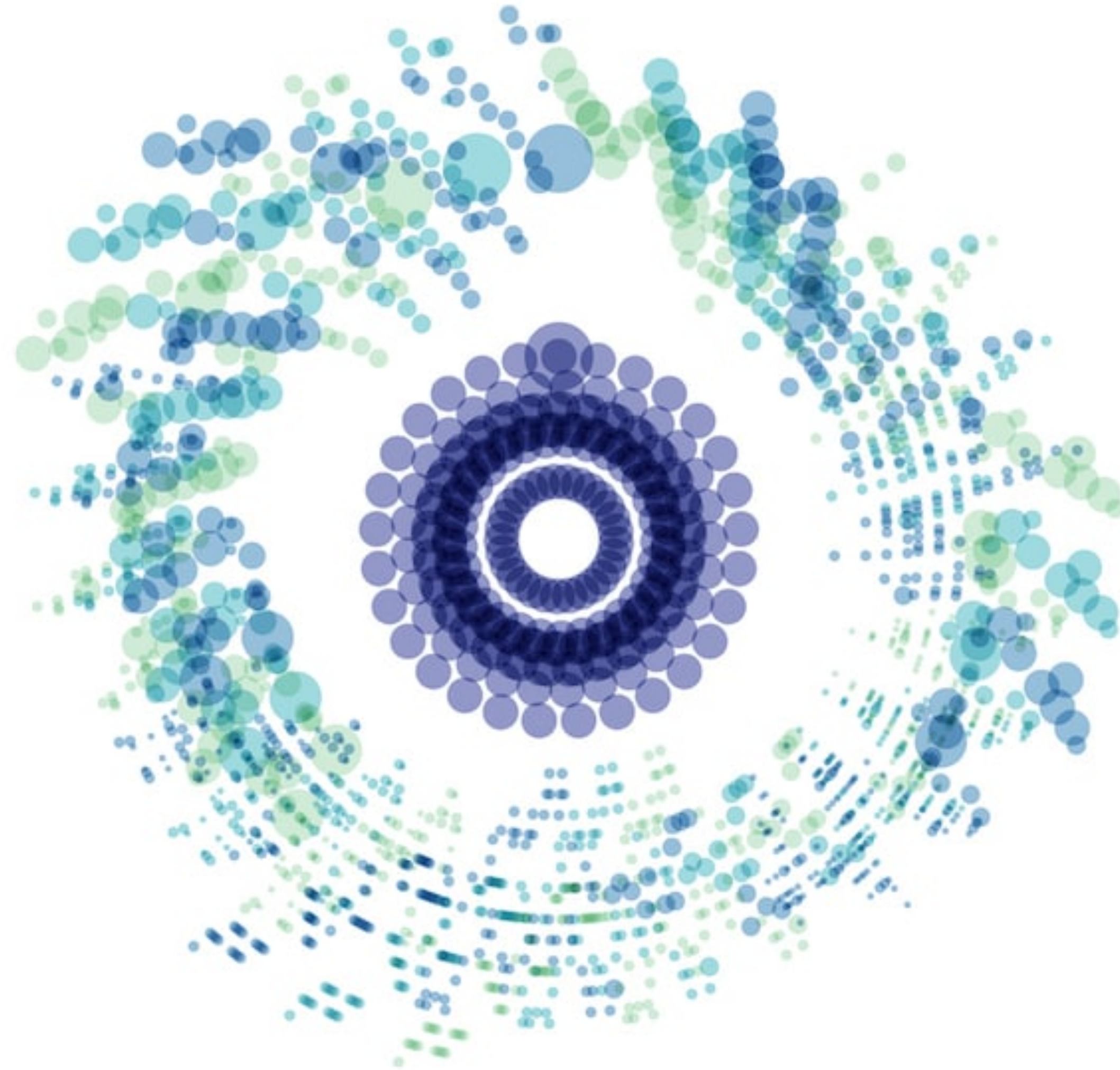


# Procurement Analytics

DSI 9 Capstone Project - **TOH YONG XUN**







# Challenges

## **1: Predict Contract Award Value**

Help the buyer estimate their budget the seller to estimate their offers

## **2: Predict No. of Bidders**

Help seller decide whether to bid for a contract based on the anticipated level of competitiveness

## **3: Recommend Similar Suppliers**

Help the buyer identify potential suppliers that could provide the item/service

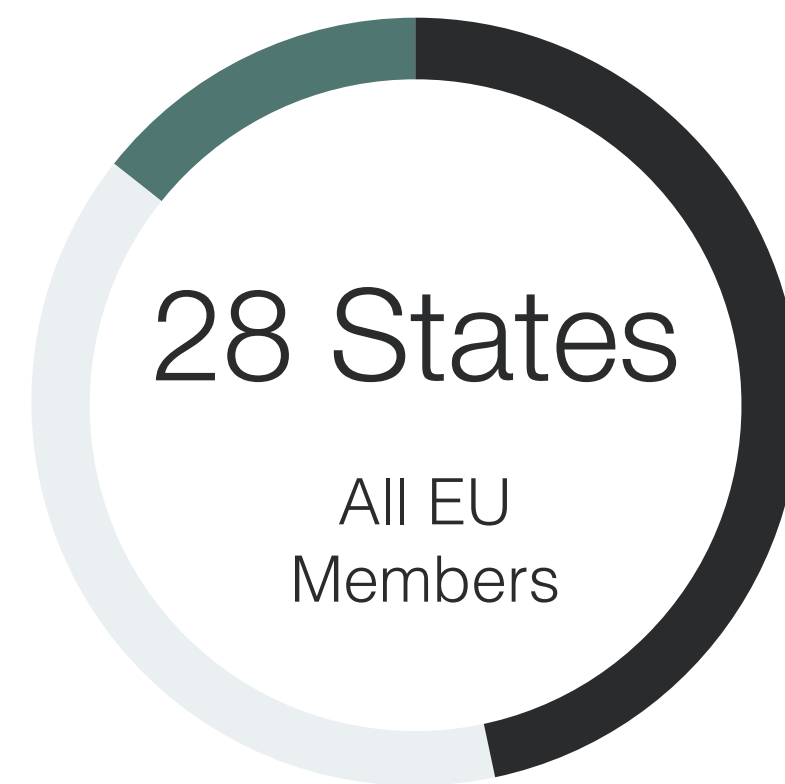
# Experiment Dataset

European Union Tenders Electronic Daily Records

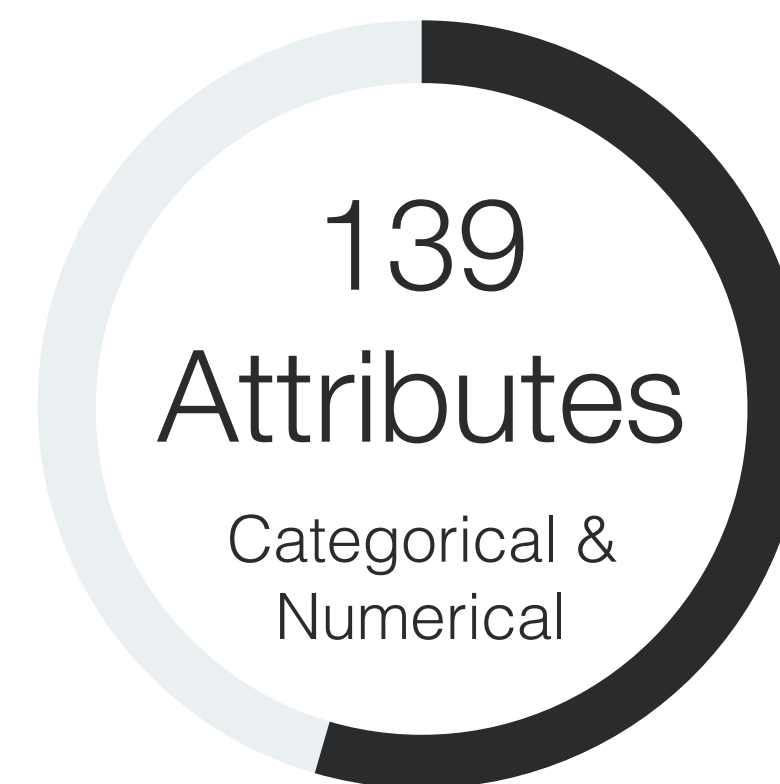
(source: <https://data.europa.eu/euodp/en/data/dataset/ted-csv>)



