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BUSI1693 – Global Networks and Innovation

A1 Company Report: Hyundai Motor Company

Dataset: USPTO_2012_2

Executive Summary

This report entails Hyundai Motor Company's Internationalisation strategy along with their innovation strategy. Besides, the allocated data set of "USPTO_2012_2" has been analysed to understand the basic function of data analytics and their implication on business practice and strategy. The report found; Hyundai Motor Company has an effective business strategy, when it comes to internationalisation as a result they have achieved economies of scale. It is worth mentioning the company has shown significant leadership in co-operative innovation efforts. In the given data, it has emerged, Hyundai Motor Company has a significantly weak network and connectivity compared to other major players.

1 Overview of the Company

Hyundai Motor Company was first established in South Korea to meet the local demand of automobiles. Since then, the corporation has grown into a significant level across the world, while still retaining a strong local presence. The company expanded its operation even in financing, marketing, even investment in professional sports (Hyundai Motor Company in Brief, 2022). Company has a sustainable global supply chain. Hyundai Motors accounted for about 50 percent of the South Korean automotive market, and this percentage would rise if Kia Motors was included (Financial Times, 2022). Another subsidiary of Hyundai model is the popular automobile brand Kia. Hyundai and Kia led the market in income revenue throughout the first decade of 2000, but as local and global rivalry increased, profit margins shrank. Hyundai and Kia's total sales declined 3% in 2019 to 7.19 million cars, missing their sales goal for the sixth year in a row.

Key Facts of the Company

Corporate Name of the Organisation: Hyundai Motor Company

EST: 29/12/1967

Chief Executive Officer: Euisun Chung / Jae Hoon Chang

Sector: Automotive Manufacturing Company

Capital Stock: 1,488,993

Total Assets: 231,109,982

2 An overview of Hyundai Motor Company's Internationalization Strategy

2.1 Economies of Scale

Company has manufacturing plants all over the world, reflecting the company's global orientation. One of the top ten automobile producers has a Hyundai Motor Company plant inside their boundaries. The superb quality of the created automobiles was praised abroad. A reputable survey found Hyundai automobiles became one of the most dependable new cars bought in the US. Both brands have a very equal distribution of sales across the globe, despite their native market dominance (2019). Both Hyundai and Kia credit its achievements to strong brands reputation enhancements, owing to outward aesthetics, reliability, and efficiency. HMC's interesting new product releases and ambitious battery and fuel cell car strategies should keep investors interested.

2.2 Joint Venture Strategy for International Expansion

In the year of 1980s, the company started to look for ways to expand its global market outreach. The initial step to internationalisation was to form joint ventures with sophisticated foreign automakers to produce a global automobile. Increasing mass production and exports demands better product design and process technologies. Hyundai teamed up with Mitsubishi on this project as they got hard-to-find chassis components and other parts. This collaboration with Japanese companies helps them to overcome such issues. As the company needed to diversify its global market in the following phase, it took them until the end of 1980s since they had saturated the local market by then. Later the company expanded its international manufacturing locations to reach out to new customers. This is due to the largely saturated local automobile market, inexpensive overseas labour costs, and strengthened trade barriers erected by advanced nations on car imports. Company spotted these opportunities as an entry point to the international market.

2.3 Value Added Network

The company's operational structure is organized in groups, and various wings/sister concerns collaborate to accommodate in a systematic manner. These operations and maintenance strategies enable them to be more agile when faced with a critical business decision to adopt agility (Boschma and Ter Wal, 2007), such as a global epidemic, geopolitical turbulence, or economic catastrophe, among others.

2.4 Development of New Technology through International Partnership

Company has turned up the opportunity approach to co-operative relationship- which gives them an advantage to form joint value analysis. The significant outcome of this relationship to sub-contracting unilateral or bilateral partnership to create quality of the products and cost efficiency (Media et al., 2009). In the late 80s companies introduced subcontracting with Japanese companies by forming an organisation. By being part of these networks, Hyundai corporation minimised their shortcomings and created more opportunities to learn from other organisations. For these initiatives, the company has been regarded as one of the founding members of innovators. By forming these value- added networks, Hyundai constantly becomes innovative in a cost effective way. While utilising current modern information and communication technologies, firms are able to rationalise its logistics- they can now entirely manage their logistics supply chain, increasing the logistic plan's flexibility.

