# 데이터 탐색적 분석 및 전처리

In [1]:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import time
import random
from datetime import datetime, timedelta
np.random.seed(1)
```

In [3]:

```
meta_dataset = pd.read_csv('./data_2015_2019/meta_dataset_2015_2019.csv')
```

In [3]:

```
meta_dataset
```

Out[3]:

| | category_name | location_name | country_displayable_name | usd_goal | set_fundraising_period | target_goal_period_rate | date_launched_year | date_lau |
|---|---|---|---|---|---|---|---|---|
| **0** | Graphic Novels | Minneapolis | the United States | 12000.000000 | 2592000 | 0.004630 | 2015 | |
| **1** | Architecture | New York | the United States | 500.000000 | 2588400 | 0.000193 | 2015 | |
| **2** | Gaming Hardware | Oshkosh | the United States | 10000.000000 | 3884400 | 0.002574 | 2015 | |
| **3** | Drama | Manchester | the United Kingdom | 998.226229 | 2306670 | 0.000433 | 2015 | |
| **4** | Flight | South Florida | the United States | 17500.000000 | 3020400 | 0.005794 | 2015 | |
| **...** | ... | ... | ... | ... | ... | ... | ... | |
| **153571** | Accessories | Sydney | Australia | 393.166059 | 2592000 | 0.000152 | 2019 | |
| **153572** | Accessories | London | the United Kingdom | 1305.500070 | 2592000 | 0.000504 | 2019 | |
| **153573** | Web | Prague | Germany | 7893.879210 | 1728000 | 0.004568 | 2019 | |
| **153574** | Faith | Washington | the United States | 20000.000000 | 5011887 | 0.003991 | 2019 | |
| **153575** | Textiles | Seattle | the United States | 700.000000 | 2657079 | 0.000263 | 2019 | |

153576 rows × 12 columns

## 데이터 탐색(EDA)

In [5]:

```
meta_dataset.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 153576 entries, 0 to 153575
Data columns (total 12 columns):
 #   Column                    Non-Null Count   Dtype  
---  ------                    --------------   -----  
 0   category_name             153576 non-null  object 
 1   location_name             153576 non-null  object 
 2   country_displayable_name  153576 non-null  object 
 3   usd_goal                  153576 non-null  float64
 4   set_fundraising_period    153576 non-null  int64  
 5   target_goal_period_rate   153576 non-null  float64
 6   date_launched_year        153576 non-null  int64  
 7   date_launched_month       153576 non-null  int64  
 8   launching_delay_time      153576 non-null  int64  
 9   disable_communication     153576 non-null  bool   
 10  is_starrable              153576 non-null  bool   
 11  state                     153576 non-null  object 
dtypes: bool(2), float64(2), int64(4), object(4)
memory usage: 12.0+ MB
```

In [6]:

```
# 결측치 확인
meta_dataset.isna().sum()
```

Out[6]:

```
category_name               0
location_name               0
country_displayable_name    0
usd_goal                    0
set_fundraising_period      0
target_goal_period_rate     0
date_launched_year          0
date_launched_month         0
launching_delay_time        0
disable_communication       0
is_starrable                0
state                       0
dtype: int64
```

In [24]:

```python
# 타깃('state') 분포 확인
print(meta_dataset['state'].value_counts())
print(meta_dataset['state'].value_counts(normalize=True))
```