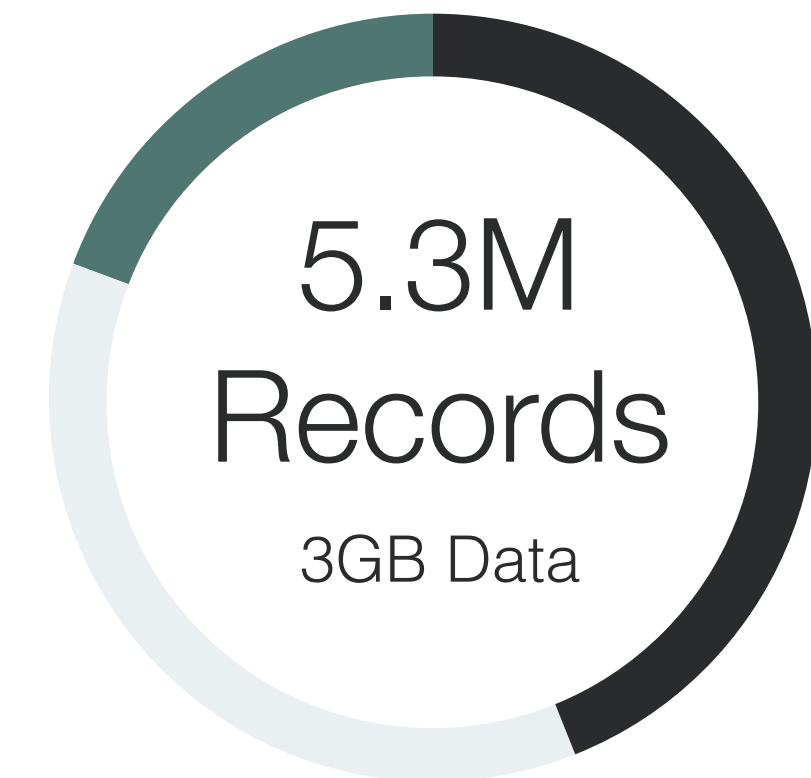
**DURATION**



**SCALE**



**DEPTH**



**SIZE**

# Challenge 1

**Predict Contract Award Value**

# Data Processing

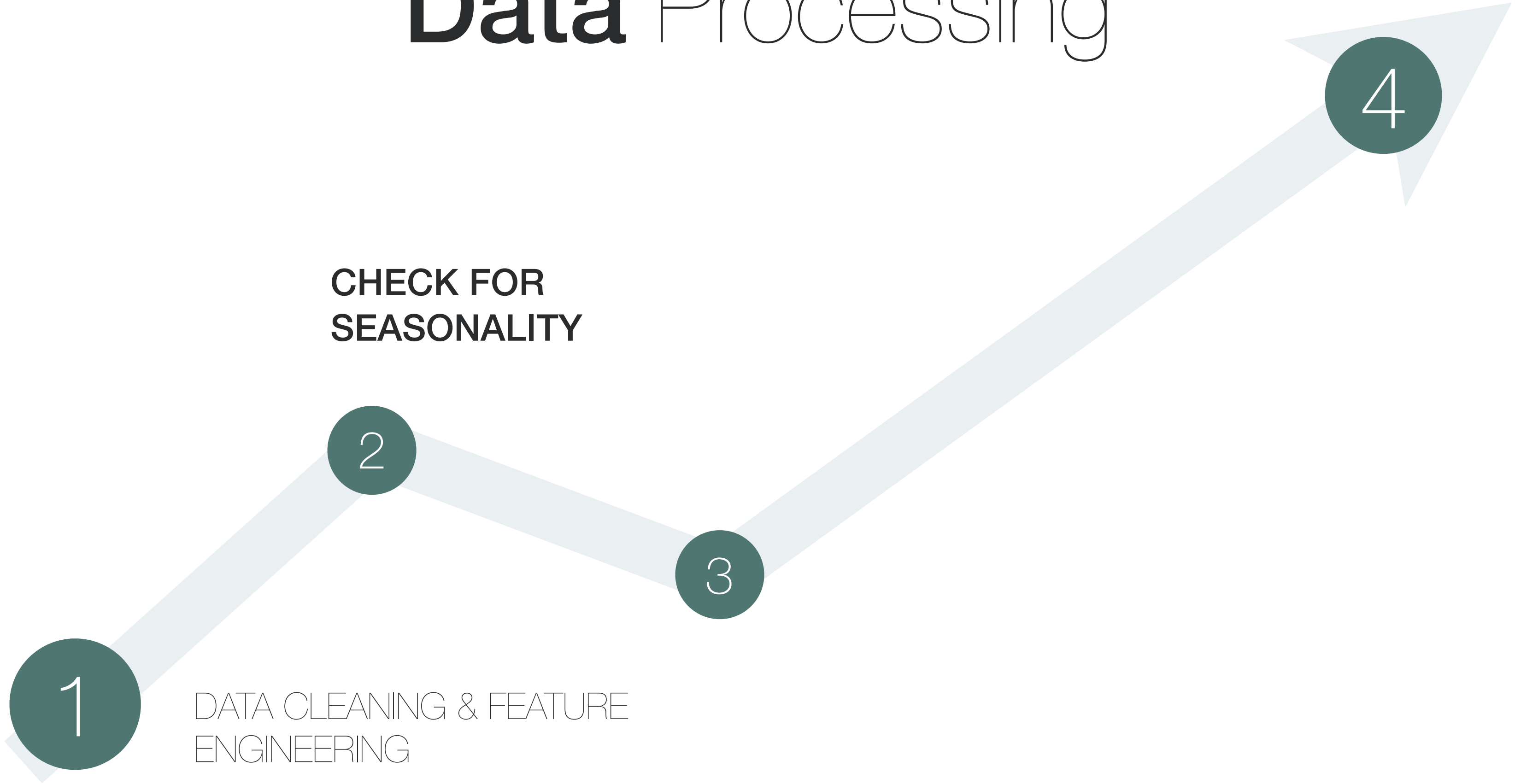




# The Dataset

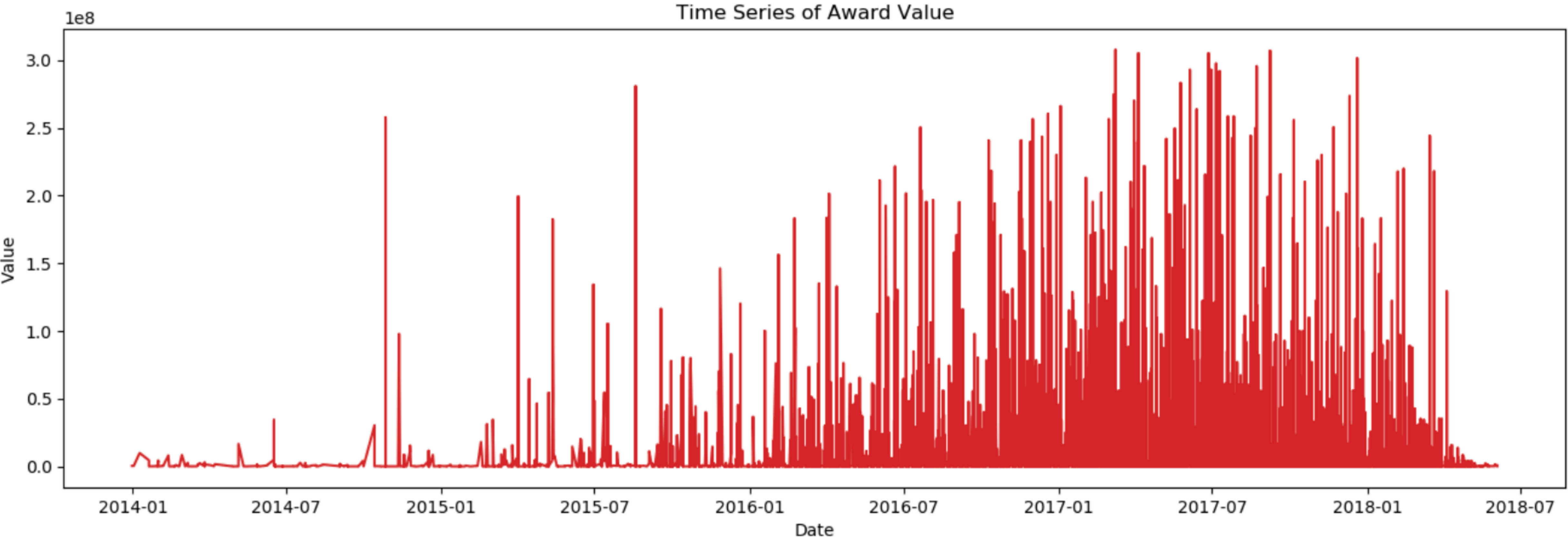
| WIN_NAME  | WIN_NATIONALID                 | WIN_ADDRESS   | WIN_TOWN  | WIN_POSTAL_CODE                               | WIN_COUNTRY_CODE       | B_CONTRACTOR_SME  | CONTRACT_NUMBER                    |
|---|--------------------------------|---|---|---|------------------------|-------------------|------------------------------------|
| NaN   | NaN                            | NaN   | NaN   | NaN   | NaN                    | NaN               | EIOPA/OP/009/2017, Lot 2           |
| ELT associati<br>di Guaglio<br>Davide e<br>Molinari Pao...    | NaN                            | Via<br>Mantovanella 4-<br>--Galleria<br>Crocetta 10/a--<br>-... | Mantova---<br>Parma---<br>Parma---<br>Parma---<br>Parma | 46100---43126--<br>-43126---43123--<br>-43122 | IT---IT---IT---IT---IT | Y---Y---Y---Y---Y | OC/EFSA/CORSER/2017/03 -<br>FWC 01 |
| A.I.Erre<br>engineering                                       | NaN                            | Strada<br>Cavagnari 10  | Parma   | 43126   | IT                     | Y                 | OC/EFSA/CORSER/2017/03 -<br>FWC02  |
| Dialogika<br>GmbH---<br>Dokumenta<br>S.A.                     | NaN                            | Pascalschacht<br>1---Rue<br>d&apos;Epernay<br>16                | Saarbrücken-<br>--<br>Luxembourg                        | 66125---1490                                  | DE---LU                | Y---Y             | NaN                                |
| Información y<br>Desarrollo SL<br>(INFYDE)---<br>Socieda...   | ES-B48236251---<br>PT503821012 | Avenida<br>Zugazarte 8-<br>3PL---Avenida<br>Marechal Gom...     | Las Arenas---<br>Porto                                  | 48930---4150-356                              | ES---PT                | N---N             | 2016CE160AT109                     |
| G4S Secure<br>Solution AG                                     | NaN                            | Dresdner<br>Strasse 91/1  | Wien  | 1200  | AT                     | N                 | PR/2017-004-SEC/VIE                |
| Ecologic<br>Institute<br>gemeinnützige<br>GmbH---The<br>In... | NaN                            | Pfalzburger Str.<br>43/44---11<br>Belgrave Road,<br>IEE...      | Berlin---<br>London---<br>Brussels                      | 10717---SW1V 1RB--<br>-1030                   | DE---UK---BE           | Y---Y---Y         | 07.0202/2017/768146/ENV.D.3        |