3 Data Analysis

3.1 Key Findings from the data

From the allocated data the key findings about Hyundai Motor Company in 2012 are below (Appendix 1):

- Total patent count 3839
- Total Turnover lay 90029031.0
- Total turnover 78899421.0
- Total asset 113523083.0
- R&D 641328

Provided dataset entail edgelist which corresponds below (Appendix 2):

- Number of node (companies): 606
- Number of edges(connections): 552

3.2 Identification of Industrial Network

The figure: 1 shows an industrial network. Industrial network in the data defined as the data in a large scale that meant to transfer/ transmit across various channel of define network.

```
[ ]: import matplotlib.pyplot as plt
     import networkx as nx
     draw_network = nx.draw_networkx()
     draw_network(edgelist_data)
     plt.title('Figure 1. Network Visualization using Pythons networkx package ')
```

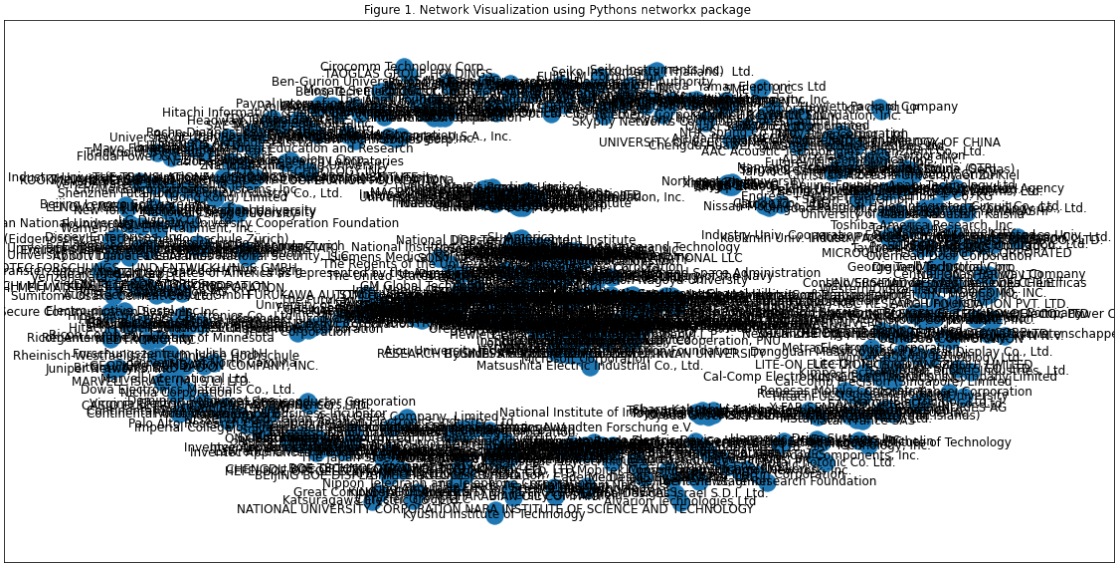


Figure: 1.0- Network Visualization of the companies in the data series

3.3 Implementation of Girvan Newman Algorithm

In the figure: 2 below, it shows two different communities as yellow and green. This detection has been conducted by using the method of the girvan_newman algoirthm. Under this method of algorithm, the groups in the infographic are discovered iteratively by removing the boundaries of the infographic, based on the edge betweenness and centrality value. The edge with the highest edge betweenness is removed first. Hyundai Motor Company have number of degree 7 which means it has a total of 7 unique direct connections with companies.

```
[ ]: a = nx.connected_components(edgelist_data)
     lena = len(list(a)) #The number of connected components
     while (lena == 1):
       d1 = nx.edge_betweenness_centrality(edgelist_data)
       list_of_tuples = list(d1.items())
```

```
  sorted(list(d1.items()), key = lambda x:x[1], reverse = True)
  u, v = list_of_tuples[0][0]
  g.remove_edge(u, v)
  a = nx.connected_components(edgelist_data)

plt.figure(figsize=(10,10))
nx.draw(a, with_labels=True)
plt.title('Figure 2. girvan_newman community detection')
plt.show()
```