```
successful    93112
failed        60464
Name: state, dtype: int64
successful    0.606293
failed        0.393707
Name: state, dtype: float64
```

In [110]:

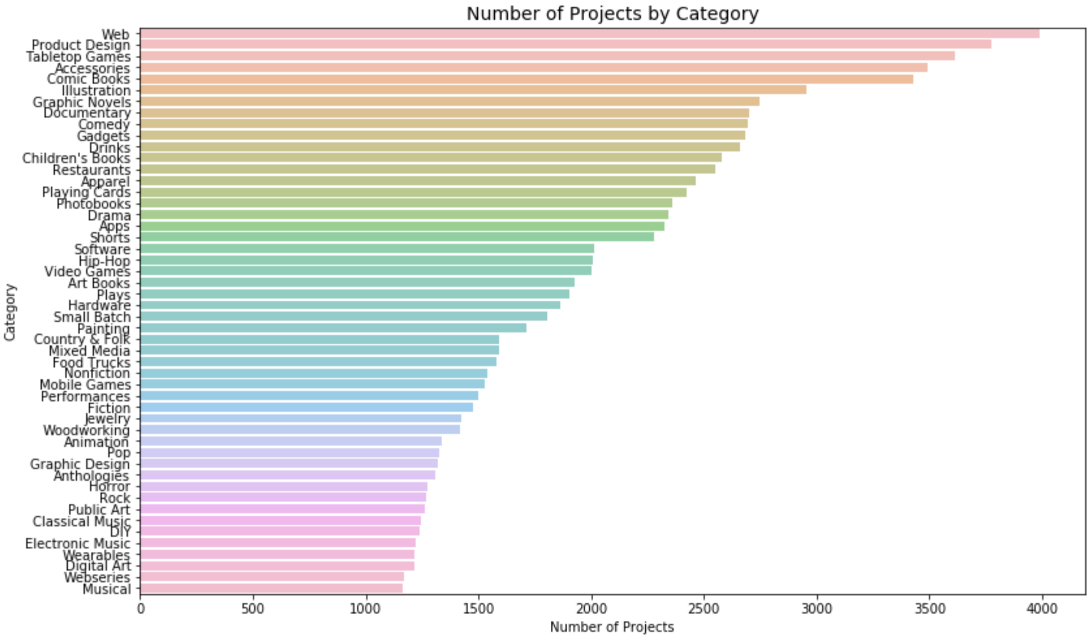
```python
# 카테고리(유형)별 펀딩 프로젝트 수 (상위 50개)
category_counts = meta_dataset['category_name'].value_counts().head(50)
category_counts
```

Out[110]:

```
Web                   3989
Product Design        3773
Tabletop Games        3615
Accessories           3493
Comic Books           3430
Illustration          2953
Graphic Novels        2744
Documentary           2703
Comedy                2693
Gadgets               2682
Drinks                2662
Children's Books      2581
Restaurants           2553
Apparel               2461
Playing Cards         2421
Photobooks            2357
Drama                 2340
Apps                  2324
Shorts                2278
Software              2016
Hip-Hop               2006
Video Games           2000
Art Books             1928
Plays                 1904
Hardware              1862
Small Batch           1803
Painting              1711
Country & Folk        1592
Mixed Media           1590
Food Trucks           1579
Nonfiction            1540
Mobile Games          1530
Performances          1501
Fiction               1478
Jewelry               1424
Woodworking           1418
Animation             1338
Pop                   1329
Graphic Design        1320
Anthologies           1309
Horror                1275
Rock                  1267
Public Art            1262
Classical Music       1248
DIY                   1237
Electronic Music      1222
Wearables             1218
Digital Art           1217
Webseries             1173
Musical               1164
Name: category_name, dtype: int64
```

In [114]:

```
# 카테고리(유형)별 펀딩 프로젝트 수 그래프
plt.figure(figsize=(13,8))
sns.barplot(x=category_counts.values, y=category_counts.index, alpha=0.6)
plt.title("Number of Projects by Category", fontsize=14)
plt.xlabel("Number of Projects", fontsize=10)
plt.ylabel("Category", fontsize=10)
plt.show()
```



In [ ]:

```
# 가장 수가 많은 펀딩 카테고리(유형) top 6: Web, Product Design, Tabletop Games, Accessories, Comic Books, Illustration
```

In [116]:

```
# 성공/실패별 펀딩 프로젝트 유형
state_category = meta_dataset.groupby('state')['category_name'].value_counts()
state_category
```

Out[116]:

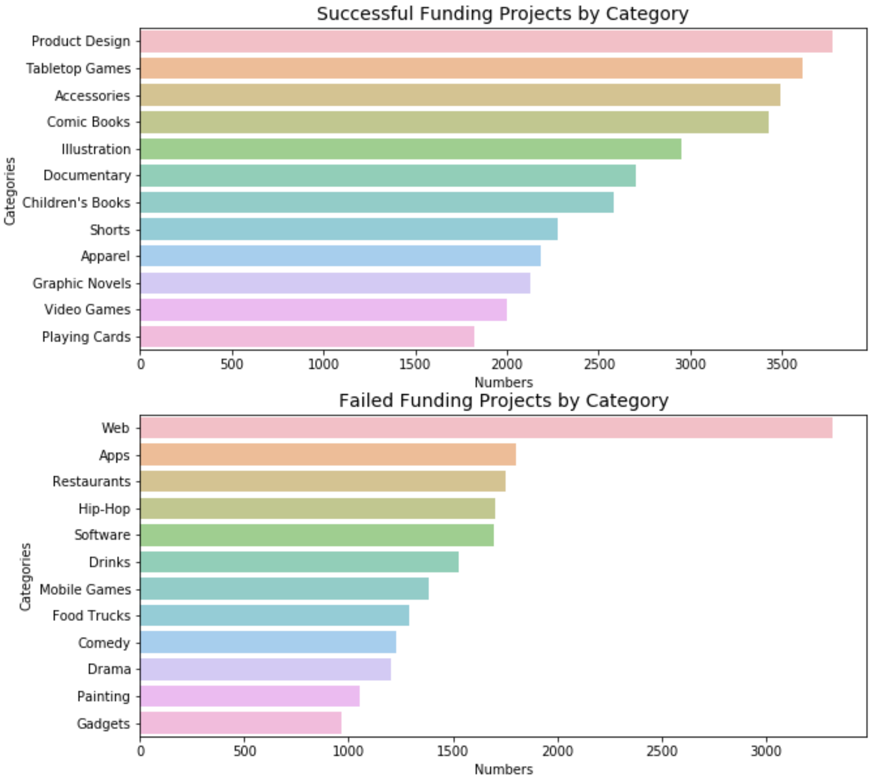
```
state       category_name
failed      Web                3318
            Apps               1801
            Restaurants        1752
            Hip-Hop            1704
            Software           1696
                               ...
successful  Quilts               26
            Chiptune             25
            Social Practice      23
            Bacon                15
            Taxidermy             4
Name: category_name, Length: 292, dtype: int64
```

In [129]:

