Final Analisis

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```
library(dplyr)
```

```
##
## Attaching package: 'dplyr'
```

```
## The following objects are masked from 'package:stats':
##
##     filter, lag
```

```
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```
library(ggplot2)
library(useful)
```

```
## Warning: package 'useful' was built under R version 4.3.2
```

#Estadisticas general

```
data <- read.csv("Mall_Customers.csv")
data
```

```
##     CustomerID  Genre Age Annual_Income_.k.. Spending_Score
## 1            1   Male  19                 15              39
## 2            2   Male  21                 15              81
## 3            3 Female  20                 16               6
## 4            4 Female  23                 16              77
## 5            5 Female  31                 17              40
## 6            6 Female  22                 17              76
## 7            7 Female  35                 18               6
## 8            8 Female  23                 18              94
## 9            9   Male  64                 19               3
## 10          10 Female  30                 19              72
## 11          11   Male  67                 19              14
## 12          12 Female  35                 19              99
## 13          13 Female  58                 20              15
## 14          14 Female  24                 20              77
## 15          15   Male  37                 20              13
## 16          16   Male  22                 20              79
## 17          17 Female  35                 21              35
## 18          18   Male  20                 21              66
## 19          19   Male  52                 23              29
## 20          20 Female  35                 23              98
```

```
## 21          21   Male  35                  24                  35
## 22          22   Male  25                  24                  73
## 23          23 Female  46                  25                   5
## 24          24   Male  31                  25                  73
## 25          25 Female  54                  28                  14
## 26          26   Male  29                  28                  82
## 27          27 Female  45                  28                  32
## 28          28   Male  35                  28                  61
## 29          29 Female  40                  29                  31
## 30          30 Female  23                  29                  87
## 31          31   Male  60                  30                   4
## 32          32 Female  21                  30                  73
## 33          33   Male  53                  33                   4
## 34          34   Male  18                  33                  92
## 35          35 Female  49                  33                  14
## 36          36 Female  21                  33                  81
## 37          37 Female  42                  34                  17
## 38          38 Female  30                  34                  73
## 39          39 Female  36                  37                  26
## 40          40 Female  20                  37                  75
## 41          41 Female  65                  38                  35
## 42          42   Male  24                  38                  92
## 43          43   Male  48                  39                  36
## 44          44 Female  31                  39                  61
## 45          45 Female  49                  39                  28
## 46          46 Female  24                  39                  65
## 47          47 Female  50                  40                  55
## 48          48 Female  27                  40                  47
## 49          49 Female  29                  40                  42
## 50          50 Female  31                  40                  42
## 51          51 Female  49                  42                  52
## 52          52   Male  33                  42                  60
## 53          53 Female  31                  43                  54
## 54          54   Male  59                  43                  60
## 55          55 Female  50                  43                  45
## 56          56   Male  47                  43                  41
## 57          57 Female  51                  44                  50
## 58          58   Male  69                  44                  46
## 59          59 Female  27                  46                  51
## 60          60   Male  53                  46                  46
## 61          61   Male  70                  46                  56
## 62          62   Male  19                  46                  55
## 63          63 Female  67                  47                  52
## 64          64 Female  54                  47                  59
## 65          65   Male  63                  48                  51
## 66          66   Male  18                  48                  59
## 67          67 Female  43                  48                  50
## 68          68 Female  68                  48                  48
## 69          69   Male  19                  48                  59
## 70          70 Female  32                  48                  47
```