Figure 2. girvan_newman community detection

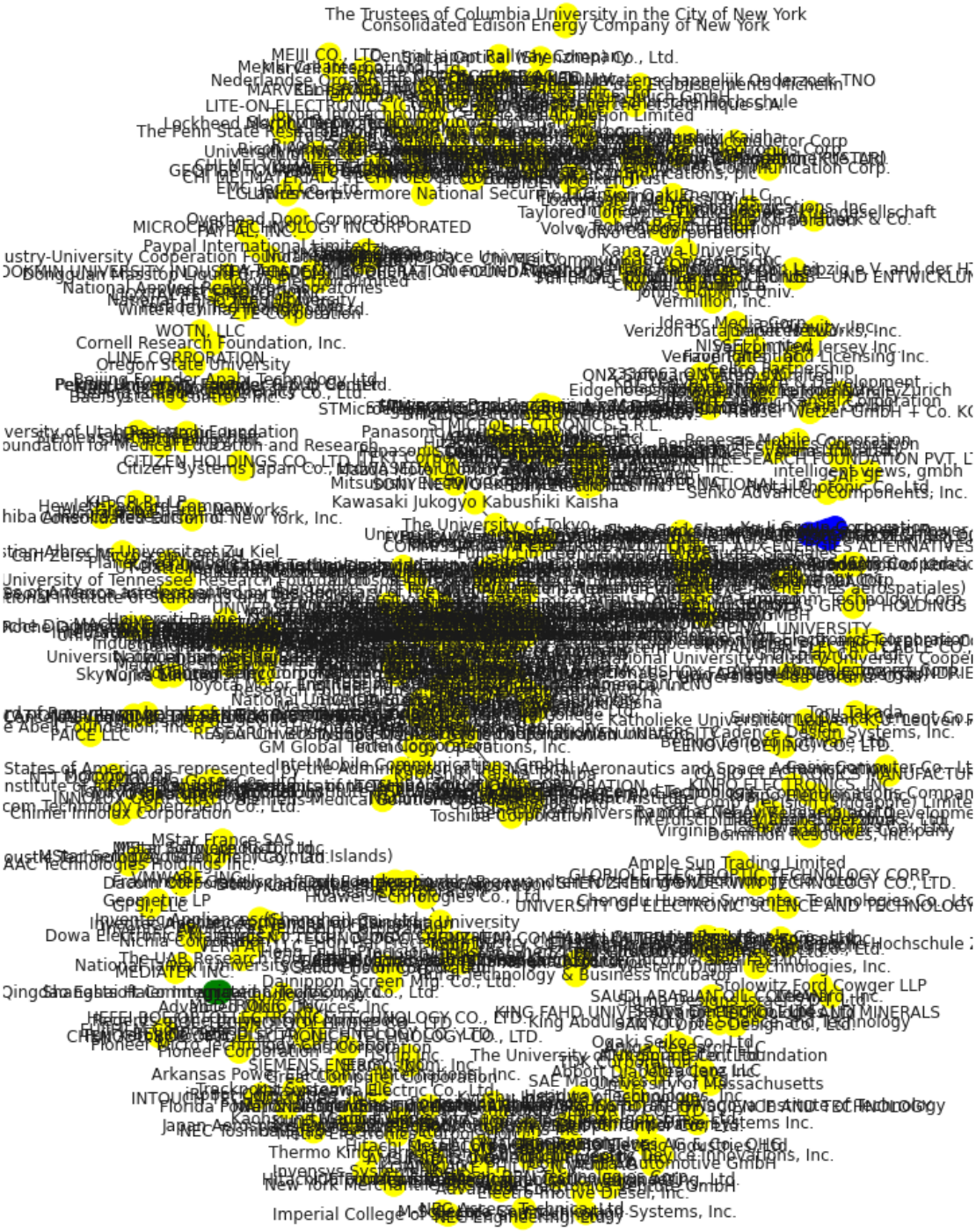


Figure: 2.0- Implementation of Girvan Newman Algorithm

4 Data Interpretation

4.1 Aspects of Centrality

Degree Centrality- means number of relations of a node. For the dataset of edge list, 3 companies have the best connections. These are; Samsung Electronics Co., Ltd. (0.0396694214876033),Sony Côrporation (0.024793388429752067), Electronics and Telecommunications Research Institute (0.01983471074380165). While Hyundai Motor Company (0.011570247933884297) has a comparatively lower degree of centrality this means the company has less effective connectivity with other networks. (Appendix 3)

Eigenvector Centrality- it is a measurement through an algorithm which measures the transitive effect of nodes. High scoring nodes connected to various nodes. In the given data set high score nodes are ; Xiangping Meng (0.3535528214423834),Qiuye Sun (0.3535528214423834), Northeastern University (0.3535528214423834). These have eigenvector centrality- it means they are the most significant impeccable firm in the network. From the degree of centrality and based on the ranking of the companies; degree of centrality and eigenvector centrality are similar. From the findings; Hyundai Motor Company's (1.615359648074642e-08) low score suggests they are less connected in the network.(Appendix 4)