```
# 성공/실패별 펀딩 프로젝트 그래프 (상위 12개)
plt.figure(figsize=(10,10))

plt.subplot(2,1,1)
a1 = sns.barplot(y=state_category['successful'].index[:12], x=state_category['successful'].values[:12], alpha=0.6)
a1.set_title("Successful Funding Projects by Category", fontsize=14)
a1.set_xlabel("Numbers", fontsize=10)
a1.set_ylabel("Categories", fontsize=10)

plt.subplot(2,1,2)
a2 = sns.barplot(y=state_category['failed'].index[:12], x=state_category['failed'].values[:12], alpha=0.6)
a2.set_title("Failed Funding Projects by Category", fontsize=14)
a2.set_xlabel("Numbers", fontsize=10)
a2.set_ylabel("Categories", fontsize=10)
```

Out[129]:

```
Text(0, 0.5, 'Categories')
```



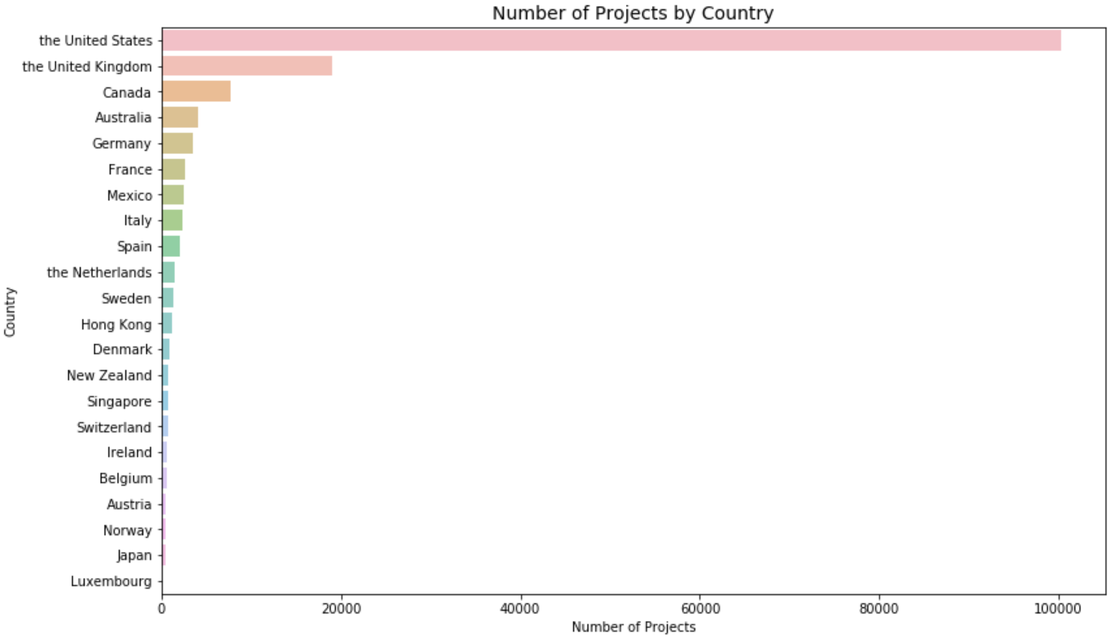
Successful Funding Projects by Category

Failed Funding Projects by Category

In [ ]:

```
# 모금에 성공한 펀딩 유형에는 Product Design, Tabletop Games, Accessories, Comic Books, Illustration 순으로 많았고
# 모금에 실패한 펀딩 유형에는 Web, Apps, Restaurants, Hip-Hop, Software, Drinks 순으로 많았음
```

In [15]:
```
# 펀딩 프로젝트 개수 by 국가
country_counts = meta_dataset['country_displayable_name'].value_counts()
plt.figure(figsize=(13,8))
sns.barplot(x=country_counts.values, y=country_counts.index, alpha=0.6)
plt.title("Number of Projects by Country", fontsize=14)
plt.xlabel("Number of Projects", fontsize=10)
plt.ylabel("Country", fontsize=10)
plt.show()
```



In [18]:
```
# 연도 별 펀딩 프로젝트 개수
meta_dataset['date_launched_year'].value_counts().sort_index()

# 평균적으로 매년 30000개 정도의 성공/실패 펀딩 프로젝트가 있다
```

Out[18]:
```
2015    34696
2016    27413
2017    26866
2018    27398
2019    37203
Name: date_launched_year, dtype: int64
```

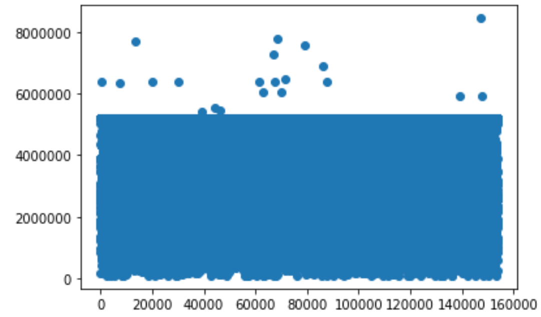
In [28]:
```
# 월별 펀딩 프로젝트 수
meta_dataset['date_launched_month'].value_counts()

#3,10,5월에 펀딩이 가장 많고, 12월은 유독 적다
```

Out[28]:
```
3     14933
10    14902
5     14132
6     13706
4     13606
9     13028
2     12931
8     12833
7     12790
1     12105
11    11937
12     6673
Name: date_launched_month, dtype: int64
```

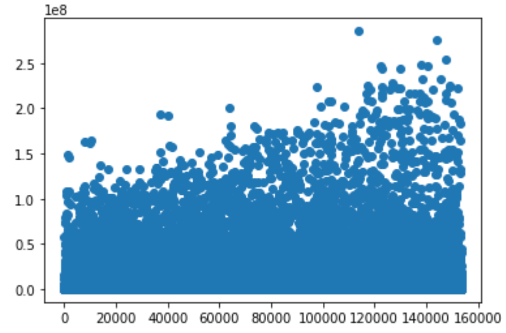
```
In [34]: # 성공/실패별 월별 펀딩 개수
         meta_dataset.groupby(meta_dataset['state'])['date_launched_month'].value_counts()

         #성공한 펀딩이 가장 많은 달은 10월, 3월, 5월 순
         #실패한 펀딩이 가장 많은 달은 3월, 5월, 4월 순
         # 월은 성공/실패에 영향을 준다고 보기 어렵다
```

```
Out[34]: state       date_launched_month
         failed      3                      5795
                     5                      5643
                     4                      5447
                     2                      5381
                     1                      5351
                     6                      5322
                     8                      5018
                     10                     5006
                     7                      4960
                     9                      4818
                     11                     4539
                     12                     3184
         successful  10                     9896
                     3                      9138
                     5                      8489
                     6                      8384
                     9                      8210
                     4                      8159
                     7                      7830
                     8                      7815
                     2                      7550
                     11                     7398
                     1                      6754
                     12                     3489
         Name: date_launched_month, dtype: int64
```

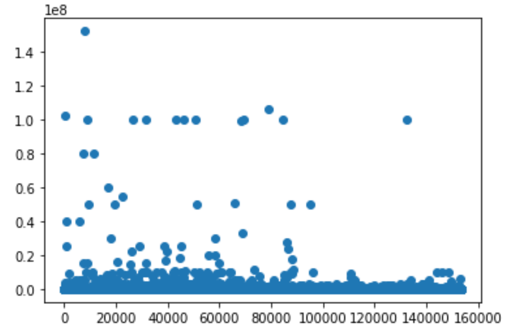
```
In [47]: # 설정된 펀딩 기간 분포 확인
         plt.scatter(x=meta_dataset['set_fundraising_period'].index, y=meta_dataset['set_fundraising_period'].values)
         plt.show()
```



```
In [48]: # 런칭 딜레이 기간 분포 확인
         plt.scatter(x=meta_dataset['launching_delay_time'].index, y=meta_dataset['launching_delay_time'].values)
         plt.show()
```

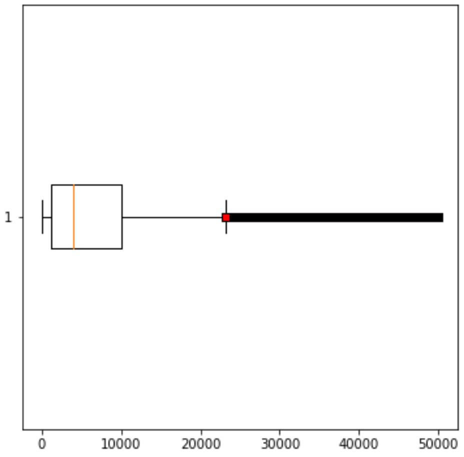


```
In [5]: # 펀딩 목표액 분포 확인
        plt.scatter(x=meta_dataset['usd_goal'].index, y=meta_dataset['usd_goal'].values)
        plt.show()
```



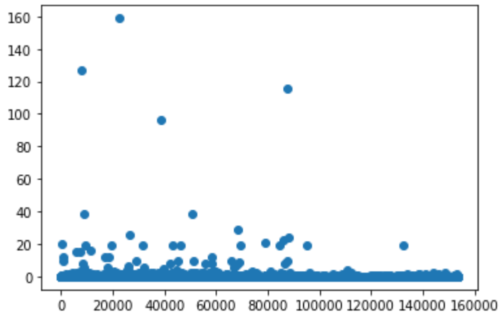
In [10]:

```
plt.figure(figsize=(6,6))
red_square = dict(markerfacecolor='r', marker='s')
plt.boxplot(meta_dataset['usd_goal'].sort_values(ascending=False)[10000:], flierprops=red_square, vert=False, whis=
1.5)
plt.show()
```



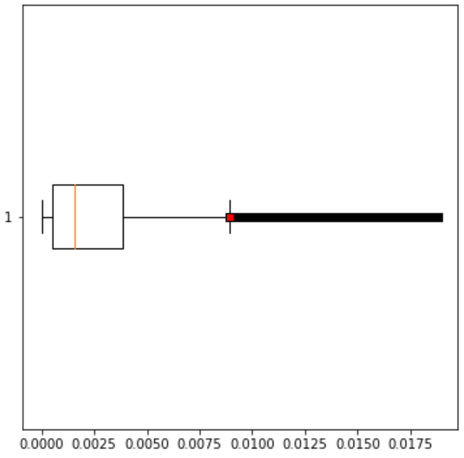
In [11]:

```
# 설정된 펀딩 기간대비 펀딩 목표액 비율 분포 확인
plt.scatter(x=meta_dataset['target_goal_period_rate'].index, y=meta_dataset['target_goal_period_rate'].values)
plt.show()
```



In [12]:

```
plt.figure(figsize=(6,6))
red_square = dict(markerfacecolor='r', marker='s')
plt.boxplot(meta_dataset['target_goal_period_rate'].sort_values(ascending=False)[10000:], flierprops=red_square, ver
t=False, whis=1.5)
plt.show()
```



## 이상치 확인 및 처리

In [39]:

```
#IQR 기반 이상치 검출
#IQR : 3분위수-1분위수
#이상치 기준 (rate는 일반적으로 1.5사용)
#1분위수 - IQR*rate 보다 작은수
#3분위 + IQR*rate 보다 큰수