```
## 71          71   Male  70                49                55
## 72          72 Female  47                49                42
## 73          73 Female  60                50                49
## 74          74 Female  60                50                56
## 75          75   Male  59                54                47
## 76          76   Male  26                54                54
## 77          77 Female  45                54                53
## 78          78   Male  40                54                48
## 79          79 Female  23                54                52
## 80          80 Female  49                54                42
## 81          81   Male  57                54                51
## 82          82   Male  38                54                55
## 83          83   Male  67                54                41
## 84          84 Female  46                54                44
## 85          85 Female  21                54                57
## 86          86   Male  48                54                46
## 87          87 Female  55                57                58
## 88          88 Female  22                57                55
## 89          89 Female  34                58                60
## 90          90 Female  50                58                46
## 91          91 Female  68                59                55
## 92          92   Male  18                59                41
## 93          93   Male  48                60                49
## 94          94 Female  40                60                40
## 95          95 Female  32                60                42
## 96          96   Male  24                60                52
## 97          97 Female  47                60                47
## 98          98 Female  27                60                50
## 99          99   Male  48                61                42
## 100        100   Male  20                61                49
## 101        101 Female  23                62                41
## 102        102 Female  49                62                48
## 103        103   Male  67                62                59
## 104        104   Male  26                62                55
## 105        105   Male  49                62                56
## 106        106 Female  21                62                42
## 107        107 Female  66                63                50
## 108        108   Male  54                63                46
## 109        109   Male  68                63                43
## 110        110   Male  66                63                48
## 111        111   Male  65                63                52
## 112        112 Female  19                63                54
## 113        113 Female  38                64                42
## 114        114   Male  19                64                46
## 115        115 Female  18                65                48
## 116        116 Female  19                65                50
## 117        117 Female  63                65                43
## 118        118 Female  49                65                59
## 119        119 Female  51                67                43
## 120        120 Female  50                67                57
```

```
## 121        121   Male  27                67                56
## 122        122 Female  38                67                40
## 123        123 Female  40                69                58
## 124        124   Male  39                69                91
## 125        125 Female  23                70                29
## 126        126 Female  31                70                77
## 127        127   Male  43                71                35
## 128        128   Male  40                71                95
## 129        129   Male  59                71                11
## 130        130   Male  38                71                75
## 131        131   Male  47                71                 9
## 132        132   Male  39                71                75
## 133        133 Female  25                72                34
## 134        134 Female  31                72                71
## 135        135   Male  20                73                 5
## 136        136 Female  29                73                88
## 137        137 Female  44                73                 7
## 138        138   Male  32                73                73
## 139        139   Male  19                74                10
## 140        140 Female  35                74                72
## 141        141 Female  57                75                 5
## 142        142   Male  32                75                93
## 143        143 Female  28                76                40
## 144        144 Female  32                76                87
## 145        145   Male  25                77                12
## 146        146   Male  28                77                97
## 147        147   Male  48                77                36
## 148        148 Female  32                77                74
## 149        149 Female  34                78                22
## 150        150   Male  34                78                90
## 151        151   Male  43                78                17
## 152        152   Male  39                78                88
## 153        153 Female  44                78                20
## 154        154 Female  38                78                76
## 155        155 Female  47                78                16
## 156        156 Female  27                78                89
## 157        157   Male  37                78                 1
## 158        158 Female  30                78                78
## 159        159   Male  34                78                 1
## 160        160 Female  30                78                73
## 161        161 Female  56                79                35
## 162        162 Female  29                79                83
## 163        163   Male  19                81                 5
## 164        164 Female  31                81                93
## 165        165   Male  50                85                26
## 166        166 Female  36                85                75
## 167        167   Male  42                86                20
## 168        168 Female  33                86                95
## 169        169 Female  36                87                27
## 170        170   Male  32                87                63
```

```
## 171        171   Male  40                87              13
## 172        172   Male  28                87              75
## 173        173   Male  36                87              10
## 174        174   Male  36                87              92
## 175        175 Female  52                88              13
## 176        176 Female  30                88              86
## 177        177   Male  58                88              15
## 178        178   Male  27                88              69
## 179        179   Male  59                93              14
## 180        180   Male  35                93              90
## 181        181 Female  37                97              32
## 182        182 Female  32                97              86
## 183        183   Male  46                98              15
## 184        184 Female  29                98              88
## 185        185 Female  41                99              39
## 186        186   Male  30                99              97
## 187        187 Female  54               101              24
## 188        188   Male  28               101              68
## 189        189 Female  41               103              17
## 190        190 Female  36               103              85
## 191        191 Female  34               103              23
## 192        192 Female  32               103              69
## 193        193   Male  33               113               8
## 194        194 Female  38               113              91
## 195        195 Female  47               120              16
## 196        196 Female  35               120              79
## 197        197 Female  45               126              28
## 198        198   Male  32               126              74
## 199        199   Male  32               137              18
## 200        200   Male  30               137              83
```