Betweenness Centrality: This measures the shortest path in the graph. It detects information flow in a network. Usually this measurement is used to figure out the shortest path within the network, like one company to another company. It gives a score to each category of nodes. Firms within the network have the shortest path and achieved the highest score in the network. In the given dataset Samsung Electronics Co., Ltd. (0.011724408443252513), Purdue Research Foundation (0.005648295112473318), Toyota Jidosha Kabushiki Kaisha (0.004830058562749713) had the highest betweenness score and they are the ones who influence the flow of information around the network. Removal of them from the network would create a disruption in the network as they are the most important node in the network. From the findings, it can be interpreted that Hyundai Motor Company (0.002337036834327623) has a lower score, this suggests the firm has low influence on the flow of information in the network compared to others. (Appendix 5)

Closeness Centrality: the close approximate can be measured from this network. It measures average distance with other companies in the network. In the given data set top 4 closely connected companies are: Samsung Electronics Co., Ltd. (0.0505300035932447), Purdue Research Foundation (0.044699618563254925), Board of Regents, University of Texas System (0.040075520091194076). This determines these companies have a close connection in the network- which gives them an advantage to quick decision making and quick co-operation with the network. While Hyundai Motor Company (0.030888772960654568) has a significantly low score- which suggests the company has disadvantages over their network. (Appendix 6)

4.2 Annual Turnover

In the figure: 3 it indicates company achieved had 7th highest turnover in 2012, compare to other companies in the data series

```
[ ]: plt.figure(figsize=(25,5))
     index = [cmp for cmp, data in data.groupby(['ID'])]
     companies_sum = data.groupby(['ID']).sum()
     plt.bar(index,companies_sum['Turnover_2012'])
     plt.ylabel('Turnover in 2012')
     plt.xlabel('Companies')
     plt.xticks(index, rotation='vertical', size=10)
     plt.title('Figure 3. Total turnover')
     plt.show()
```

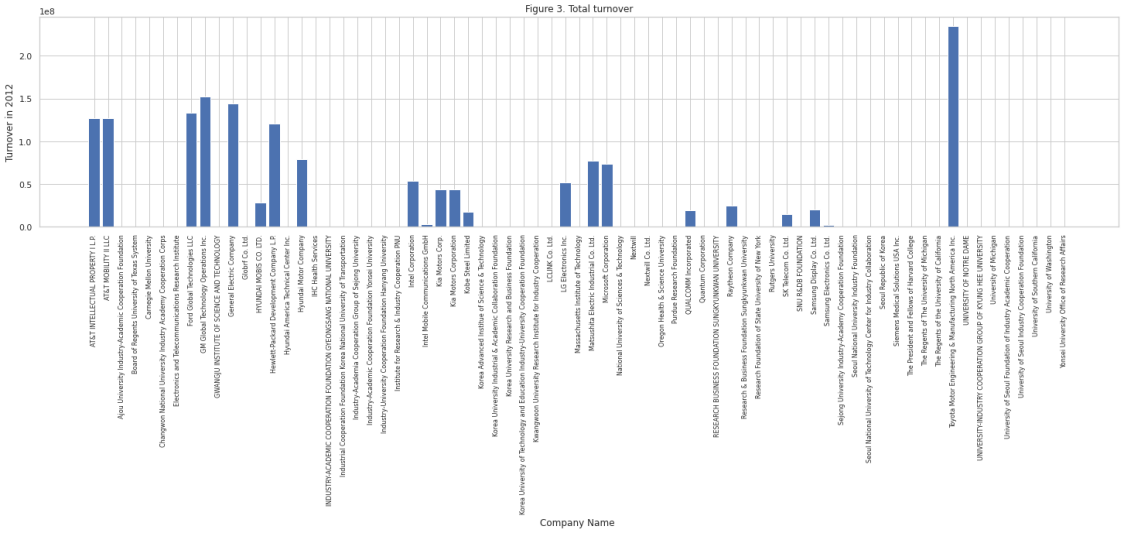


Figure 3.0: Total Turnover by each company

4.3 Current Asset Allocation

In the figure: 4 indicates that the company also achieved the 7th highest position containing total asset in the year of 2012.

```
[ ]: plt.figure(figsize=(25,5))
     plt.bar(index,companies_sum['Total_assets_2012'])
     plt.ylabel('Total asset in 2012')
     plt.xlabel('Company Name ')
     plt.xticks(index, rotation='vertical', size=10)
     plt.title('Figure 4. Total Current asset by each comapany')
     plt.show()
```