def get_outlier(data, rate=1.5):
    q1 = np.quantile(data, q=0.25)
    q3 = np.quantile(data, q=0.75)
    IQR = q3 - q1
    return (data < q1 - IQR * rate) | (data > q3 + IQR * rate)
```

In [43]:
```
# usd_goal 컬럼 --> outlier 아닌 값들 중 최대값으로 대체
max_usd_goal = np.max(meta_dataset.usd_goal[~get_outlier(meta_dataset['usd_goal'])])
meta_dataset.loc[meta_dataset['usd_goal']>max_usd_goal, 'usd_goal'] = max_usd_goal
```

In [45]:
```
# target_goal_period_rate 컬럼 --> outlier 아닌 값들 중 최대값으로 대체
max_target_goal_period_rate = np.max(meta_dataset.target_goal_period_rate[~get_outlier(meta_dataset['target_goal_period_rate'])])
meta_dataset.loc[meta_dataset['target_goal_period_rate']>max_target_goal_period_rate, 'target_goal_period_rate'] = max_target_goal_period_rate
```

In [ ]:
```

```

In [48]:
```
# 성공 예측 모델에 사용하지 않을 컬럼 추가적으로 제거
metadata = meta_dataset.drop(columns=['location_name','country_displayable_name','date_launched_year','date_launched_month'])
metadata
```

Out[48]:

| | category_name | usd_goal | set_fundraising_period | target_goal_period_rate | launching_delay_time | disable_communication | is_starrable | state |
|---|---|---|---|---|---|---|---|---|
| **0** | Graphic Novels | 12000.000000 | 2592000 | 0.004630 | 871654 | False | False | successful |
| **1** | Architecture | 500.000000 | 2588400 | 0.000193 | 1407876 | False | False | successful |
| **2** | Gaming Hardware | 10000.000000 | 3884400 | 0.002574 | 16110 | False | False | successful |
| **3** | Drama | 998.226229 | 2306670 | 0.000433 | 8063 | False | False | failed |
| **4** | Flight | 17500.000000 | 3020400 | 0.005794 | 1965192 | False | False | successful |
| **...** | ... | ... | ... | ... | ... | ... | ... | ... |
| **153571** | Accessories | 393.166059 | 2592000 | 0.000152 | 655598 | False | False | successful |
| **153572** | Accessories | 1305.500070 | 2592000 | 0.000504 | 171726 | False | False | successful |
| **153573** | Web | 7893.879210 | 1728000 | 0.004568 | 245102 | False | False | failed |
| **153574** | Faith | 20000.000000 | 5011887 | 0.003991 | 2599879 | False | False | failed |
| **153575** | Textiles | 700.000000 | 2657079 | 0.000263 | 2568846 | False | False | failed |

153576 rows × 8 columns

## Encoding & Scaling

In [ ]:
```
# label encoding : disable_communication, is_starrable, state
# one-hot encoding : category_name
# standard scaling : usd_goal, set_fundraising_period, target_goal_period_rate, launching_delay_time
```

In [14]:
```
from sklearn.preprocessing import LabelEncoder, OneHotEncoder, StandardScaler, MinMaxScaler
from sklearn.model_selection import train_test_split
```

In [15]:
```
col_to_label_encode = ['disable_communication', 'is_starrable', 'state']
col_to_oh_encode = ['category_name']
col_to_scale = ['usd_goal', 'set_fundraising_period', 'target_goal_period_rate', 'launching_delay_time']
```

In [16]:
```
#Label Encoding

def l_encoding(x):
    le = LabelEncoder()
    le.fit(x)
    l_encoded_x = le.transform(x)
    return l_encoded_x
```

In [49]:
```
col_to_label_encode = ['disable_communication', 'is_starrable', 'state']

metadata[col_to_label_encode] = metadata[col_to_label_encode].apply(l_encoding)
metadata[col_to_label_encode]
```

Out[49]:

| | disable_communication | is_starrable | state |
|---|---|---|---|
| **0** | 0 | 0 | 1 |
| **1** | 0 | 0 | 1 |
| **2** | 0 | 0 | 1 |
| **3** | 0 | 0 | 0 |
| **4** | 0 | 0 | 1 |
| **...** | ... | ... | ... |
| **153571** | 0 | 0 | 1 |
| **153572** | 0 | 0 | 1 |
| **153573** | 0 | 0 | 0 |
| **153574** | 0 | 0 | 0 |
| **153575** | 0 | 0 | 0 |

153576 rows × 3 columns

In [50]:
```
#One-Hot Encoding -- Pandas.get_dummies()

col_to_oh_encode = ['category_name']

metadata = pd.get_dummies(metadata, columns=col_to_oh_encode)
metadata
```

Out[50]:

| | usd_goal | set_fundraising_period | target_goal_period_rate | launching_delay_time | disable_communication | is_starrable | state | category_name_3D Printing | c |
|---|---|---|---|---|---|---|---|---|---|
| **0** | 12000.000000 | 2592000 | 0.004630 | 871654 | 0 | 0 | 1 | 0 | |
| **1** | 500.000000 | 2588400 | 0.000193 | 1407876 | 0 | 0 | 1 | 0 | |
| **2** | 10000.000000 | 3884400 | 0.002574 | 16110 | 0 | 0 | 1 | 0 | |
| **3** | 998.226229 | 2306670 | 0.000433 | 8063 | 0 | 0 | 0 | 0 | |
| **4** | 17500.000000 | 3020400 | 0.005794 | 1965192 | 0 | 0 | 1 | 0 | |
| **...** | ... | ... | ... | ... | ... | ... | ... | ... | |
| **153571** | 393.166059 | 2592000 | 0.000152 | 655598 | 0 | 0 | 1 | 0 | |
| **153572** | 1305.500070 | 2592000 | 0.000504 | 171726 | 0 | 0 | 1 | 0 | |
| **153573** | 7893.879210 | 1728000 | 0.004568 | 245102 | 0 | 0 | 0 | 0 | |
| **153574** | 20000.000000 | 5011887 | 0.003991 | 2599879 | 0 | 0 | 0 | 0 | |
| **153575** | 700.000000 | 2657079 | 0.000263 | 2568846 | 0 | 0 | 0 | 0 | |

153576 rows × 167 columns

In [51]:
```
#Standard Scaling

col_to_scale = ['usd_goal', 'set_fundraising_period', 'target_goal_period_rate', 'launching_delay_time']

s_scaler = StandardScaler()
metadata[col_to_scale] = s_scaler.fit_transform(metadata[col_to_scale])
metadata[col_to_scale]
```

Out[51]:

| | usd_goal | set_fundraising_period | target_goal_period_rate | launching_delay_time |
|---|---|---|---|---|
| **0** | -0.025104 | -0.209350 | -0.015407 | -0.282325 |
| **1** | -0.035191 | -0.212905 | -0.021688 | -0.240724 |
| **2** | -0.026858 | 1.066828 | -0.018317 | -0.348701 |
| **3** | -0.034754 | -0.491099 | -0.021348 | -0.349325 |
| **4** | -0.020280 | 0.213672 | -0.013759 | -0.197485 |
| **...** | ... | ... | ... | ... |
| **153571** | -0.035284 | -0.209350 | -0.021746 | -0.299088 |
| **153572** | -0.034484 | -0.209350 | -0.021248 | -0.336628 |
| **153573** | -0.028705 | -1.062506 | -0.015494 | -0.330935 |
| **153574** | -0.018087 | 2.180162 | -0.016312 | -0.148244 |
| **153575** | -0.035015 | -0.145088 | -0.021588 | -0.150652 |

153576 rows × 4 columns

```
In [61]: print(metadata.shape)
         metadata.head()
```

```
(153576, 167)
```

Out[61]:

| | usd_goal | set_fundraising_period | target_goal_period_rate | launching_delay_time | disable_communication | is_starrable | state | category_name_3D Printing | category_n |
|---|---|---|---|---|---|---|---|---|---|
| **0** | -0.025104 | -0.209350 | -0.015407 | -0.282325 | 0 | 0 | 1 | 0 | |
| **1** | -0.035191 | -0.212905 | -0.021688 | -0.240724 | 0 | 0 | 1 | 0 | |
| **2** | -0.026858 | 1.066828 | -0.018317 | -0.348701 | 0 | 0 | 1 | 0 | |
| **3** | -0.034754 | -0.491099 | -0.021348 | -0.349325 | 0 | 0 | 0 | 0 | |
| **4** | -0.020280 | 0.213672 | -0.013759 | -0.197485 | 0 | 0 | 1 | 0 | |

5 rows × 167 columns

```
In [ ]: # 파일 중간저장
        # metadata.to_csv('metadata_encoded_scaled.csv', index=False, encoding='utf-8')
```

## Encoding 및 Scaling 후 종속변수 데이터 탐색

```
In [109]: # 연속형 변수 기본 통계 집계
          # count, mean, median, mode, standard deviation, min, max, quantile 25%, 50%, 75%, nan/null

          columns_scaled = metadata[col_scaled]
          list_for_df = []
          for column_to_look in columns_scaled:
              basic_stat = {"column_scaled":column_to_look, "count":metadata[column_to_look].count(), "mean":metadata[column_t
          o_look].mean(),
                            "median":metadata[column_to_look].median(), "mode":metadata[column_to_look].mode(), "std":metadata
          [column_to_look].std(),
                            "min":metadata[column_to_look].min(), "25%":metadata[column_to_look].quantile(0.25),
                            "50%":metadata[column_to_look].quantile(0.5), "75%":metadata[column_to_look].quantile(0.75),
                            "max":metadata[column_to_look].max(), "nan":metadata[column_to_look].isna().sum()}
              list_for_df.append(basic_stat)