# Data Processing



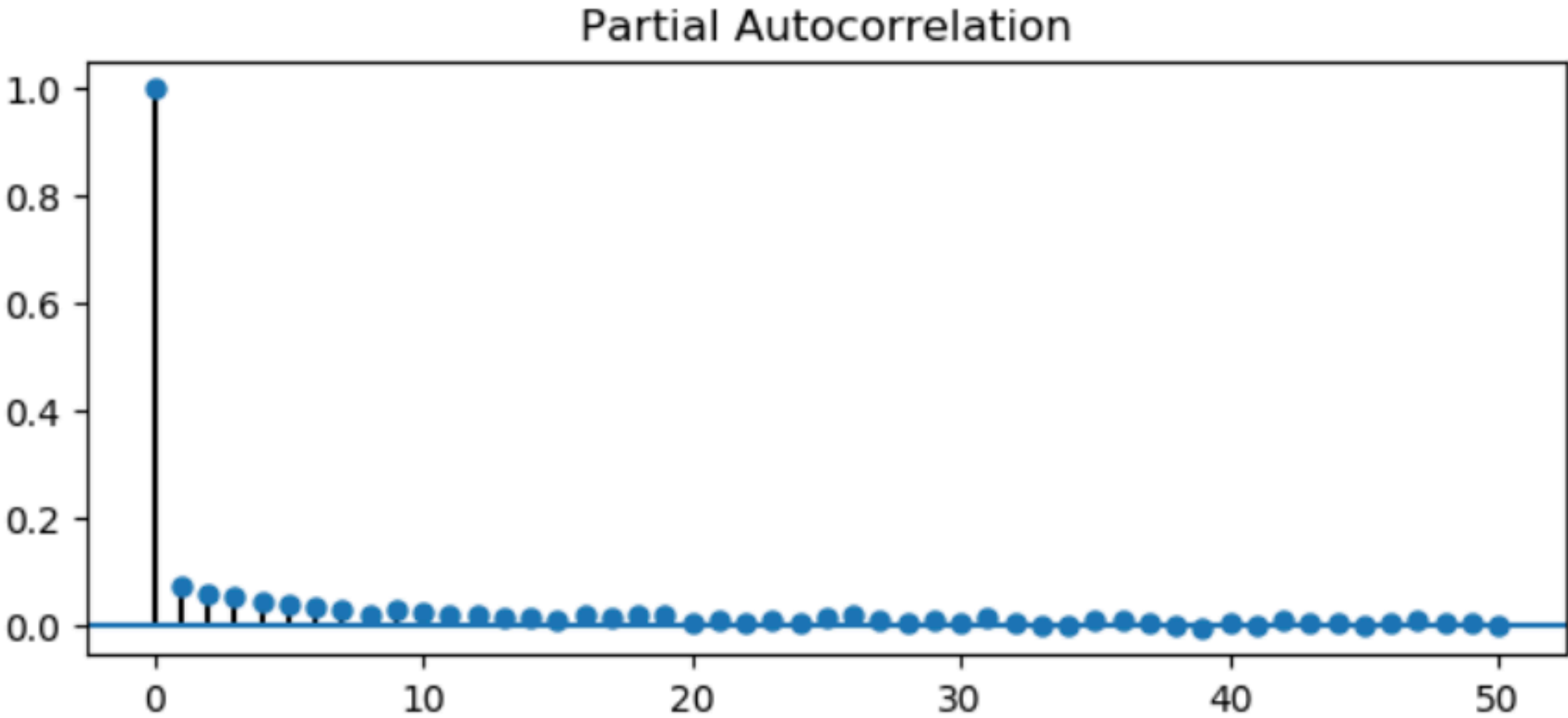
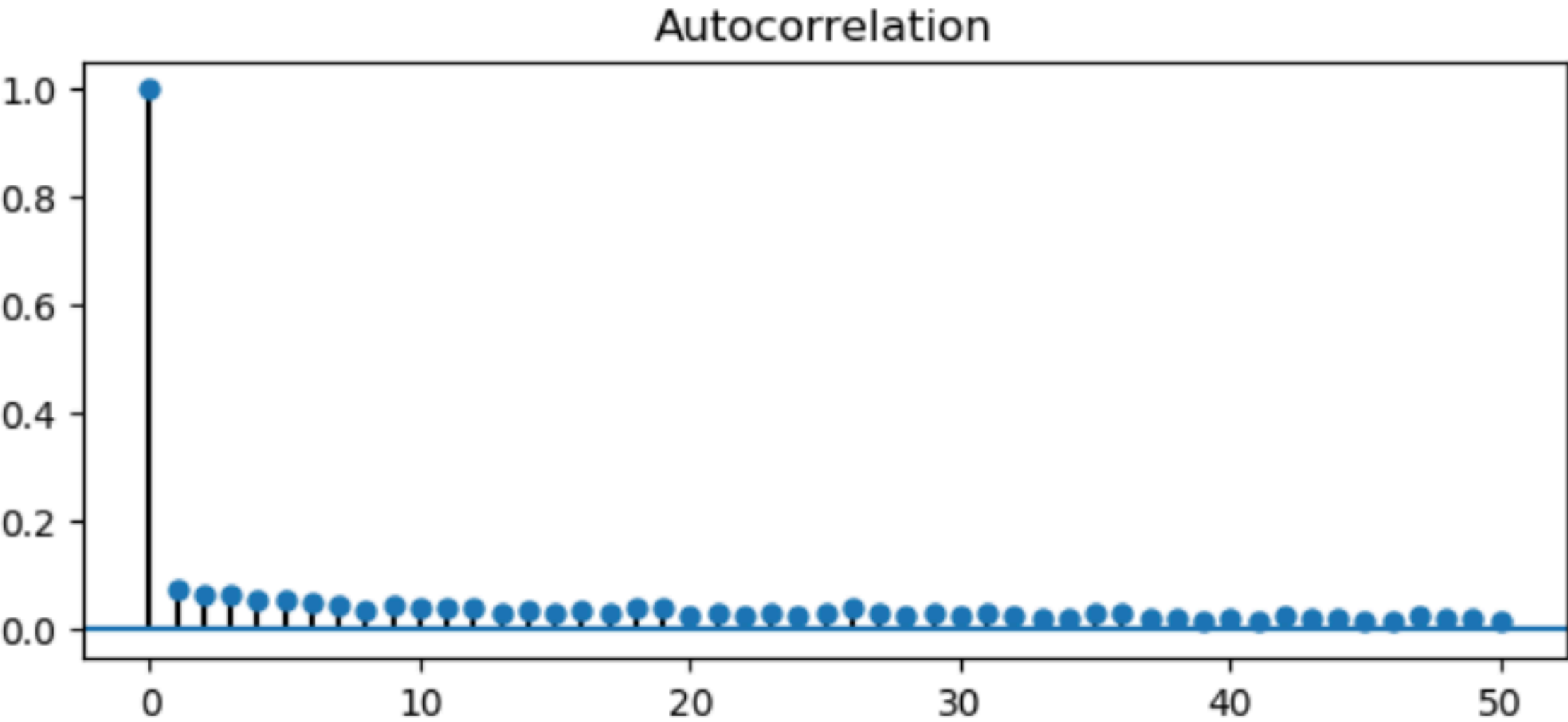
# Award Value is Stationarity

ADF Statistic: -44.652193340943924  
p-value: 0.0  
Critical Values:  
1%, -3.43037000945912  
Critical Values:  
5%, -2.861548843935082  
Critical Values:  
10%, -2.566774707305386

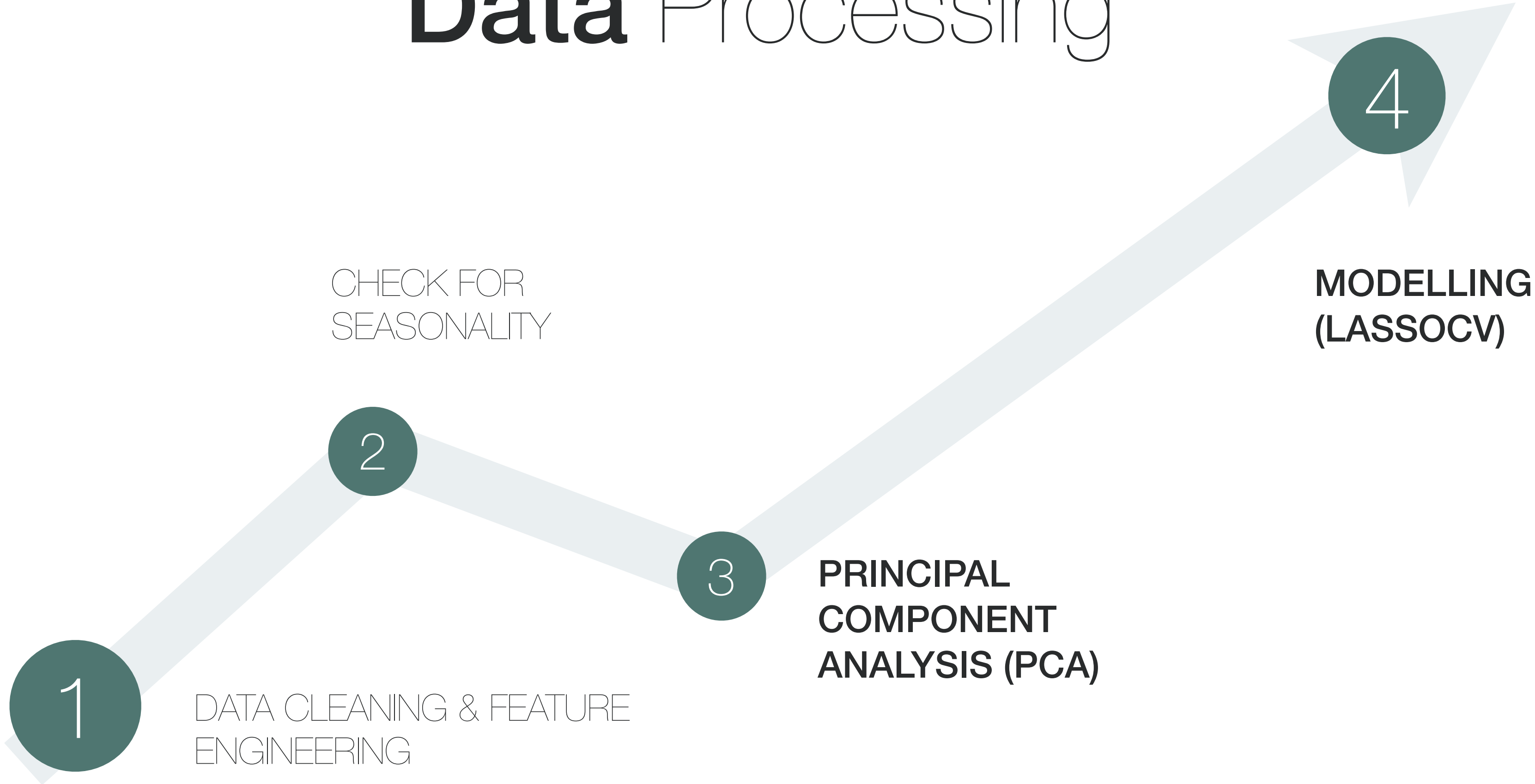




# No Seasonality



# Data Processing



# The 0.10 Problem

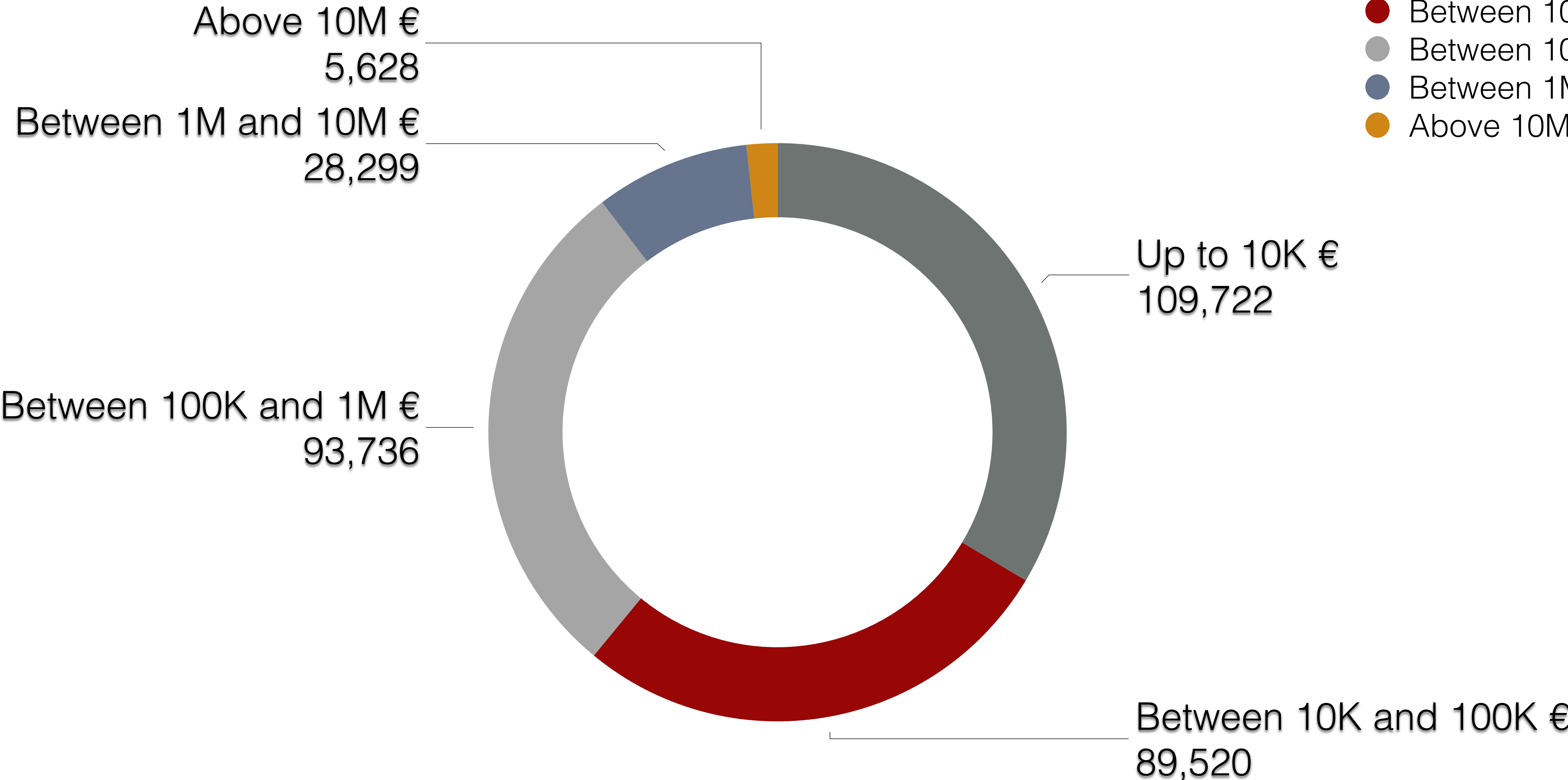


Nothing was wrong. We simply do not have the necessary data to explain for contract award value

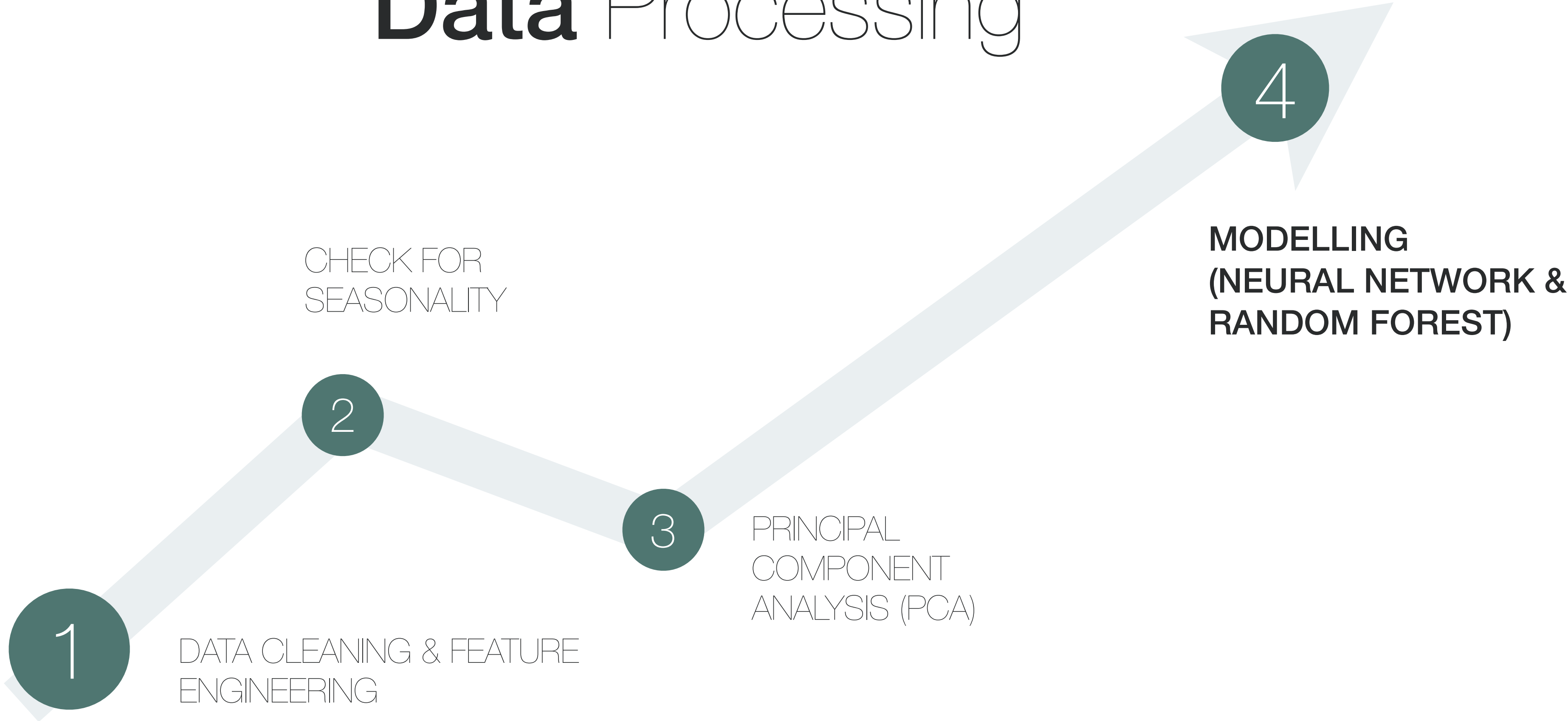
# Regression —> Classification

Engineer new targets

- Up to 10K €
- Between 10K and 100K €
- Between 100K and 1M €
- Between 1M and 10M €
- Above 10M €



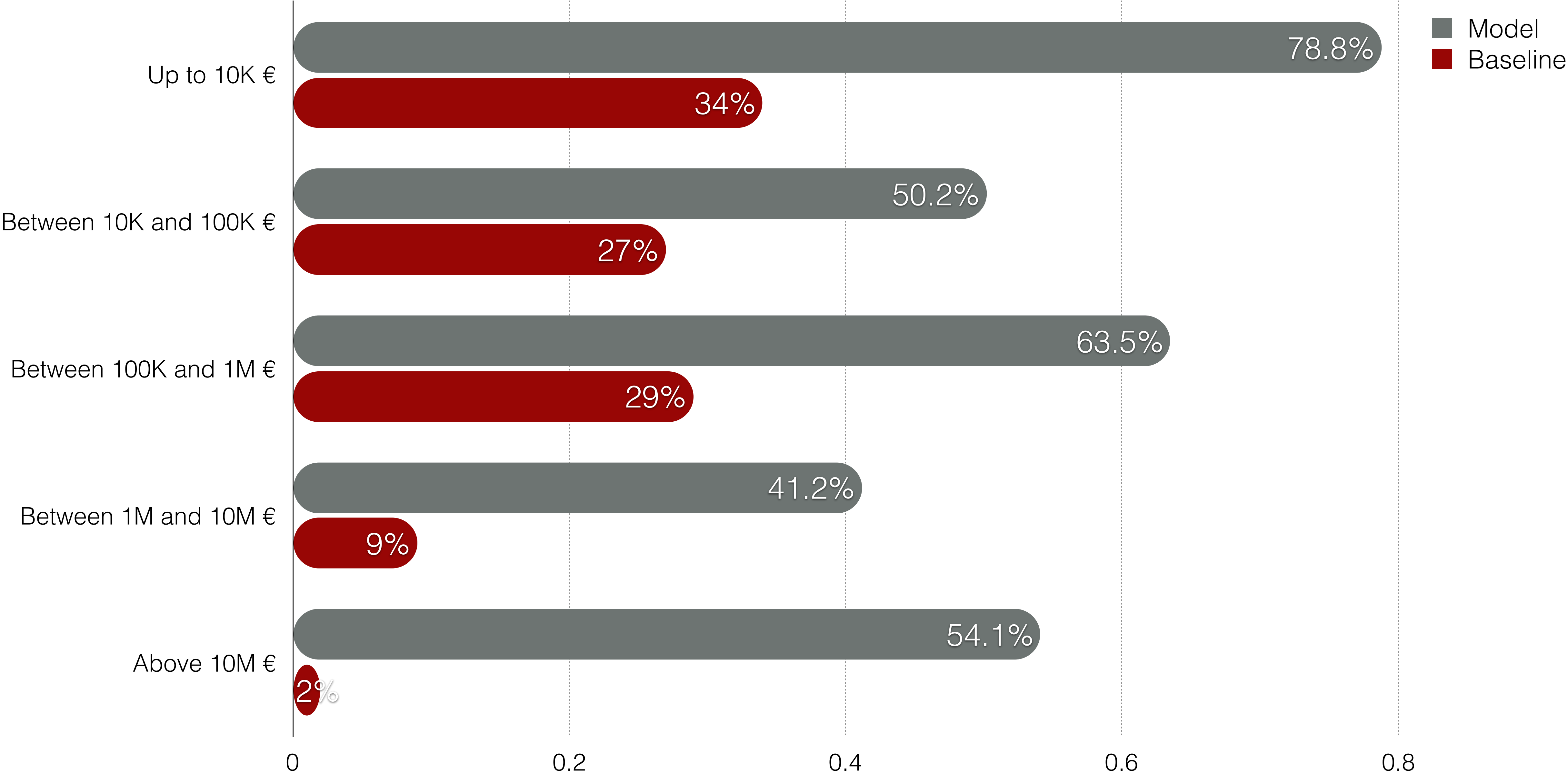
# Data Processing





# Model Results

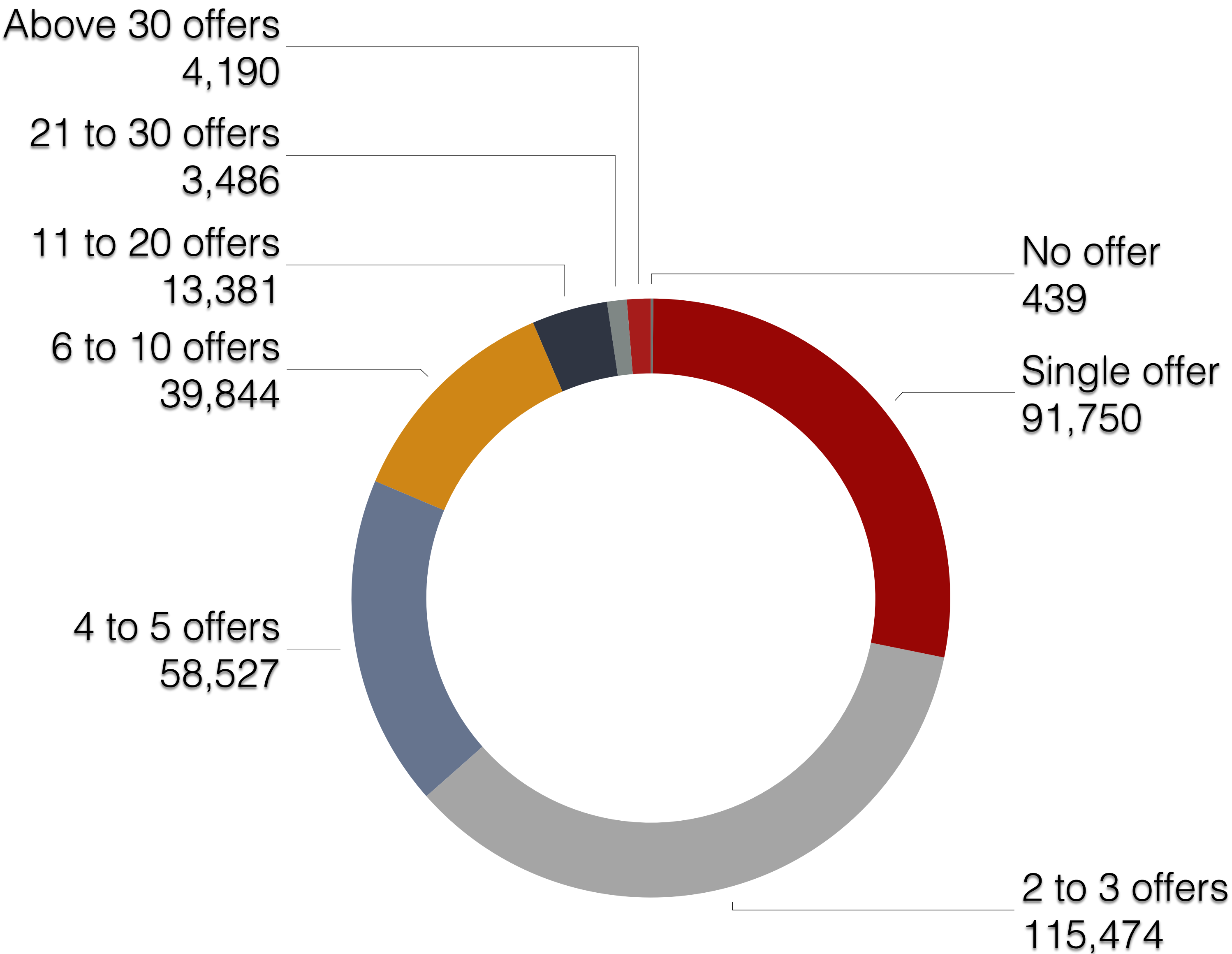
## Challenge 1: Predict Contract Award Value



# Challenge 2

**Predict No. of Bidders**

# Regression —> Classification



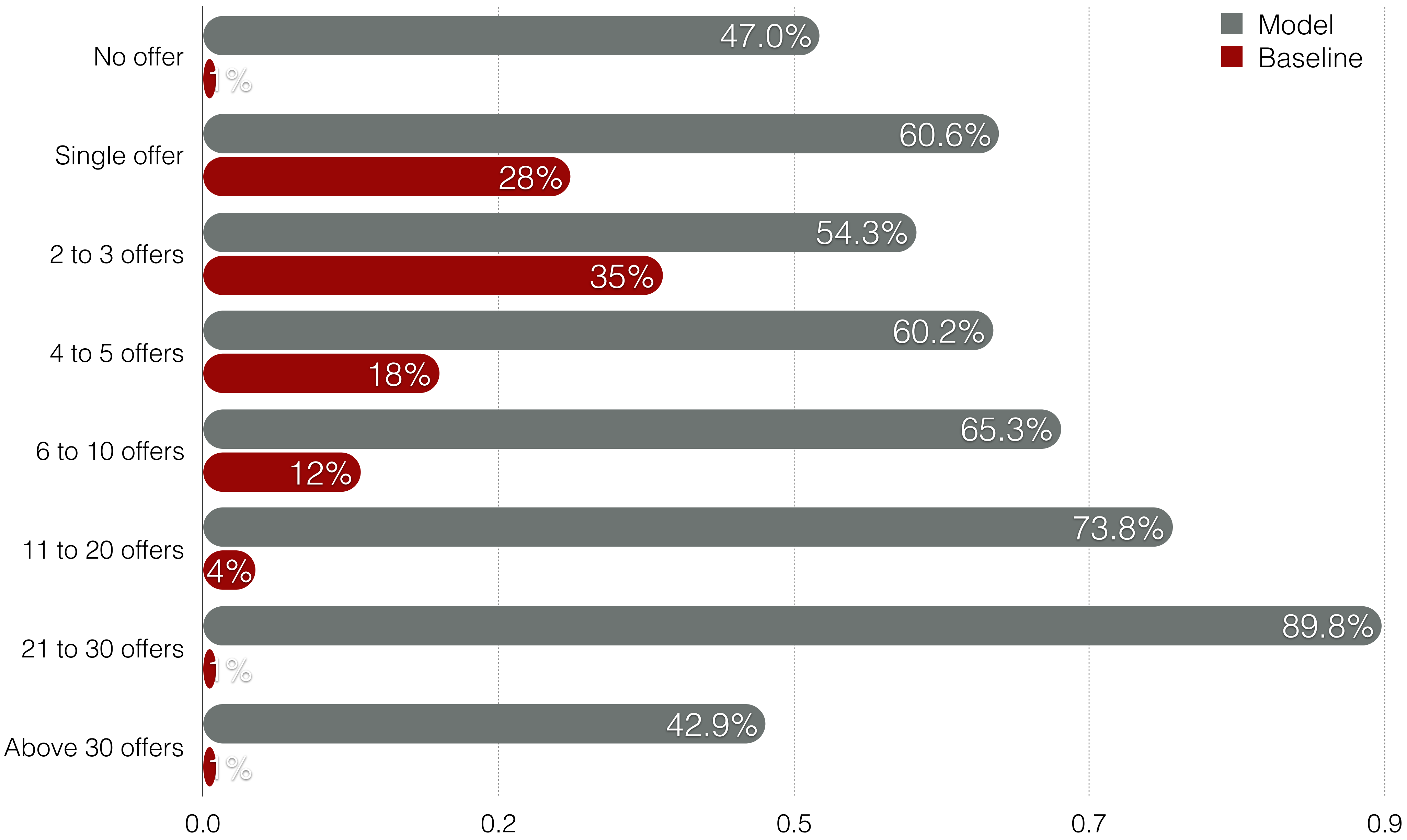
## Engineer new targets

- No offer
- Single offer
- 2 to 3 offers
- 4 to 5 offers
- 6 to 10 offers
- 11 to 20 offers
- 21 to 30 offers
- Above 30 offers



# Model Results

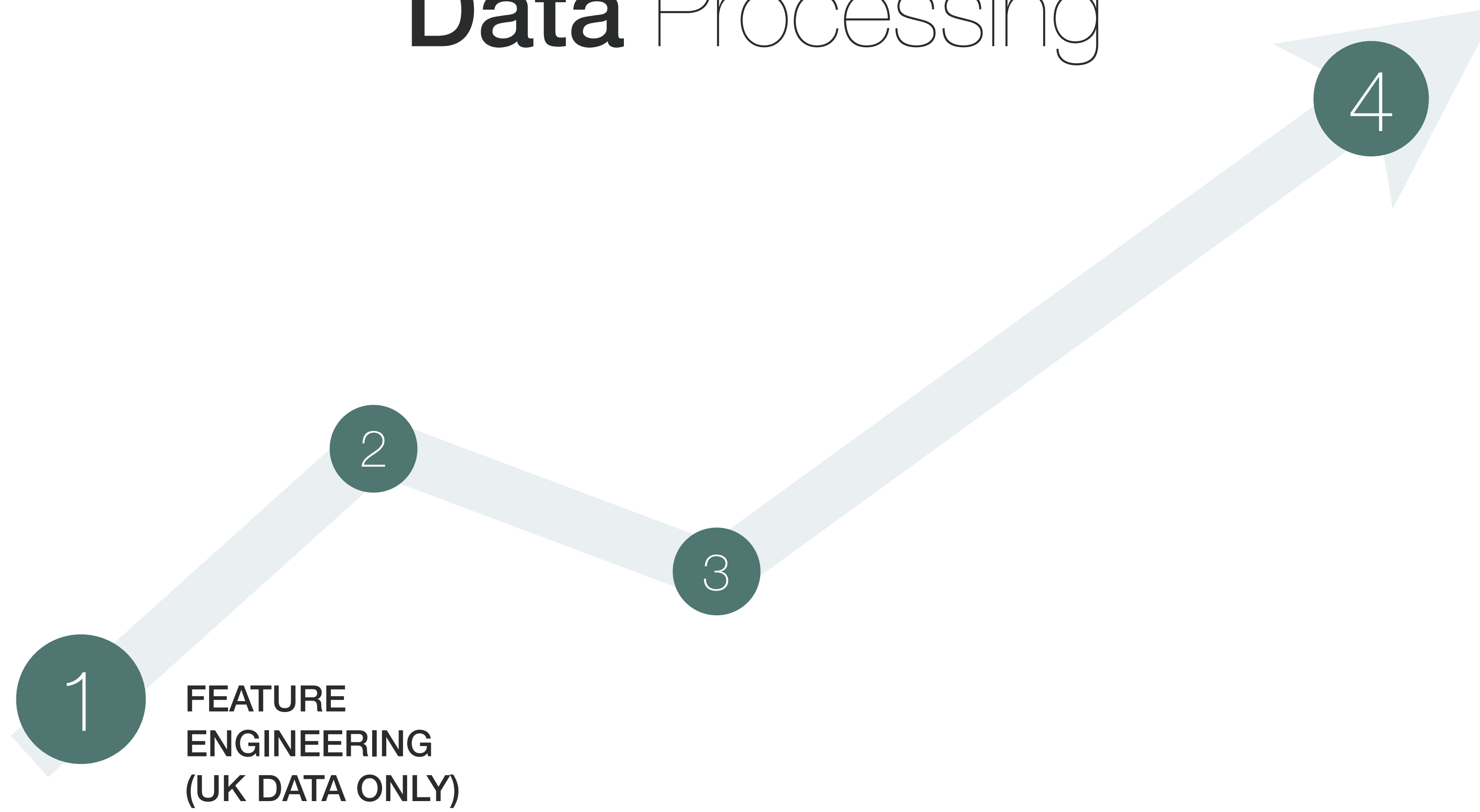
## Challenge 2: Predict No. of Bidders



# Challenge 3

**Find Similar Suppliers**

# Data Processing





# Common Procurement Vocabulary

|              |            |   |
|--------------|------------|---|
| Division     | 35000000-4 | Other transport equipment   |
| Group        | 35100000-5 | Ships and boats   |
|              | ...        | ...   |
| Class        | 35110000-8 | Ships   |
| Category     | 35112000-2 | Ships and similar vessels for the transport of persons or goods                         |
| Sub-category | 35112100-3 | Cruise ships, ferry boats and the like, primarily designed for the transport of persons |
|              | 35112110-6 | Ferry boats   |
|              | 35112180-7 | Cruise or excursion boats n.e.c.  |
|              | 35112200-4 | Tankers   |
|              | ...        | ...   |

# Feature Engineering

[Title] +

|    | CPV      | ADDITIONAL_CPVS                                   |
|----|----------|---|
| 0  | 72300000 | 72319000  |
| 1  | 79411000 | NaN   |
| 2  | 79411000 | NaN   |
| 3  | 48000000 | NaN   |
| 4  | 79000000 | 72700000  |
| 5  | 79710000 | 79992000  |
| 6  | 90700000 | NaN   |
| 7  | 45000000 | 45100000---45110000---45200000---45220000---45... |
| 8  | 45320000 | 45321000  |
| 9  | 45000000 | 71240000  |
| 10 | 45252127 | 45252130---45231300---45100000---45330000---45... |
| 11 | 45000000 | NaN   |
| 12 | 45200000 | 45200000---45232400---45232410---45232411---45... |
| 13 | 45234100 | 45213321---45233144---45234116---45234115---45... |
| 14 | 32400000 | 32400000  |
| 15 | 45316110 | 45316110  |

+

| CPV           | CPV DESCRIPTION   |
|---------------|---|
| 64215000-6    | IP Telephone services.  |
| 64216000-3    | Electronic message and information services.                                |
| 64216100-4    | Electronic message services.  |
| 64216110-7    | Electronic data exchange services.  |
| 64216120-0    | Electronic mail services.   |
| 64216130-3    | Telex services.   |
| 64216140-6    | Telegraph services.   |
| 64216200-5    | Electronic information services.  |
| 64216210-8    | Value-added information services.   |
| 64216300-6    | Teletext services.  |
| 64220000-4    | Telecommunication services except telephone and data transmission services. |
| 64221000-1    | Interconnection services.   |
| 64222000-8    | Teleworking services.   |
| 64223000-5    | Paging services.  |
| 64224000-2    | Teleconferencing services.  |
| 64225000-9    | Air-to-ground telecommunications services.                                  |
| 64226000-6    | Telematics services.  |
| 64227000-3    | Integrated telecommunications services.                                     |
| 64228000-0(6) | Television and radio broadcast transmission services.                       |
| 64228100-1(6) | Television broadcast transmission services.                                 |
| 64228200-2(6) | Radio broadcast transmission services.                                      |
| 65000000-3    | Public utilities.   |
| 65100000-4    | Water distribution and related services.                                    |
| 65110000-7    | Water distribution.   |
| 65111000-4    | Drinking-water distribution.  |

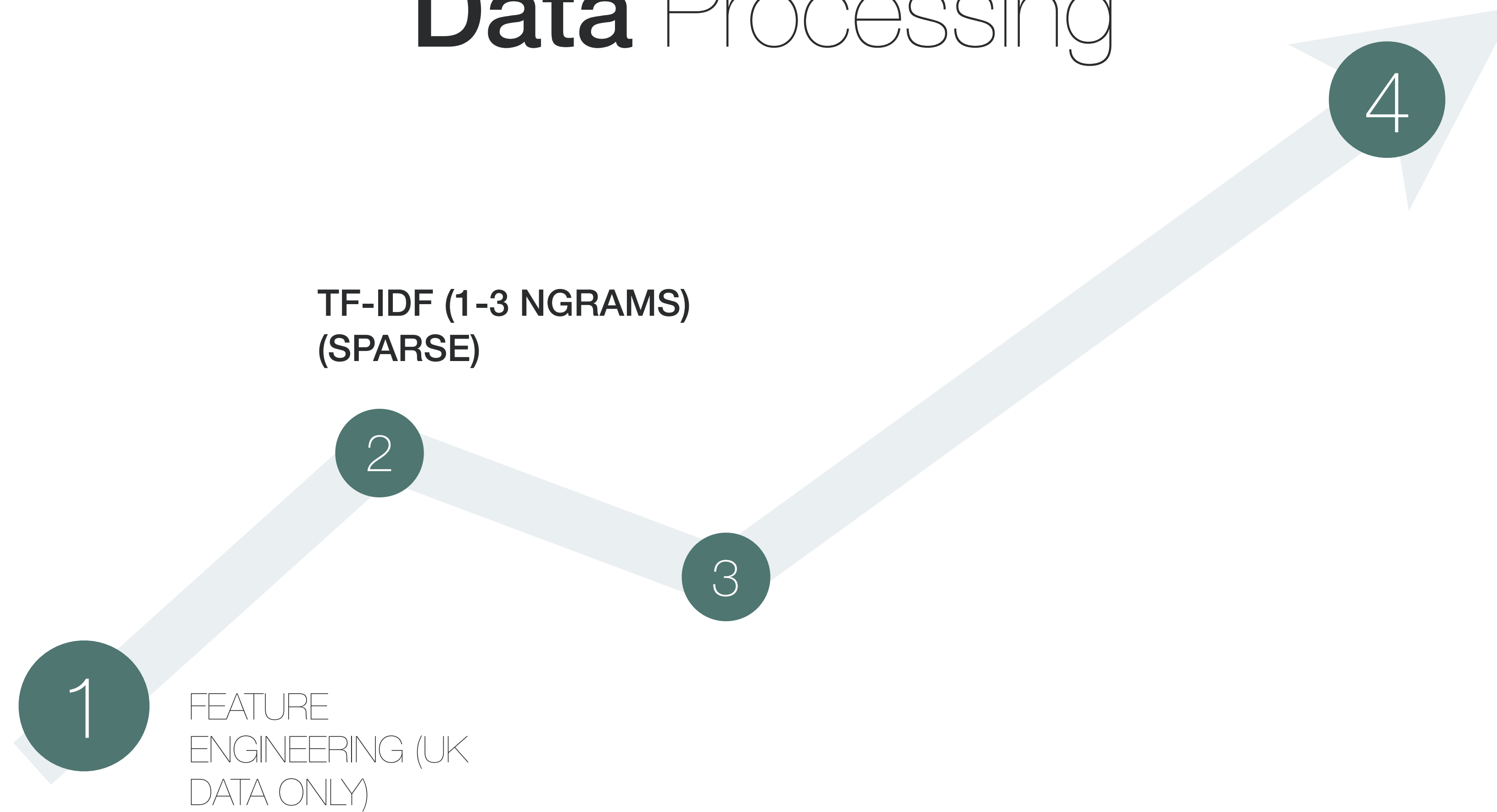
## Challenge 3: Find Similar Suppliers



### Challenge 3: Find Similar Suppliers

| cpv      | full_desc   |
|----------|---|
| 72300000 | Financial Market Input Data for ValidationData services.Data supply services.   |
| 79411000 | Consultancy services to improve efficiency and effectiveness of EFSA facility management processesGeneral management consultancy services.  |
| 79411000 | Consultancy service to improve efficiency and effectiveness of EFSA facility management processesGeneral management consultancy services.   |
| 48000000 | Framework Service Contract covering the maintenance and improvement of existing tools and techniques used by Nuclear Inspectors of the European CommissionSoftware package and information systems.     |
| 79000000 | EU-CELAC Cooperation on territorial cohesion — EU-CELAC INNOV-AL platform promotion of decentralised innovation policies in CELAC countries — BrazilBusiness services: law, marketing, consulting, r... |
| 79710000 | Security Guard and Reception/Switchboard services for the premises of the EU-House in Vienna/AustriaSecurity services.Reception services.   |
| 90700000 | Service contract for supporting the delivery of the Action Plan for nature, people and the economy in relation to actions 4, 5 and 7Environmental services.   |
| 45000000 | Rewitalizacja Obszarowa Centrum Łodzi - Projekt 2, Projekt 5 oraz Projekt 6- Przebudowa układu drogowego ul. Nawrot na odcinku od ul. Piotrkowskiej do ul. Kilińskiego (...)Construction work.Site p... |
| 45320000 | UFG15VHS – Neubau der Volkshochschule mit Musikschule in Unterföhring – 118 – DämmarbeitenInsulation work.Thermal insulation work.  |
| 45000000 | GU+ für die Generalsanierung des Gebäudekomplexes der SVA - Wiedner Hauptstraße/Ziegelofengasse/HartmannngasseConstruction work.Architectural, engineering and planning services.                       |
| 45252127 | Budowa systemu gospodarki ściekowej w Gminie Pruchnik- rozbudowa oczyszczalni ścieków w Pruchniku nrref: IZ 271/8/2017Wastewater treatment plant construction work.Sewage plant equipment.Constructi... |
| 45000000 | Contract Relating to the Design and Construction of Residential Units at Forty Hill, Holthwhites Hill, Lavender Hill and Jasper CloseConstruction work.   |
| 45200000 | Vállalkozási szerződés a KEHOP 2.2.2.-15-2015-00031 azonosítószámú és ÉMO1) elnevezésű projekt keretében megvalósítandó szennyvíztisztító telep, ill. csatornahálózat fejlesztési feladatainak ellát... |
| 45234100 | Vállalkozási Szerződéses MegállapodásRailway construction works.Railway station construction work.Overpass construction work.Track construction works.Railway signalling works.Catenary's constructi... |

# Data Processing



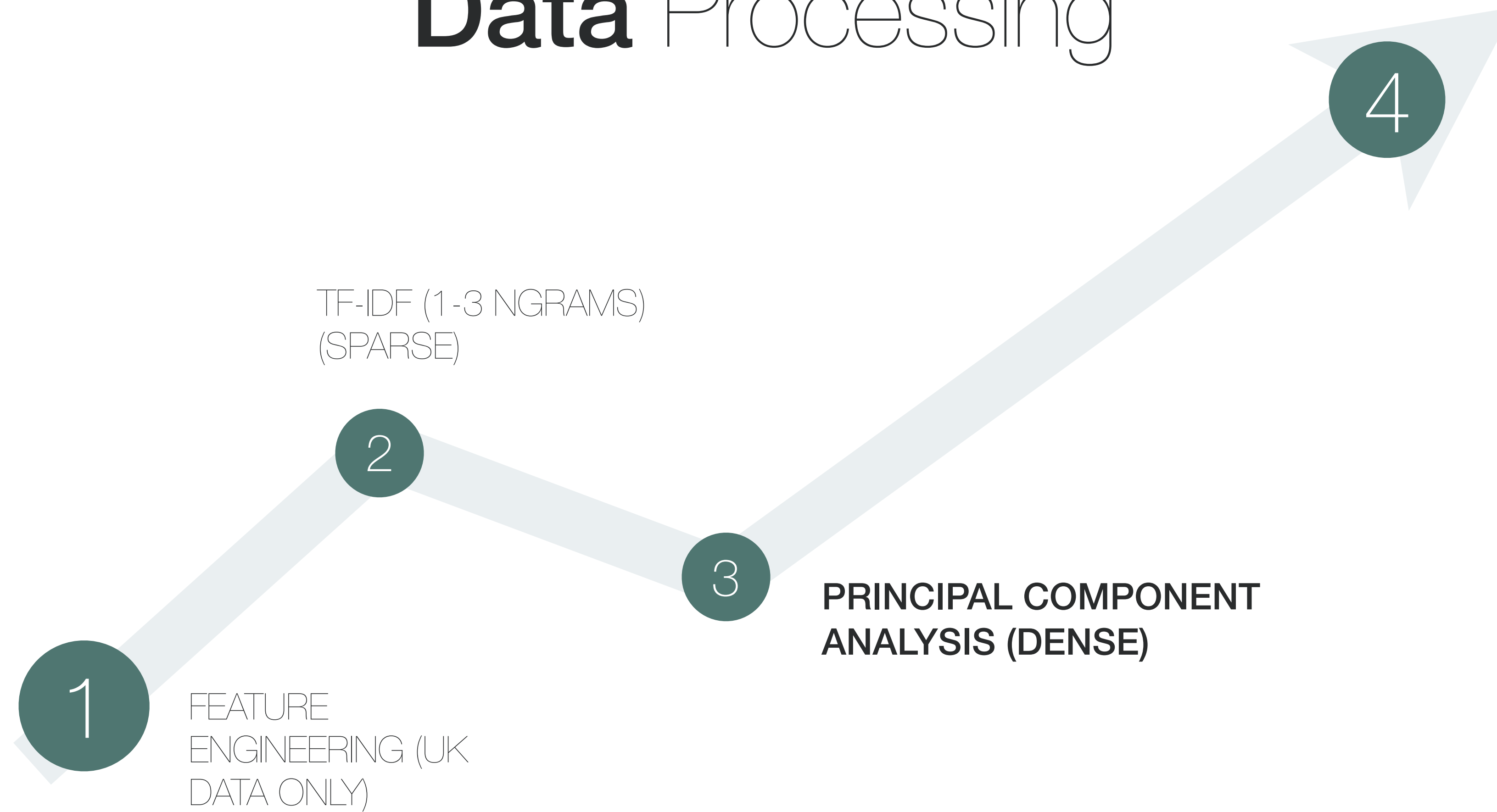


### Challenge 3: Find Similar Suppliers

[illegible]



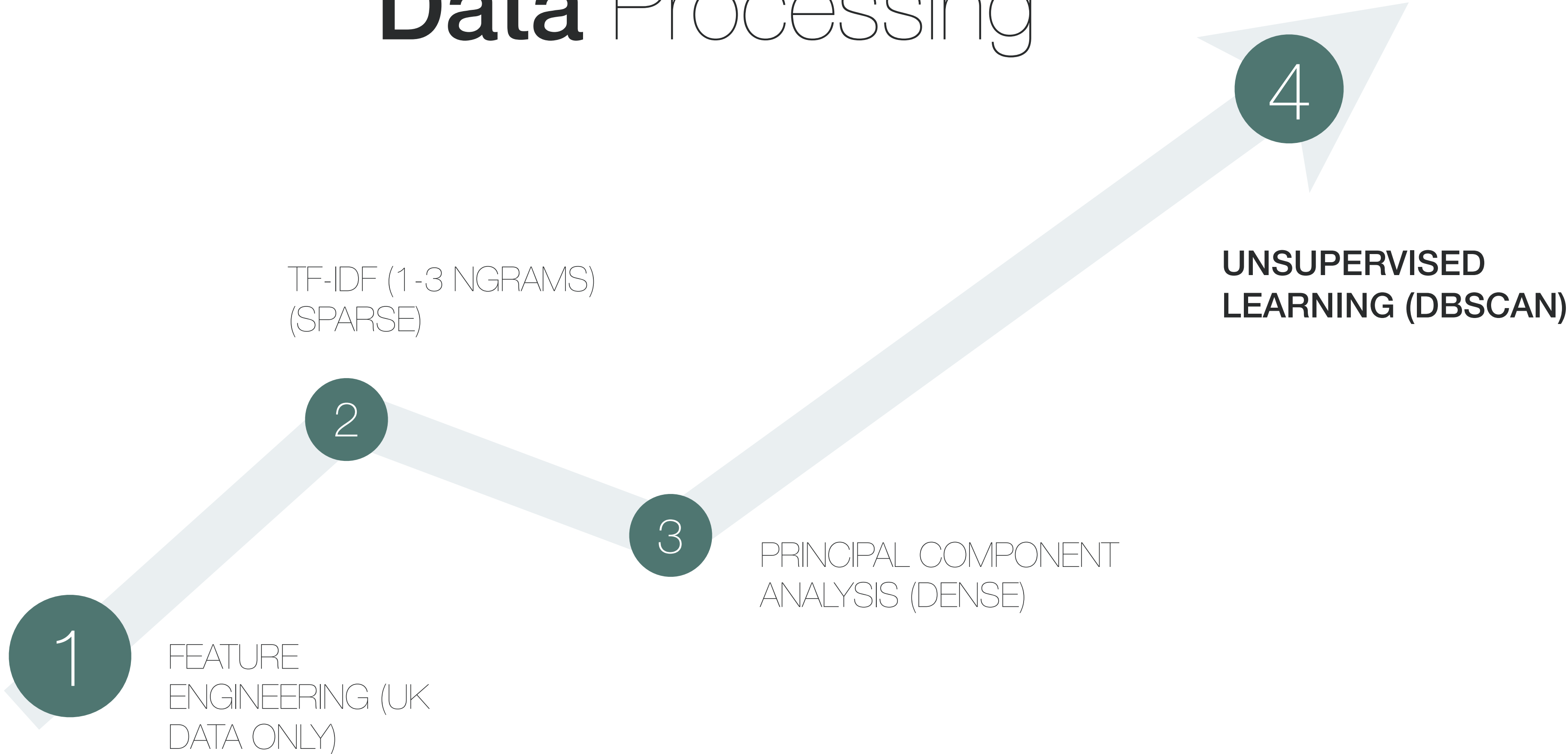
# Data Processing

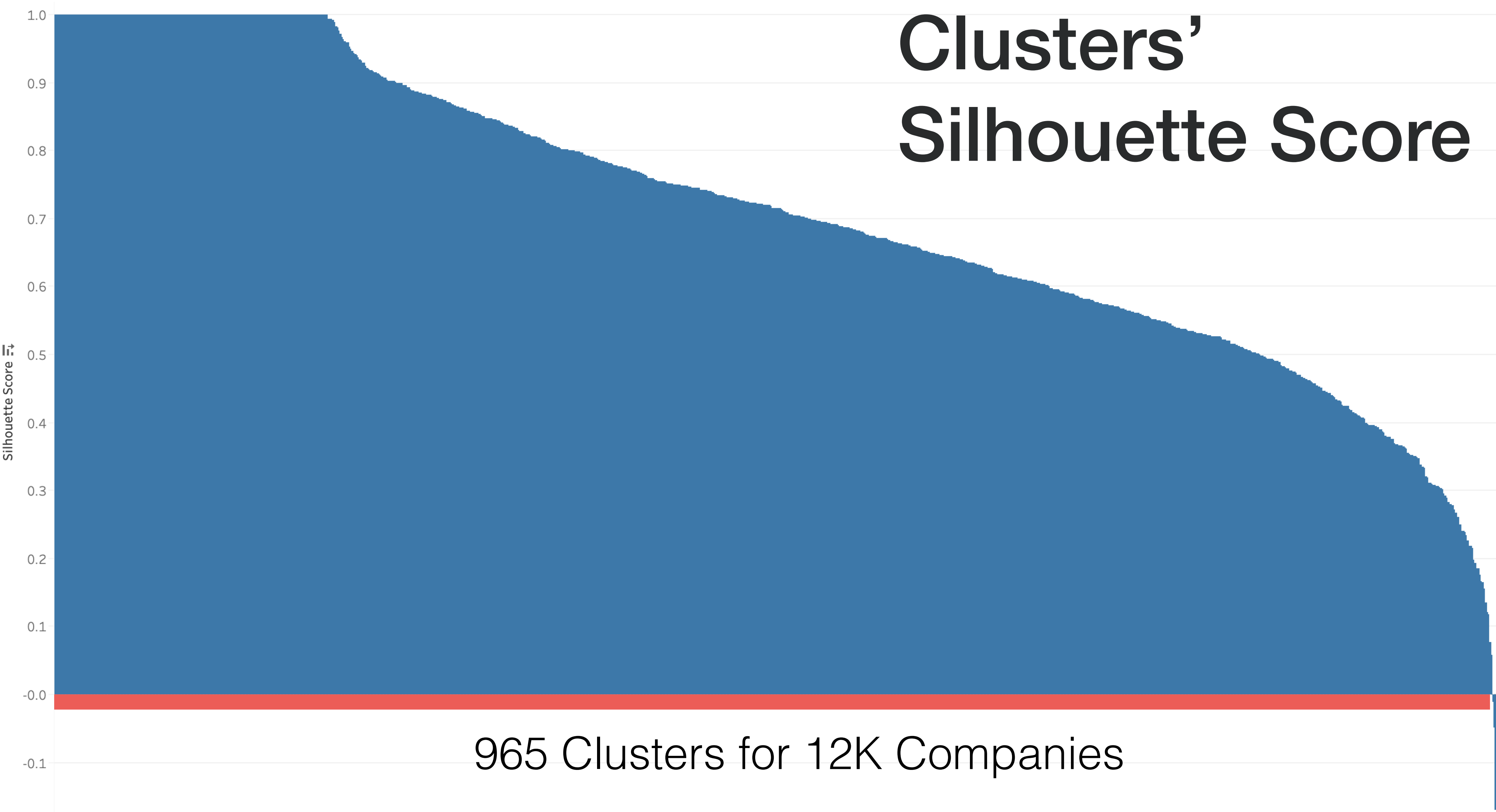


Challenge 3: Find Similar Suppliers

|                                  | PC1       | PC2       | PC3       | PC4       | PC5       | PC6       | PC7       | PC8       | PC9       | PC10      | PC11      | PC12      | PC13      |
|----------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| academy                          | -0.000400 | -0.001971 | -0.000083 | -0.000789 | -0.001683 | -0.002533 | 0.006702  | -0.000427 | -0.000351 | 0.005724  | -0.002638 | -0.005317 | 0.023223  |
| access                           | -0.000281 | -0.000420 | -0.001569 | 0.001623  | -0.001045 | -0.000925 | -0.001197 | -0.001445 | -0.001300 | -0.000613 | -0.001735 | 0.003137  | -0.001331 |
| accessories                      | -0.001184 | -0.003490 | -0.007860 | -0.001978 | -0.003358 | -0.007798 | -0.005124 | -0.007367 | -0.010739 | -0.004084 | -0.001269 | 0.021376  | -0.000359 |
| accident                         | -0.000034 | -0.000799 | -0.002100 | -0.000883 | -0.002895 | -0.003405 | -0.007620 | 0.034951  | 0.007201  | 0.009692  | 0.009418  | 0.002771  | -0.000770 |
| accommodation                    | -0.187059 | 0.238575  | 0.132253  | -0.328769 | 0.015919  | 0.010366  | 0.003333  | -0.005385 | -0.008862 | 0.000627  | 0.012788  | 0.011252  | 0.006164  |
| accommodation<br>building        | -0.000224 | -0.000206 | -0.000753 | -0.001289 | -0.000450 | -0.000835 | -0.001193 | -0.001311 | 0.000969  | -0.000010 | -0.001404 | -0.002824 | 0.011336  |
| accommodation<br>building window | -0.000224 | -0.000206 | -0.000753 | -0.001289 | -0.000450 | -0.000835 | -0.001193 | -0.001311 | 0.000969  | -0.000010 | -0.001404 | -0.002824 | 0.011336  |
| accounting                       | -0.000203 | -0.000816 | -0.001937 | -0.000682 | -0.001992 | 0.000645  | -0.001631 | 0.001311  | -0.001391 | -0.001618 | -0.006045 | -0.001333 | -0.007606 |
| accounting<br>auditing           | -0.000074 | -0.000365 | -0.000866 | -0.000341 | -0.000675 | -0.000579 | -0.000825 | 0.000727  | -0.000105 | -0.000639 | -0.002569 | -0.001400 | -0.000573 |
| accounting<br>auditing fiscal    | -0.000052 | -0.000251 | -0.000597 | -0.000235 | -0.000476 | -0.000416 | -0.000611 | 0.000579  | -0.000078 | -0.000466 | -0.001997 | -0.001128 | -0.000659 |
| adhesive                         | -0.000374 | -0.001107 | -0.002531 | -0.000596 | -0.001164 | -0.002812 | -0.002561 | -0.002273 | -0.007090 | -0.004606 | 0.000859  | 0.025495  | 0.004370  |
| adhesive<br>dressings            | -0.000235 | -0.000694 | -0.001595 | -0.000353 | -0.000795 | -0.001772 | -0.001655 | -0.001336 | -0.004383 | -0.002849 | 0.000647  | 0.014203  | 0.002262  |

# Data Processing







# Sample Cluster

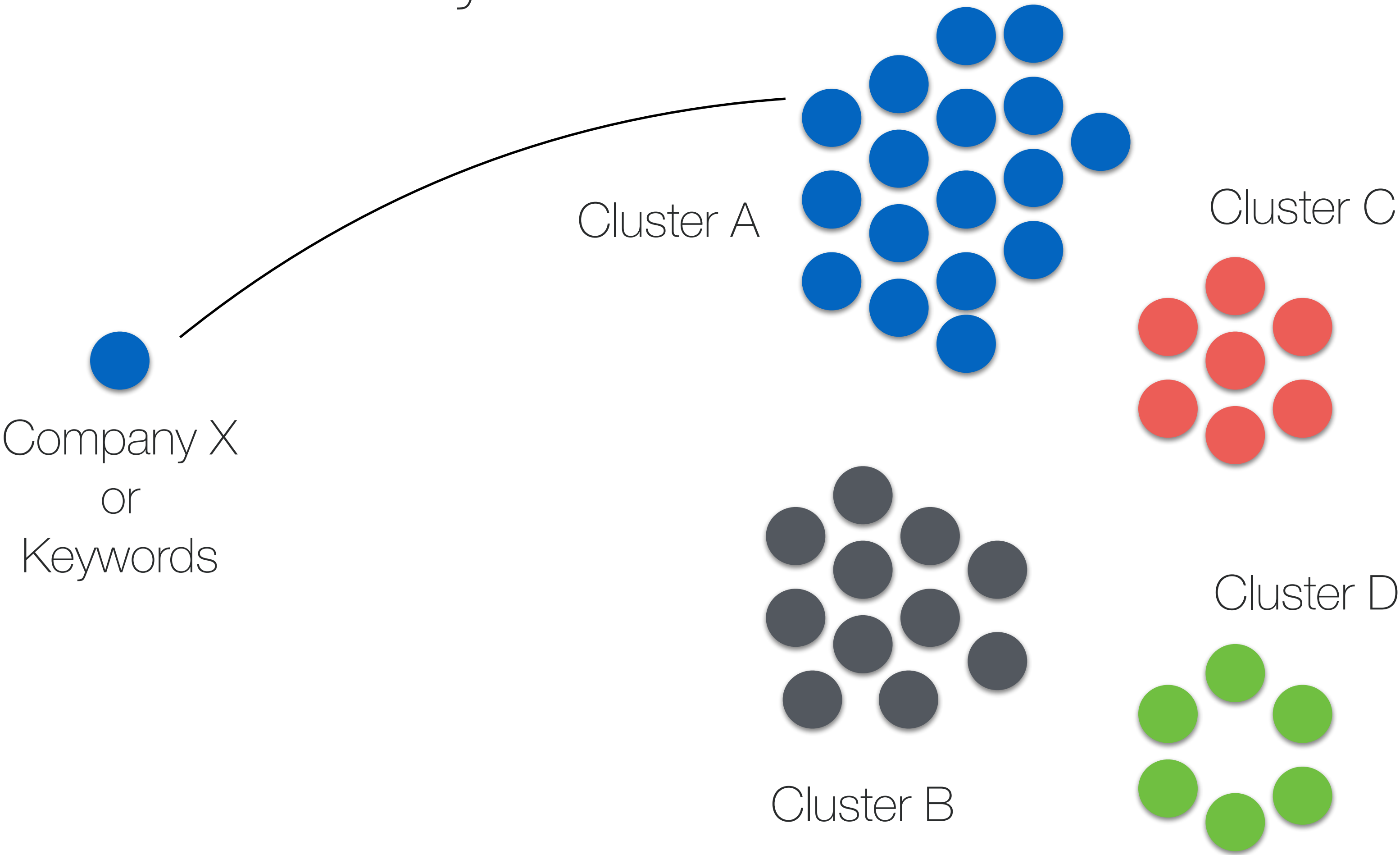
| win_name                       | cpv      | full_desc   | clus_db |
|--------------------------------|----------|---|---------|
| 11KBW                          | 79110000 | Legal advisory and representation services.       | 2       |
| 12 College Place               | 79100000 | Legal services. Legal services. Legal advisor...  | 2       |
| A L Goodbody                   | 79100000 | Contract Legal services. Legal advisory and re... | 2       |
| A and L Goodbody               | 79100000 | Northern Ireland Legal services. Legal advisor... | 2       |
| Action of Disability           | 79110000 | Legal advisory and representation services. L...  | 2       |
| Anthony Collins Solicitors LLP | 79100000 | Corporate Finance and Banking Legal services. ... | 2       |
| Anthony Collins Solicitors LLP | 79100000 | Non-property including Governance, Commercial ... | 2       |
| Anthony Collins Solicitors LLP | 79100000 | Legal Services Framework Agreement Legal servi... | 2       |
| Anthony Collins Solicitors LLP | 79100000 | Contracts, Commercial, Procurement, Health and... | 2       |
| Arthur Cox                     | 79100000 | Debt Recovery and Insolvency Legal services. L... | 2       |
| Arthur Cox                     | 79100000 | Property Legal services. Legal advisory and re... | 2       |
| Arthur Cox                     | 79100000 | Public Law Legal services. Legal advisory and ... | 2       |
| Arthur Cox                     | 79100000 | Information Law Legal services. Legal advisory... | 2       |
| Arthur Cox                     | 79100000 | Alternative Dispute Resolution Legal services.... | 2       |
| Arthur Cox                     | 79100000 | Pensions Legal services. Legal advisory and re... | 2       |
| Arthur Cox                     | 79100000 | Corporate and Commercial Legal services. Legal... | 2       |
|                                |          |   |         |



# Search by

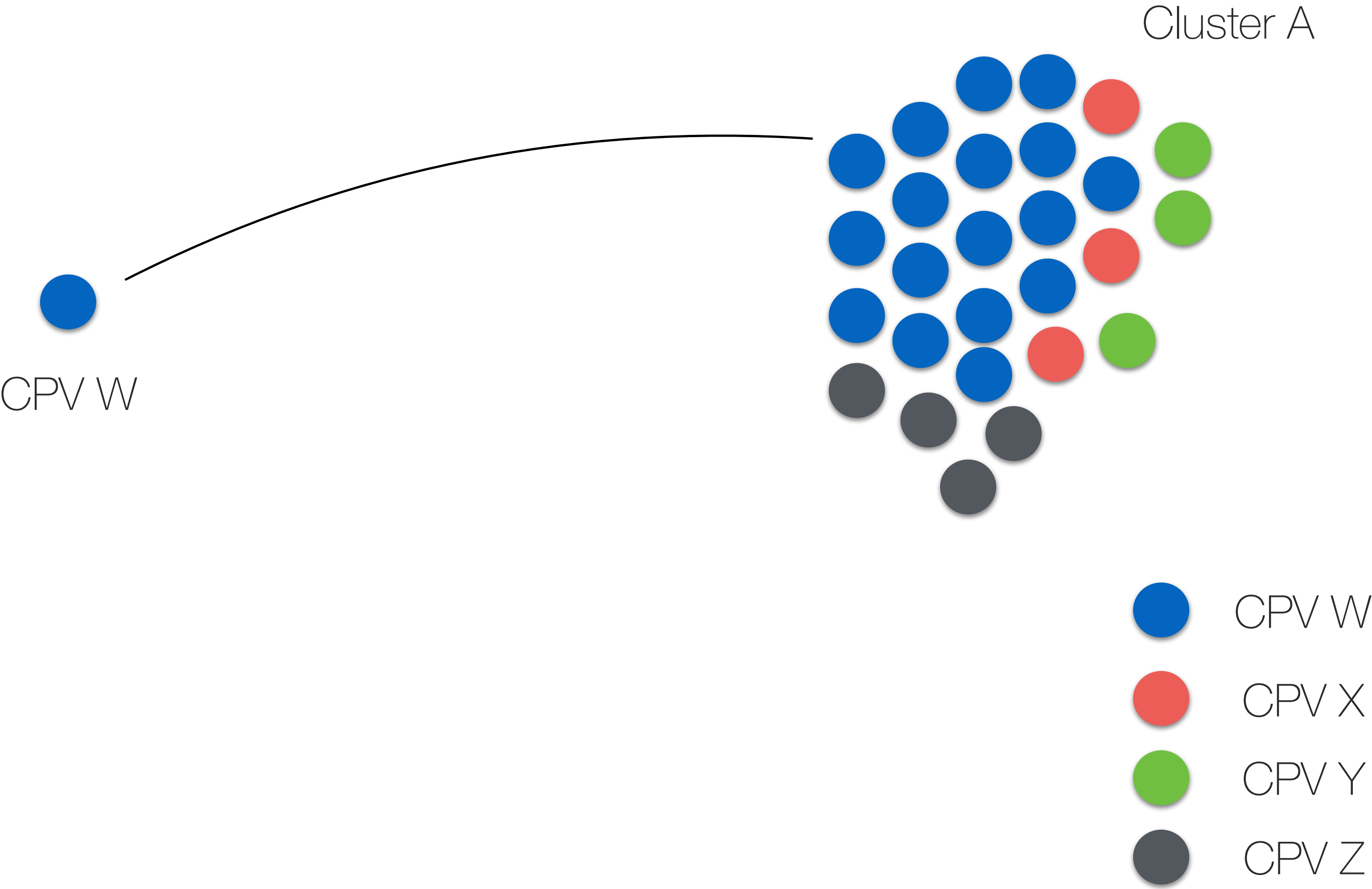
Company Name of Keywords

## Supplier Clusters

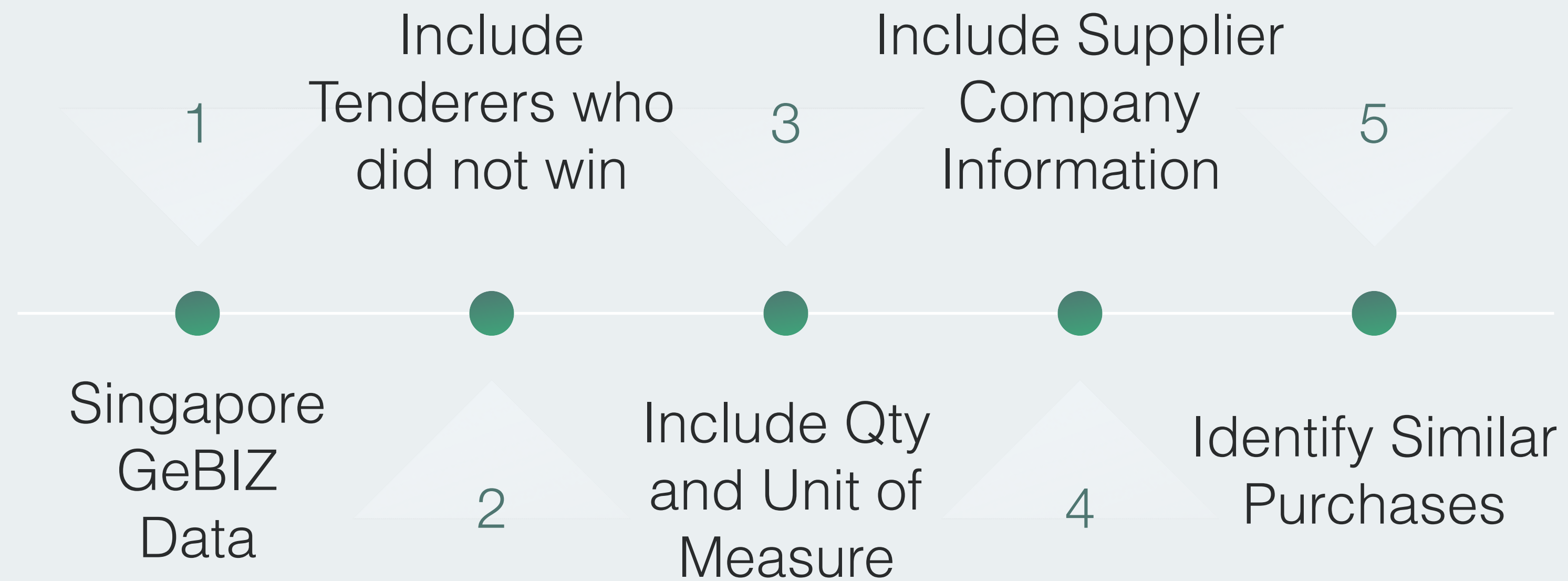


# Search by CPV

## Supplier Clusters



# Further Experiment





# The End