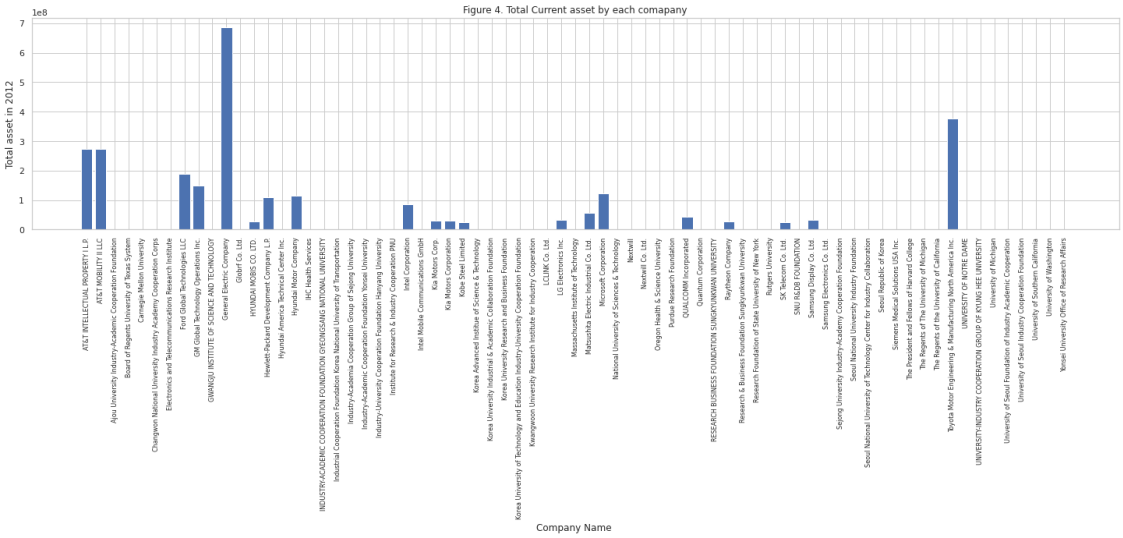


Figure: 4.0- Current Asset in 2012

4.4 Correlation with Turnover and Turnover Lay

The figure: 5 below represents the correlation between variables which suggests turnover and turnover laid had the highest positive correlation of 0.96.

[ ]:
```
import seaborn as sn

plt.figure(figsize=(16, 6))

heatmap = sn.
 ↪heatmap(data[['Patent_count','Turnover_lay','Turnover_2012','Total_assets_2012',␣
 ↪'Employees_2012','R&D_2012']].corr(),
                      vmin=-1, vmax=1,cmap="PiYG", annot=True)

plt.title('Figure 5. Correlation Analysis')

plt.show()
```

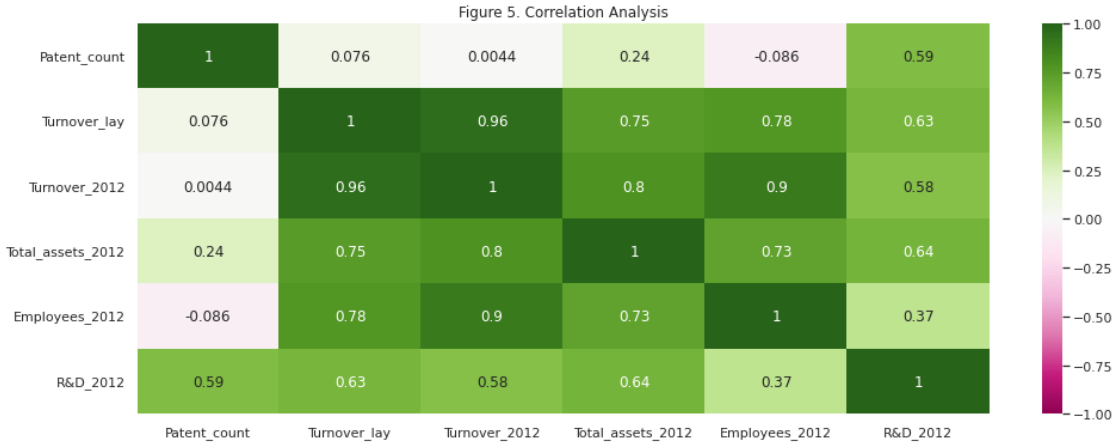
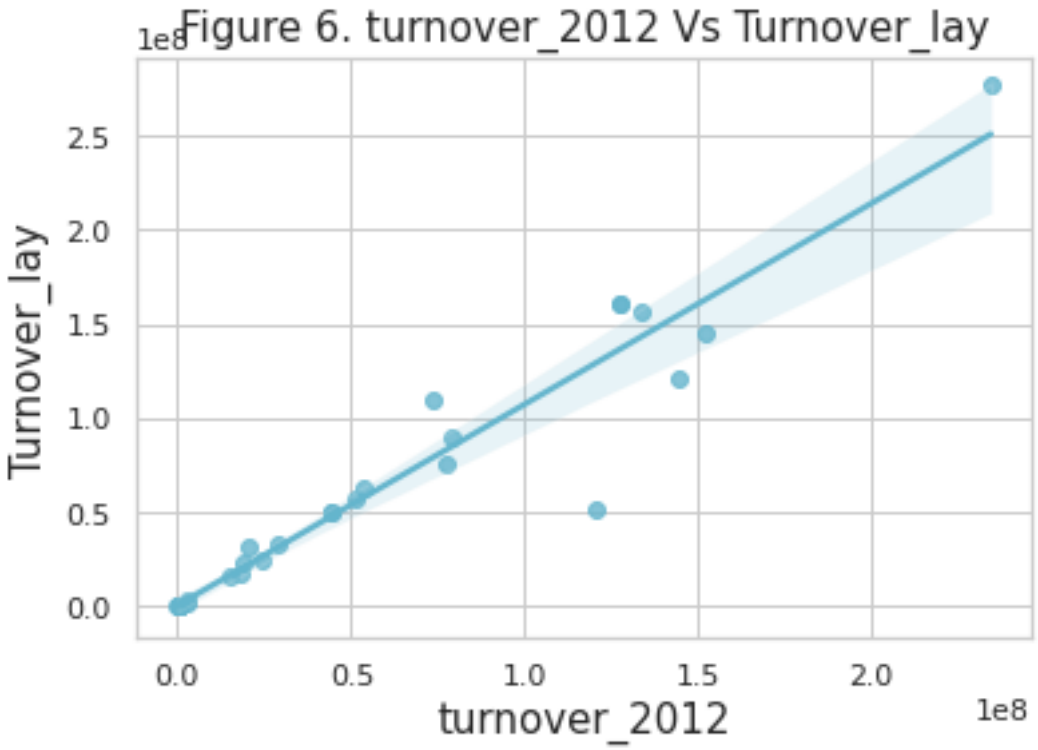


Figure: 5.0- Co-relation with Turnover and Turnover Lay.

While the figure: 6 indicates that turnover and turnover lay variables had a positive correlation line. Which means 1 unit increase in turnover will cause turnover lay to increase by 0.96 units.

[ ]:
```
plt.figure(figsize=(16, 6))
sn.set_style("whitegrid")
ax = sn.regplot(x=data['Turnover_2012'],y=data['Turnover_lay'],color='c')
plt.title('Figure 5. Correlation Analysis')
plt.ylabel('"turnover_2012"')
plt.xlabel("turnover_2012")
plt.show()
```



5 Company's Innovation Strategy

To describe a company's innovation strategy, the "Production Model" concept will be used to understand a company's innovative strategy (Bartlett and Beamish, 2018). A production model is a firm policy instrument that permits a long-term profit plan (Cross and Parker, 2004). It includes production planning, product design, and staff relations (Carton, 2017). Extending the notion of a production model to Hyundai, the production model as follows:

Adapting Machine Learning: By adopting machine learning within the production model, the company has increased its reliance on manufacturing in the meantime decreasing its reliance on direct labour. Such manufacturing approach is possible when engineers oversee the whole process, while factory employees just assist in the production process. As result employees perform a limited part in preventative maintenance and monitoring-which complements indirect workers' responsibilities. On the other hand most direct manufacturing employees might be immediately replaced by others since their task is basic and low-skilled.

New Product Development through Pilot Project: Company has enhanced the significance of new products development at the same time introducing unique techniques to improve its product quality later in the development process. A small group of skilled employees construct test models/ prototypes in a large-scale pilot project in a separate factory near the research centre. By doing this the company has overcomes 90% of potential mass production issues during pilot manufacturing, thus the production version makes use of a massive pilot plant.

Outsourcing for Maximum Production (Modular Innovation): It is a production process

where available parts are being collected from suppliers and assembled to units for final installation. This process has been facilitated by the outsourcing department. In addition, most outsourcing components typically sub-assembled onto components prior proceeding to the final installation. These features of production give them an advantage to become cost effective. Thus the company has reaped tremendous value from massive importing and modularity manufacturing; it is not only reduced cost but creates quality and efficiency. By doing this the company is able to focus on product development and better marketing strategies (Cross and Parker, 2004). These three different aspects; Machine Learning, Pilot Project-new product development and Modular Innovation has benefited the company and put them in place as one of the innovative companies in their production process.

6 Conclusion

It's significant to mention, Hyundai Motor Company successfully staged their internationalisation strategy- which helped them to expand their business in international markets like USA, Europe. Another reason companies still successfully trade is due to their innovative efforts and strategy in place. However, in the future the company might experience a volatile international market due to recent geo-political conflict in Europe. Thus, it is imperative company; mitigate those risks through situational corporate leadership.

7 References

Bloomberg.com. (2022). Bloomberg - Are you a robot?. [online] Available at: https://www.bloomberg.com/profile/company/005380:KS [Accessed 5 March 2022]. Bartlett, C., and, P. Beamish (2018). Transnational management, 8th edition Cambridge University Press.

B. Goncalves, and, N. Perra (2015). Social phenomena: from data analysis to models Springer.

Cross, R.L., A. Parker (2004). The hidden power of social networks: Understanding how work really gets done in organizations. Harvard Business Press.

Carton, G., (2017). A Blue Ocean Strategy for "Blue Ocean Strategy": on Performativity of Strategic Management. Academy of Management Proceedings, 2017(1), p.17635.

Grus, J. (2015). Data science from scratch: First principles with Python

Gulati, R. (2007). Managing network resources Oxford University Press Godel, M., Koch, L. and Castagnetti, A., 2017. [online] Londoneconomics.co.uk. Available at: https://londoneconomics.co.uk/wp-content/uploads/2017/10/The-economic-impact-of-Hyundai-and-Kia-in-Europe-October-2017.pdf [Accessed 6 March 2022].

Freyssenet, Michel (ed.), The Second Automobile Revolution (Palgrave Macmillan, 2009).

HYUNDAI MOTORS. 2022. Company Overview. [online] Available at: https://www.hyundai.com/worldwide/en/company/ir/corporate-information/company-overview [Accessed 5 March 2022].

Markets.ft.com. 2022. Hyundai Motor Co, HYUD:LSE summary - FT.com. [online] Available at: https://markets.ft.com/data/equities/tearsheet/summary?s=HYUD:LSE [Accessed 5 March 2022].

O'Reilly Media, Inc. Conway, and., S., F. Steward (2009). Managing and shaping innovation Oxford University Press.

Yoon, J., 2022. Topic: Hyundai Motor Company. [online] Statista. Available at: https://www.statista.com/topics/7084/hyundai-motor-company/ [Accessed 6 March 2022].Wyman, Oliver, The Harbour Report North America 2008.

8 Appendix

1. Hyundai motor company's details collected from the USPTO_2012_2_proj_attributes_NEW.csv

```
[ ]: Hyundai_Motor_Company = data[data['ID']=='Hyundai Motor Company']
```

```
[ ]:                        ID  Patent_industry  University  Patent_count  \
70  Hyundai Motor Company                 2           0          3839

    Turnover_lay  Turnover_2012  Total_assets_2012  Employees_2012  R&D_2012  \
70    90029031.0     78899421.0        113523083.0             NaN  641328.0

    Country_code
70           8.0
```

2. Number of nodes and edges

```
[ ]: print("Number of nodes:", graph.number_of_nodes())
     print("Number of edges:", graph.number_of_edges())
```

```
Number of nodes: 606
Number of edges: 552
```

3. Degree Centrality

```
Samsung Electronics Co., Ltd. 0.0396694214876033
Sony Corporation 0.024793388429752067
Electronics and Telecommunications Research Institute 0.01983471074380165
Industrial Technology Research Institute 0.01818181818181818
STMICROELECTRONICS S.R.L. 0.01818181818181818
AU Optronics Corp. 0.01487603305785124
Kabushiki Kaisha Toshiba 0.013223140495867768
Toyota Jidosha Kabushiki Kaisha 0.013223140495867768
Airbus Operations SAS 0.013223140495867768
Honda Motor Co., Ltd. 0.011570247933884297
Centre National de la Recherche Scientifique (CNRS) 0.011570247933884297
Denso Corporation 0.011570247933884297
Xiangping Meng 0.011570247933884297
Qiuye Sun 0.011570247933884297
Northeastern University 0.011570247933884297
Yan Zhao 0.011570247933884297
Jing Guo 0.011570247933884297
Qingqi Zhao 0.011570247933884297
Jianguo Zhou 0.011570247933884297
```

4. Eigenvector centrality

```
Xiangping Meng 0.3535528214423834
Qiuye Sun 0.3535528214423834
Northeastern University 0.3535528214423834
Yan Zhao 0.3535528214423834
Jing Guo 0.3535528214423834
Qingqi Zhao 0.3535528214423834
Jianguo Zhou 0.3535528214423834
Tieyan Zhang 0.3535528214423834
Industrial Technology Research Institute 0.0007382672690205771
AU Optronics Corp. 0.0007018568478175622
Chunghwa Picture Tubes, Ltd. 0.0006383749671237463
Taiwan TFT LCD Association 0.0006383749671237463
HannStar Display Corp. 0.0006383749671237463
Chi Mei Optoelectronics Corp. 0.0006383749671237463
TPO Displays Corp. 0.0006383749671237463
University of Central Florida Research Foundation, Inc. 0.0002362379870152275
International Business Machines Corporation 0.00013144549333483297
National Sun Yat-Sen University 0.00012110537659460138
University of Florida Research Foundation, Inc. 0.00011801094577766981
```

5. Betweeness centrality

```
Samsung Electronics Co., Ltd. 0.011724408443252513
Purdue Research Foundation 0.005648295112473318
Toyota Jidosha Kabushiki Kaisha 0.004830058562749713
The Board of Trustees of the Leland Stanford Junior University 0.004165070330031197
NEC Corporation 0.004121285096601171
Honda Motor Co., Ltd. 0.004072026708992392
The Regents of The University of Michigan 0.0035493404849214604
Electronics and Telecommunications Research Institute 0.0034508237097039024
National University Corporation Nagoya University 0.0030594931859230473
SNU R&DB FOUNDATION 0.002971922719062996
Fujitsu Ten Limited 0.0029117180230967105
Kabushiki Kaisha Toshiba 0.002785835476985387
Fujitsu Limited 0.002742050243555361
Toshiba Medical Systems Corporation 0.002692791855946582
Toyota Motor Engineering & Manufacturing North America, Inc. 0.0024519730720814407
Carnegie Mellon University 0.002449236494992064
AT&T INTELLECTUAL PROPERTY I, L.P. 0.0024109244157407912
Hyundai Motor Company 0.002337036834327623
General Electric Company 0.00233156368014887
```

6. Closeness centrality

```
Samsung Electronics Co., Ltd. 0.0505300035932447
Purdue Research Foundation 0.044699618563254925
Board of Regents, University of Texas System 0.040075520091194076
Electronics and Telecommunications Research Institute 0.03956391770705117
SNU R&DB FOUNDATION 0.03890176008852311
The Regents of The University of Michigan 0.03890176008852311
Industry-Academic Cooperation Foundation, Yonsei University 0.03841950686428523
Samsung Display Co., Ltd. 0.0379490639230899
Korea Advanced Institue of Science & Technology 0.03749000266595575
General Electric Company 0.037041914984689346
AT&T INTELLECTUAL PROPERTY I, L.P. 0.03689492325855962
Postech Academy-Industry Foundation 0.03660441205179931
Korea University Research and Business Foundation 0.03660441205179931
UNIVERSITY OF NOTRE DAME 0.03617712319516352
University of Seoul Industry Cooperation Foundation 0.03603690178743033
LCLINK Co., Ltd. 0.03603690178743033
UNIVERSITY-INDUSTRY COOPERATION GROUP OF KYUNG HEE UNIVERSITY 0.03603690178743033
Industry-Academia Cooperation Group of Sejong University 0.03603690178743033
Korea University Industrial & Academic Collaboration Foundation 0.03603690178743033
```