          pd.DataFrame(list_for_df).set_index('column_scaled').T
```

Out[109]:

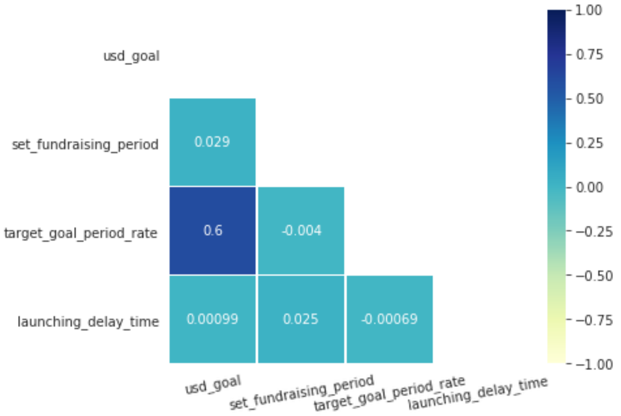
| column_scaled | usd_goal | set_fundraising_period | target_goal_period_rate | launching_delay_time |
|---|---|---|---|---|
| **count** | 153576 | 153576 | 153576 | 153576 |
| **mean** | 1.4781e-15 | 3.93822e-15 | 1.34052e-15 | 1.24227e-16 |
| **median** | -0.0312436 | -0.20935 | -0.019366 | -0.270573 |
| **mode** | 0 -0.031244 dtype: float64 | 0 -0.20935 dtype: float64 | 0 -0.01923 dtype: float64 | 0 -0.349718 1 -0.349700 2 -0.349613 3 ... |
| **std** | 1 | 1 | 1 | 1 |
| **min** | -0.0356286 | -2.6835 | -0.0219608 | -0.349928 |
| **25%** | -0.0343924 | -0.212905 | -0.0211619 | -0.330289 |
| **50%** | -0.0312436 | -0.20935 | -0.019366 | -0.270573 |
| **75%** | -0.0238255 | 0.131912 | -0.0150038 | -0.0880043 |
| **max** | 133.589 | 5.57349 | 224.818 | 21.7945 |
| **nan** | 0 | 0 | 0 | 0 |

```
In [53]: # 연속형 변수 상관관계 분석
         col_scaled = ['usd_goal', 'set_fundraising_period', 'target_goal_period_rate', 'launching_delay_time']
         corr_df = metadata[col_scaled].corr()
         corr_df
```

Out[53]:

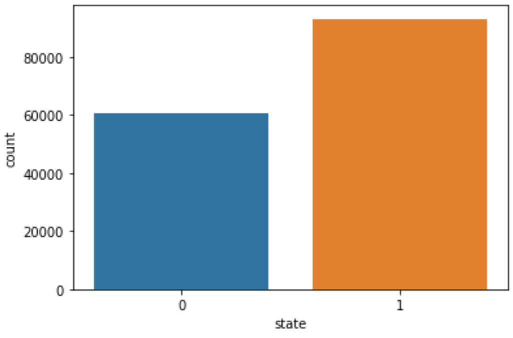
| | usd_goal | set_fundraising_period | target_goal_period_rate | launching_delay_time |
|---|---|---|---|---|
| **usd_goal** | 1.000000 | 0.028899 | 0.604225 | 0.000988 |
| **set_fundraising_period** | 0.028899 | 1.000000 | -0.004025 | 0.025013 |
| **target_goal_period_rate** | 0.604225 | -0.004025 | 1.000000 | -0.000688 |
| **launching_delay_time** | 0.000988 | 0.025013 | -0.000688 | 1.000000 |

In [72]:
```
# 연속형 변수 상관관계 히트맵 그래프
mask = np.zeros_like(corr_df)
mask[np.triu_indices_from(mask)] = True
with sns.axes_style("white"):
    f, ax = plt.subplots(figsize=(7, 5))
    ax = sns.heatmap(corr_df, vmin=-1, vmax=1, cmap="YlGnBu", annot=True, square=True, linewidth=0.5, mask=mask)
plt.xticks(rotation=10)
plt.show()
```



In [78]:
```
# 타깃('state') 분포 재확인
print(metadata['state'].value_counts())
print(metadata['state'].value_counts(normalize=True))
sns.countplot(metadata['state'])
plt.show()
```

```
1    93112
0    60464
Name: state, dtype: int64
1    0.606293
0    0.393707
Name: state, dtype: float64
```



In [44]:
```
metadata = pd.read_csv('./data_2015_2019/metadata_encoded_scaled.csv')
```

In [ ]: