In [2]:
```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.preprocessing import MinMaxScaler
from sklearn.metrics.pairwise import cosine_similarity
from sklearn.cluster import KMeans
from sklearn.metrics import davies_bouldin_score
```

In [3]:
```
# Load datasets
customers = pd.read_csv("Customers.csv")
products = pd.read_csv("Products.csv")
transactions = pd.read_csv("Transactions.csv")

# Preview datasets
print("Customers Dataset:")
print(customers.head())
print("\nProducts Dataset:")
print(products.head())
print("\nTransactions Dataset:")
print(transactions.head())
```

```
Customers Dataset:
  CustomerID        CustomerName         Region  SignupDate
0      C0001    Lawrence Carroll  South America  2022-07-10
1      C0002      Elizabeth Lutz           Asia  2022-02-13
2      C0003      Michael Rivera  South America  2024-03-07
3      C0004  Kathleen Rodriguez  South America  2022-10-09
4      C0005         Laura Weber           Asia  2022-08-15

Products Dataset:
  ProductID              ProductName     Category   Price
0      P001     ActiveWear Biography        Books  169.30
1      P002    ActiveWear Smartwatch  Electronics  346.30
2      P003  ComfortLiving Biography        Books   44.12
3      P004            BookWorld Rug   Home Decor   95.69
4      P005          TechPro T-Shirt     Clothing  429.31

Transactions Dataset:
  TransactionID CustomerID ProductID      TransactionDate  Quantity  \
0        T00001      C0199      P067  2024-08-25 12:38:23         1
1        T00112      C0146      P067  2024-05-27 22:23:54         1
2        T00166      C0127      P067  2024-04-25 07:38:55         1
3        T00272      C0087      P067  2024-03-26 22:55:37         2
4        T00363      C0070      P067  2024-03-21 15:10:10         3

   TotalValue   Price
0      300.68  300.68
1      300.68  300.68
2      300.68  300.68
3      601.36  300.68
4      902.04  300.68
```

In [4]:
```
# Merge datasets for analysis
merged_data = transactions.merge(customers, on="CustomerID").merge(products, on="Pr
```

```
print("Merged Dataset:")
print(merged_data.head())
```

```
Merged Dataset:
  TransactionID CustomerID ProductID      TransactionDate  Quantity  \
0        T00001      C0199      P067  2024-08-25 12:38:23         1
1        T00112      C0146      P067  2024-05-27 22:23:54         1
2        T00166      C0127      P067  2024-04-25 07:38:55         1
3        T00272      C0087      P067  2024-03-26 22:55:37         2
4        T00363      C0070      P067  2024-03-21 15:10:10         3

   TotalValue  Price_x     CustomerName         Region  SignupDate  \
0      300.68   300.68   Andrea Jenkins         Europe  2022-12-03
1      300.68   300.68  Brittany Harvey           Asia  2024-09-04
2      300.68   300.68  Kathryn Stevens         Europe  2024-04-04
3      601.36   300.68  Travis Campbell  South America  2024-04-11
4      902.04   300.68    Timothy Perez         Europe  2022-03-15

                      ProductName     Category  Price_y
0  ComfortLiving Bluetooth Speaker  Electronics   300.68
1  ComfortLiving Bluetooth Speaker  Electronics   300.68
2  ComfortLiving Bluetooth Speaker  Electronics   300.68
3  ComfortLiving Bluetooth Speaker  Electronics   300.68
4  ComfortLiving Bluetooth Speaker  Electronics   300.68
```

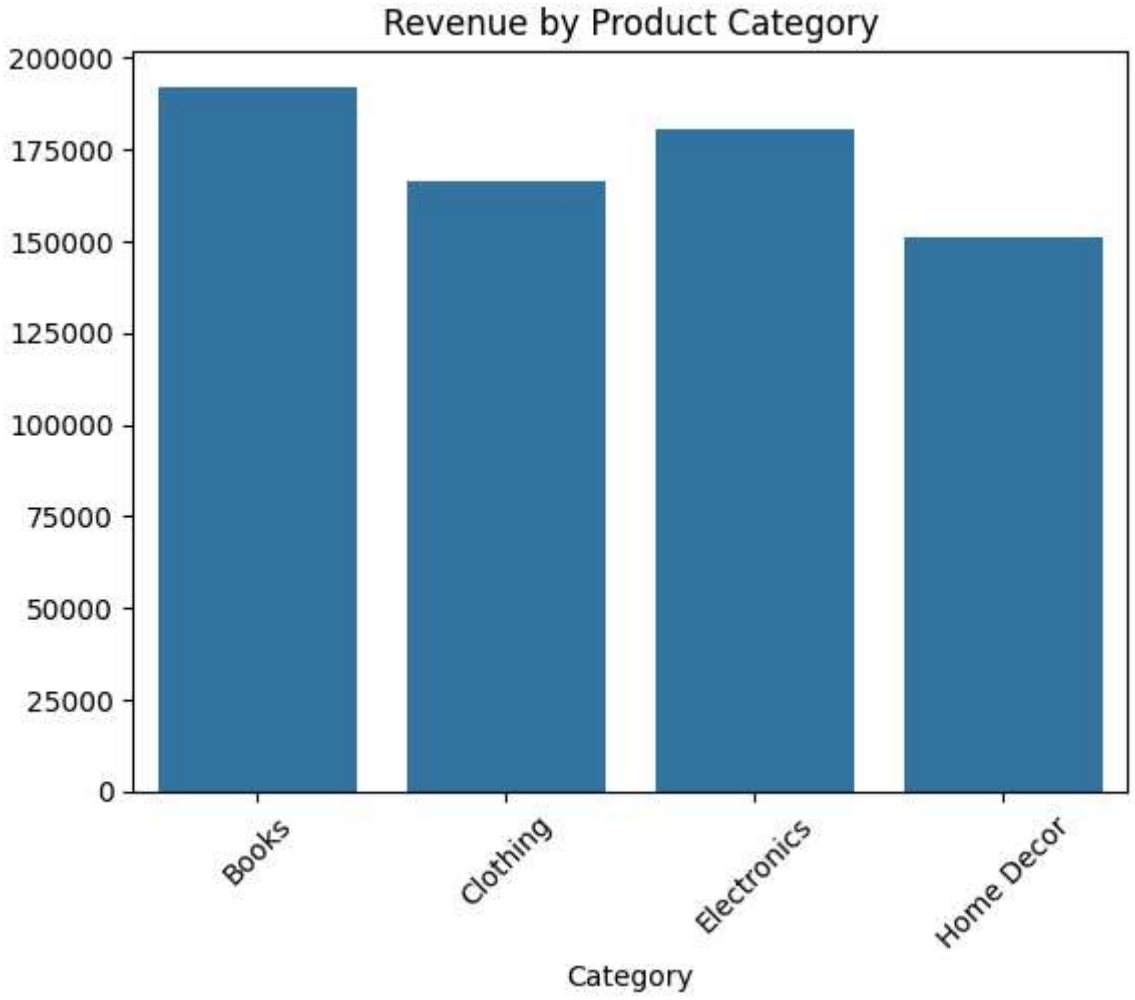
In [6]:
```
# Correct code
top_products = merged_data.groupby("ProductName")["TotalValue"].sum().sort_values(a
print("Top 5 Products by Revenue:")
print(top_products.head())
```

```
Top 5 Products by Revenue:
ProductName
ActiveWear Smartwatch    39096.97
SoundWave Headphones     25211.64
SoundWave Novel          24507.90
ActiveWear Jacket        22712.56
ActiveWear Rug           22314.43
Name: TotalValue, dtype: float64
```

In [7]:
```
region_revenue = merged_data.groupby("Region")["TotalValue"].sum()
print("Revenue by Region:")
print(region_revenue)
```

```
Revenue by Region:
Region
Asia             152074.97
Europe           166254.63
North America    152313.40
South America    219352.56
Name: TotalValue, dtype: float64
```

In [8]:
```
category_revenue = merged_data.groupby("Category")["TotalValue"].sum()
sns.barplot(x=category_revenue.index, y=category_revenue.values)
plt.title("Revenue by Product Category")
plt.xticks(rotation=45)
plt.show()
```