```
summary(data)
```

```
##    CustomerID        Genre                Age
Annual_Income_.k..
##  Min.   :  1.00   Length:200         Min.   :18.00   Min.   : 15.00
##  1st Qu.: 50.75   Class :character   1st Qu.:28.75   1st Qu.: 41.50
##  Median :100.50   Mode  :character   Median :36.00   Median : 61.50
##  Mean   :100.50                      Mean   :38.85   Mean   : 60.56
##  3rd Qu.:150.25                      3rd Qu.:49.00   3rd Qu.: 78.00
##  Max.   :200.00                      Max.   :70.00   Max.   :137.00
##  Spending_Score
##  Min.   : 1.00
##  1st Qu.:34.75
##  Median :50.00
##  Mean   :50.20
##  3rd Qu.:73.00
##  Max.   :99.00
```

#Limpieza de los datos eliminar ID

R// Se elimino el ID ya que considero que es un valor que no aporta nada al analisis de los datos y podria generar algun tipo de error.

```
dataLim <- data [,-c(1)]
summary(dataLim)
```

```
##     Genre                Age        Annual_Income_.k.. Spending_Score
##  Length:200         Min.   :18.00   Min.   : 15.00     Min.   : 1.00
##  Class :character   1st Qu.:28.75   1st Qu.: 41.50     1st Qu.:34.75
##  Mode  :character   Median :36.00   Median : 61.50     Median :50.00
##                     Mean   :38.85   Mean   : 60.56     Mean   :50.20
##                     3rd Qu.:49.00   3rd Qu.: 78.00     3rd Qu.:73.00
##                     Max.   :70.00   Max.   :137.00     Max.   :99.00
```

#Covertir el genero en un 0 o 1 -> 0 para hombre y 1 para mujer

R// Esta proceso de convertir a un valor binario es major ya que mantener los valores de hombre y mujer van en contra de la estandarizacion para mantener los datos de una manera homogenea

```
dataLim$Genre <- ifelse(dataLim$Genre == "Female",1,0)
dataLim$Genre <- as.integer(dataLim$Genre)
dataLim
```

```
##     Genre Age Annual_Income_.k.. Spending_Score
## 1       0  19                 15              39
## 2       0  21                 15              81
## 3       1  20                 16               6
## 4       1  23                 16              77
## 5       1  31                 17              40
## 6       1  22                 17              76
## 7       1  35                 18               6
## 8       1  23                 18              94
## 9       0  64                 19               3
## 10      1  30                 19              72
## 11      0  67                 19              14
## 12      1  35                 19              99
## 13      1  58                 20              15
## 14      1  24                 20              77
## 15      0  37                 20              13
## 16      0  22                 20              79
## 17      1  35                 21              35
## 18      0  20                 21              66
## 19      0  52                 23              29
## 20      1  35                 23              98
## 21      0  35                 24              35
## 22      0  25                 24              73
## 23      1  46                 25               5
## 24      0  31                 25              73
## 25      1  54                 28              14
## 26      0  29                 28              82
```

```
## 27      1  45                28              32
## 28      0  35                28              61
## 29      1  40                29              31
## 30      1  23                29              87
## 31      0  60                30               4
## 32      1  21                30              73
## 33      0  53                33               4
## 34      0  18                33              92
## 35      1  49                33              14
## 36      1  21                33              81
## 37      1  42                34              17
## 38      1  30                34              73
## 39      1  36                37              26
## 40      1  20                37              75
## 41      1  65                38              35
## 42      0  24                38              92
## 43      0  48                39              36
## 44      1  31                39              61
## 45      1  49                39              28
## 46      1  24                39              65
## 47      1  50                40              55
## 48      1  27                40              47
## 49      1  29                40              42
## 50      1  31                40              42
## 51      1  49                42              52
## 52      0  33                42              60
## 53      1  31                43              54
## 54      0  59                43              60
## 55      1  50                43              45
## 56      0  47                43              41
## 57      1  51                44              50
## 58      0  69                44              46
## 59      1  27                46              51
## 60      0  53                46              46
## 61      0  70                46              56
## 62      0  19                46              55
## 63      1  67                47              52
## 64      1  54                47              59
## 65      0  63                48              51
## 66      0  18                48              59
## 67      1  43                48              50
## 68      1  68                48              48
## 69      0  19                48              59
## 70      1  32                48              47
## 71      0  70                49              55
## 72      1  47                49              42
## 73      1  60                50              49
## 74      1  60                50              56
## 75      0  59                54              47
## 76      0  26                54              54
```

```
## 77      1  45                54              53
## 78      0  40                54              48
## 79      1  23                54              52
## 80      1  49                54              42
## 81      0  57                54              51
## 82      0  38                54              55
## 83      0  67                54              41
## 84      1  46                54              44
## 85      1  21                54              57
## 86      0  48                54              46
## 87      1  55                57              58
## 88      1  22                57              55
## 89      1  34                58              60
## 90      1  50                58              46
## 91      1  68                59              55
## 92      0  18                59              41
## 93      0  48                60              49
## 94      1  40                60              40
## 95      1  32                60              42
## 96      0  24                60              52
## 97      1  47                60              47
## 98      1  27                60              50
## 99      0  48                61              42
## 100     0  20                61              49
## 101     1  23                62              41
## 102     1  49                62              48
## 103     0  67                62              59
## 104     0  26                62              55
## 105     0  49                62              56
## 106     1  21                62              42
## 107     1  66                63              50
## 108     0  54                63              46
## 109     0  68                63              43
## 110     0  66                63              48
## 111     0  65                63              52
## 112     1  19                63              54
## 113     1  38                64              42
## 114     0  19                64              46
## 115     1  18                65              48
## 116     1  19                65              50
## 117     1  63                65              43
## 118     1  49                65              59
## 119     1  51                67              43
## 120     1  50                67              57
## 121     0  27                67              56
## 122     1  38                67              40
## 123     1  40                69              58
## 124     0  39                69              91
## 125     1  23                70              29
## 126     1  31                70              77
```

```
## 127     0  43                71              35
## 128     0  40                71              95
## 129     0  59                71              11
## 130     0  38                71              75
## 131     0  47                71               9
## 132     0  39                71              75
## 133     1  25                72              34
## 134     1  31                72              71
## 135     0  20                73               5
## 136     1  29                73              88
## 137     1  44                73               7
## 138     0  32                73              73
## 139     0  19                74              10
## 140     1  35                74              72
## 141     1  57                75               5
## 142     0  32                75              93
## 143     1  28                76              40
## 144     1  32                76              87
## 145     0  25                77              12
## 146     0  28                77              97
## 147     0  48                77              36
## 148     1  32                77              74
## 149     1  34                78              22
## 150     0  34                78              90
## 151     0  43                78              17
## 152     0  39                78              88
## 153     1  44                78              20
## 154     1  38                78              76
## 155     1  47                78              16
## 156     1  27                78              89
## 157     0  37                78               1
## 158     1  30                78              78
## 159     0  34                78               1
## 160     1  30                78              73
## 161     1  56                79              35
## 162     1  29                79              83
## 163     0  19                81               5
## 164     1  31                81              93
## 165     0  50                85              26
## 166     1  36                85              75
## 167     0  42                86              20
## 168     1  33                86              95
## 169     1  36                87              27
## 170     0  32                87              63
## 171     0  40                87              13
## 172     0  28                87              75
## 173     0  36                87              10
## 174     0  36                87              92
## 175     1  52                88              13
## 176     1  30                88              86
```

```
## 177     0  58                  88              15
## 178     0  27                  88              69
## 179     0  59                  93              14
## 180     0  35                  93              90
## 181     1  37                  97              32
## 182     1  32                  97              86
## 183     0  46                  98              15
## 184     1  29                  98              88
## 185     1  41                  99              39
## 186     0  30                  99              97
## 187     1  54                 101              24
## 188     0  28                 101              68
## 189     1  41                 103              17
## 190     1  36                 103              85
## 191     1  34                 103              23
## 192     1  32                 103              69
## 193     0  33                 113               8
## 194     1  38                 113              91
## 195     1  47                 120              16
## 196     1  35                 120              79
## 197     1  45                 126              28
## 198     0  32                 126              74
## 199     0  32                 137              18
## 200     0  30                 137              83
```

#Nulos por columna

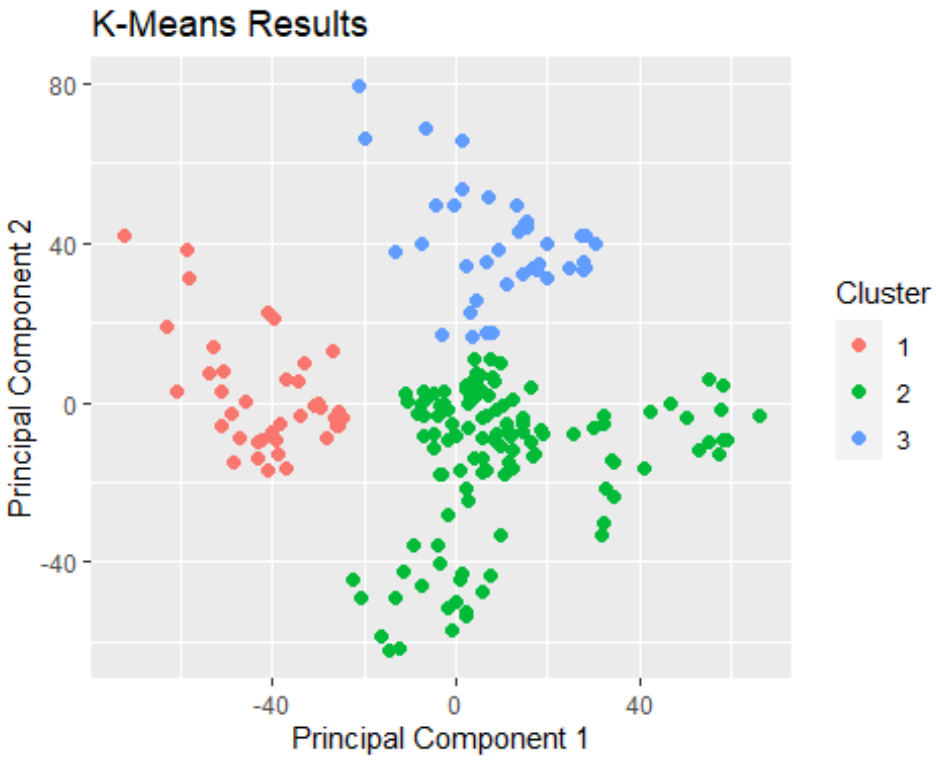
R/ Se verifica que la cantidad de nulos no sea considerable para eliminarlos

```
Nulos <- colSums(is.na(dataLim))
Nulos
```

```
##               Genre                 Age Annual_Income_.k..
Spending_Score
##                   0                   0                   0
0
```

#Metodo del kmeans 3 centros como prueba

```
datTrain <- kmeans(dataLim, centers = 3)
plot(datTrain, data = dataLim)
```



#Cuadro de clusters y error para la grafica de codo

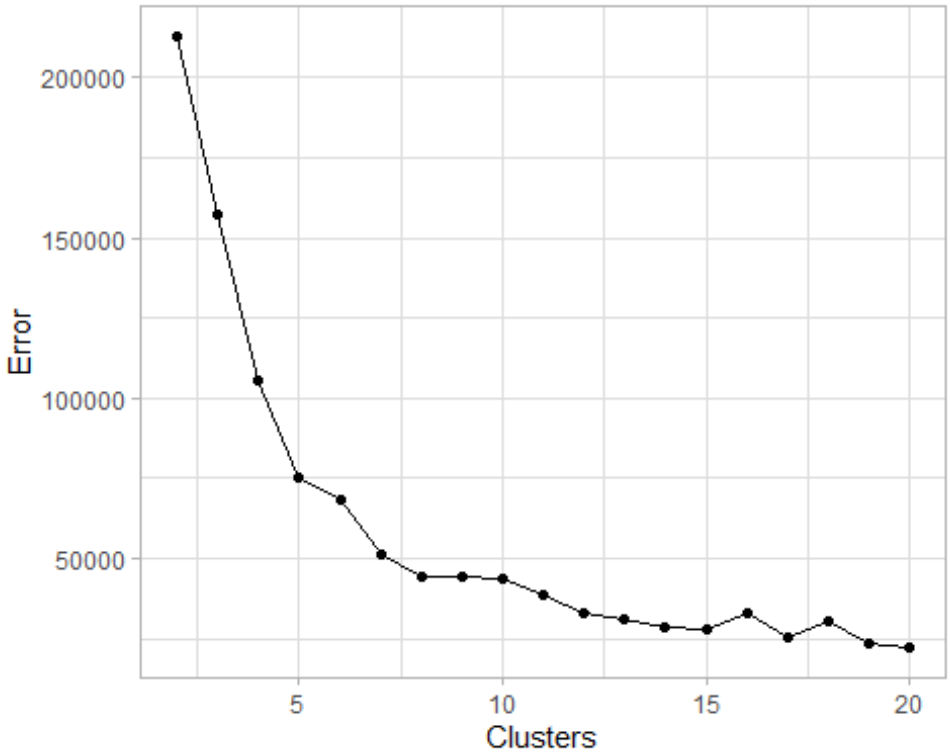
```
Gew <- data.frame(matrix(ncol = 2, nrow = 0))
  colnames(Gew) <- c("Clusters", "Error")
  for (i in 1:20)
  {
    datTrain <- kmeans(x= dataLim, centers = i)
    Gew[i-1,] <- c(i, datTrain$tot.withinss)
  }
Gew
```

```
##    Clusters     Error
## 1         2 212889.44
## 2         3 157200.67
## 3         4 105299.99
## 4         5  75399.62
## 5         6  68331.80
## 6         7  51130.69
## 7         8  44355.31
## 8         9  44346.95
## 9        10  43585.09
## 10       11  38573.41
## 11       12  32920.48
## 12       13  31048.72
## 13       14  28290.76
## 14       15  28001.65
## 15       16  32676.82
## 16       17  25569.35
```

```
## 17        18  30345.33
## 18        19  23644.26
## 19        20  22275.92
```

#Grafica de codo

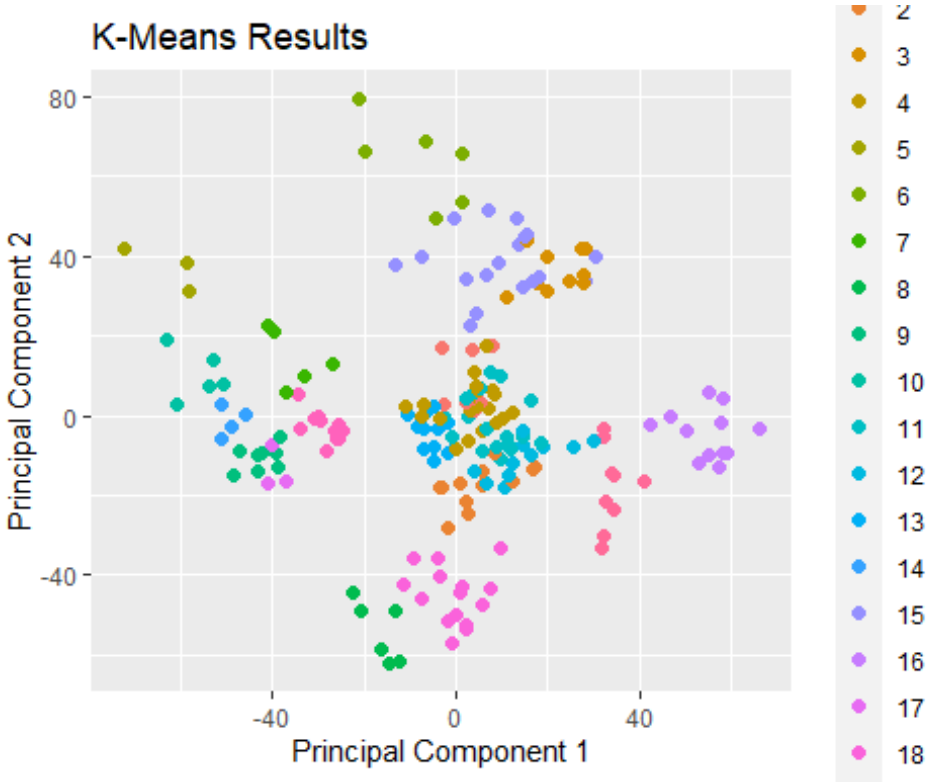
```
ggplot(data = Gew, aes(x = Clusters, y = Error)) +
  geom_line() +
  geom_point() +
  theme_light()
```



#Grafica con todos los centros solo de demostración

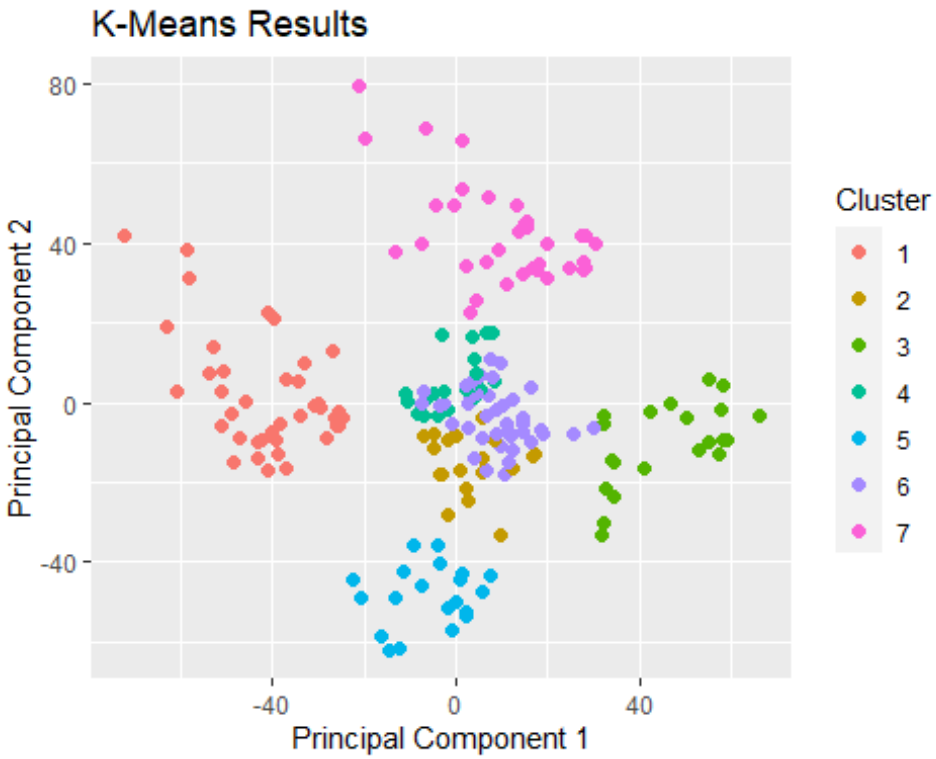
R/ Demostracion para los 18 centros creados no es el valor final a tomar

```
plot(datTrain, data = dataLim)
```



#Grafica con el numero de clusters, este si es el valor oficial a tomar ya que es el valor donde la grafica se comienza a estabilizar

```
datTrain <- kmeans(dataLim, centers = 7)
plot(datTrain, data = dataLim)
```


K-Means Results
80
40
0
-40
Principal Component 2
-40
0
40
Principal Component 1
Cluster
1
2
3
4
5
6
7