	42
3	0.87	0.87	0.87	223
4	0.83	0.86	0.85	35
accuracy			0.79	300
macro avg	0.69	0.69	0.69	300
weighted avg	0.79	0.79	0.79	300

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## References

1. Bauer, T. N. (2010). *Onboarding new employees: Maximizing success*. SHRM Foundation. <https://www.shrm.org/foundation/ourwork/initiatives/resources-from-past-initiatives/Documents/Onboarding%20New%20Employees.pdf>
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Violations of the above-mentioned rules are to be qualified as deception or attempted deception and lead to an assessment of the examination with "failed". Further sanctions are possible in the case of multiple or particularly drastic violations of the rules by the examination board.

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Erlangen, 2024-06-29