In [9]:
```
customer_features = merged_data.groupby("CustomerID").agg({
    "TotalValue": "sum",
    "TransactionID": "count"
}).rename(columns={"TotalValue": "TotalSpent", "TransactionID": "TransactionCount"}
print(customer_features.head())
```

| | CustomerID | TotalSpent | TransactionCount |
|---|---|---|---|
| 0 | C0001 | 3354.52 | 5 |
| 1 | C0002 | 1862.74 | 4 |
| 2 | C0003 | 2725.38 | 4 |
| 3 | C0004 | 5354.88 | 8 |
| 4 | C0005 | 2034.24 | 3 |

In [10]:
```
scaler = MinMaxScaler()
scaled_features = scaler.fit_transform(customer_features[["TotalSpent", "Transactio
```

In [11]:
```
similarity_matrix = cosine_similarity(scaled_features)
```

In [12]:
```
lookalikes = {}
for idx, customer_id in enumerate(customer_features["CustomerID"][:20]):
    sim_scores = list(enumerate(similarity_matrix[idx]))
    sim_scores = sorted(sim_scores, key=lambda x: x[1], reverse=True)[1:4]
    lookalikes[customer_id] = [(customer_features["CustomerID"][i], score) for i, s

print("Lookalikes for First 20 Customers:")
```

```
for key, value in lookalikes.items():
    print(f"Customer {key}: {value}")
```

```
Lookalikes for First 20 Customers:
Customer C0001: [('C0173', np.float64(0.9999999987151875)), ('C0145', np.float64(0.9
999949919723209)), ('C0137', np.float64(0.9999946982680763))]
Customer C0002: [('C0103', np.float64(0.9999993502213471)), ('C0024', np.float64(0.9
999981371395569)), ('C0034', np.float64(0.9999942994376945))]
Customer C0003: [('C0155', np.float64(0.9999996159457006)), ('C0132', np.float64(0.9
999981597569649)), ('C0107', np.float64(0.9999970204752502))]
Customer C0004: [('C0164', np.float64(0.9999993005704118)), ('C0156', np.float64(0.9
999992214244011)), ('C0021', np.float64(0.9999831686571975))]
Customer C0005: [('C0193', np.float64(0.9999999885232681)), ('C0092', np.float64(0.9
999995186259848)), ('C0100', np.float64(0.9999911360325124))]
Customer C0006: [('C0138', np.float64(0.9999999966050629)), ('C0079', np.float64(0.9
999961241266716)), ('C0148', np.float64(0.9999093043993703))]
Customer C0007: [('C0082', np.float64(0.9999999927393766)), ('C0085', np.float64(0.9
999933738178461)), ('C0171', np.float64(0.9999777581610158))]
Customer C0008: [('C0047', np.float64(0.9999998115780121)), ('C0111', np.float64(0.9
999838829932562)), ('C0157', np.float64(0.9999080459398836))]
Customer C0009: [('C0019', np.float64(0.9999377563528693)), ('C0172', np.float64(0.9
999055418525473)), ('C0161', np.float64(0.9997013566441835))]
Customer C0010: [('C0084', np.float64(0.9999999864109762)), ('C0109', np.float64(0.9
999941498800802)), ('C0184', np.float64(0.9999874092698352))]
Customer C0011: [('C0022', np.float64(0.999998984180604)), ('C0197', np.float64(0.99
9981638742939)), ('C0046', np.float64(0.9999778900110695))]
Customer C0012: [('C0102', np.float64(0.9999939192236035)), ('C0198', np.float64(0.9
999876629699103)), ('C0136', np.float64(0.9999638120142098))]
Customer C0013: [('C0100', np.float64(0.9999994086416225)), ('C0073', np.float64(0.9
999990543691356)), ('C0064', np.float64(0.9999988635670537))]
Customer C0014: [('C0020', np.float64(1.0)), ('C0033', np.float64(1.0)), ('C0058', n
p.float64(1.0))]
Customer C0015: [('C0149', np.float64(0.9999967640327179)), ('C0087', np.float64(0.9
9998496553079)), ('C0053', np.float64(0.9999110604679473))]
Customer C0016: [('C0099', np.float64(0.9999999788650036)), ('C0105', np.float64(0.9
999987624901436)), ('C0048', np.float64(0.9999952398309804))]
Customer C0017: [('C0086', np.float64(0.9999998788469018)), ('C0118', np.float64(0.9
999977677213803)), ('C0192', np.float64(0.9999965181873186))]
Customer C0018: [('C0141', np.float64(0.9999996557763399)), ('C0200', np.float64(0.9
999969565573225)), ('C0042', np.float64(0.9999800805149737))]
Customer C0019: [('C0172', np.float64(0.9999966528239834)), ('C0009', np.float64(0.9
999377563528693)), ('C0161', np.float64(0.9999117873946827))]
Customer C0020: [('C0020', np.float64(1.0)), ('C0033', np.float64(1.0)), ('C0058', n
p.float64(1.0))]
```

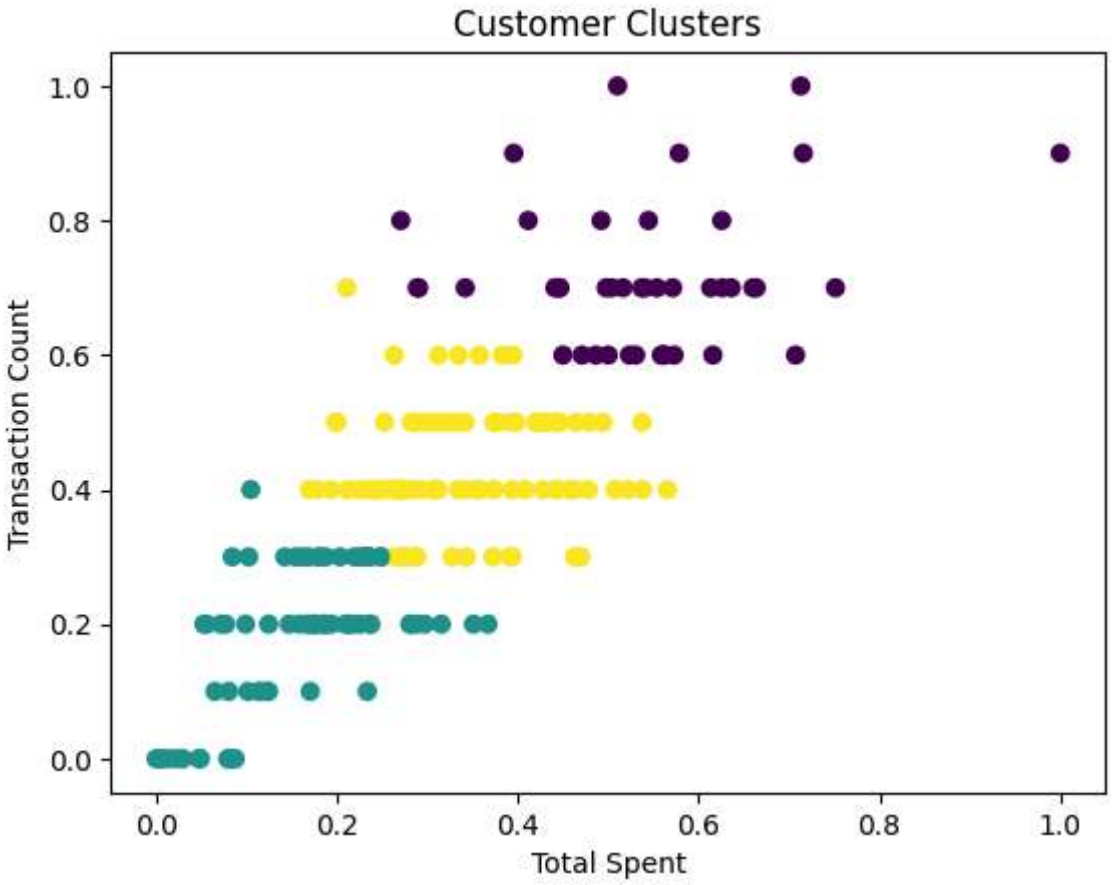
In [13]:
```
kmeans = KMeans(n_clusters=3, random_state=42)
customer_features["Cluster"] = kmeans.fit_predict(scaled_features)
```

In [14]:
```
db_index = davies_bouldin_score(scaled_features, customer_features["Cluster"])
print("Davies-Bouldin Index:", db_index)
```

```
Davies-Bouldin Index: 0.7520285743713337
```

In [15]:
```
plt.scatter(scaled_features[:, 0], scaled_features[:, 1], c=customer_features["Clus
plt.xlabel("Total Spent")
plt.ylabel("Transaction Count")
```

```
plt.title("Customer Clusters")
plt.show()
```




In [ ]: