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March 6, 2022

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**Global Networks and Innovation: A1 Company Report**

**Samsung Electronics Co. Ltd. , Dataset: USPTO\_2012\_4**

## 1 Introduction

The report includes analysis of Samsung Electronics Co. Ltd. And the given Dataset: USPTO\_2012\_4. The data set has been analysed to have an understanding of the company's internal and external relationships with subsidiaries, suppliers or any other sister concerns. How they operate, in what degree they are connected and their overall functionality will be illustrated through the data analysis. To do so, the coding language of Python has been used and a "Jupyter" notebook used to write the code and other necessary explanations. In the first part of the report, the company's overview is illustrated and Samsung Electronics Co. internationalisation strategy has been discussed. The middle part of the report illustrates data analysis to show data visualization for company networks

## 2 Company Overview

Samsung Electronics Co. Ltd is a South Korean firm that primarily manufactures and distributes electrical items across the globe (Reuters, 2022). The Company has four segments in their operation. These are; network systems, digital cameras, handheld phones (HHPs) and computers. Company's device solution work on semiconductor and display components of the device, within this department company also produces; thin film transistor-liquid crystal displays (TFT-LCDs), dynamic random access memories (DRAMs), flash memory, and Consumer Electronics (CE) and colour televisions (CTVs), monitors, printers, air conditioners, refrigerators, and washing machines (Samsung Electronics Co Ltd, 2022). Harman's automotive sector produces head units, infotainment systems, telematics, and speakers, among other products. The Company sells its goods both domestically and internationally.

Figure 1: Key Stats of Samsung Electronics Co. Ltd in the year 2019 to 2022. Source: Reuters

However, in the given data, analysis shows Samsung Electronics Co. Ltd. in 2012 had a total patent count of 64500, total Turnover lay 1590113.0, total turnover 2370656.0, total asset 943428.0, Number of employees 301.

### 3 Internationalization Strategy of Samsung Electronics Co. Ltd.

#### 3.1 Integrated Framework of Responsiveness

Samsung E. Co. Ltd., operates worldwide business through the trading name of Samsung. Company provides similar products to consumers across various locations globally. The key to its unique services depend on its enterprise international strategy of integrated approach of responsiveness (Boschma and Ter Wal, 2007; Capaldo, 2007). From this context, there are four basic principles to consider. (Hong, 2012; Jang et al., 2019)

Figure 2: Samsung’s Integrated Framework of Responsiveness.

From these four strategies, however, only could apply to Samsung international strategy. In the first place the company has started with the “Global Strategy”- that has given economic efficiency to integrate a range of sectors like; cost minimisation, product standardisation, and quality control (Hong, 2012). From the analysis, it seems the company has the vision to become an International Corporation. To exemplify that, Samsung’s “Galaxy” Model flagship series became readily available throughout the world, with similar features and consistent quality of the products. Using such a strategy, the company became one of the major smartphone manufacturers in the world. Firm has shared over 30% of the entire smartphone market (Samsung Electronics, 2022).

After a thorough analysis on the company’s internationalisation strategy, it has emerged that the company also uses a “transnational” strategy- this strategy also derived from international strategy (Hong, 2012). This strategy mainly focuses on achieving economies of scale by adapting into the local market. It mainly focuses on operational advantages from the location as well as transformation of information flows and opportunities for development (Jang et al., 2019). Samsung adapted to this approach, it is because it is highly global at the same time it integrates to local needs- in which company operates. Especially adopting this strategy, companies achieve full economies of scale and match contextual opportunities. It is seen that Samsung’s commercial activities are aligned with the key components of this approach. Company has been trying to create production facilities in a new market, for example factories in South African Countries and Egypt back in 2016. However, one particular example signifies that the company has been trying to achieve economies of scale by adopting a transnational (internationalisation) strategy. In the same year in Nigeria Company has to withdraw their launch due to disparities in infrastructure and taxation. This proves that Samsung as a company aspires to achieve economies of scale through their transnational (internationalisation) strategy.

#### 3.2 Strategic Partnership

Over the years, Samsung has been engaged in a number of other notable collaborations. Beginning of 2005, Apple Inc. formed a cooperation with Samsung for mobile phone parts and other portable goods. Especially, Apple required phone memory as the industry was in a state of influx. However, back in 2005 Samsung was the only company that could compete with Apple Inc. on price war. Company’s technological achievements over the years placed them in command of about 50% of the “NAND flash memory production- this is a type of electronic non-volatile memory storage which can be used in phone to re-programmed and erased electronically. This gives the company a competitive advantage as they were able to get hold of such rare commodity (Park et al., 2011). While Apple Inc. benefited from this cooperation by having a reliable supply of technical components such as CPUs and memory for their devices, Samsung got valuable insight into the rapidly growing smartphone business. The cooperation reached its zenith when both businesses were work-

ing together on the development of the primary processor for Apple’s top range devices- but that cooperative work did not stay for long. As the company gained rare insight from this collaboration- Samsung’s emphasis on research and development and experience with Apple’s production process persuaded the company’s management that it should join the smartphone market. The”Omnia” was the first end product of the company’s first smartphone venture, after that “Galaxy S” series of smartphones was introduced. Through the collaboration, Samsung has benefitted through research and development, became one of the fierce competitor of Apple Inc. This shows company’s adventurous collaboration approach to expand its international business.

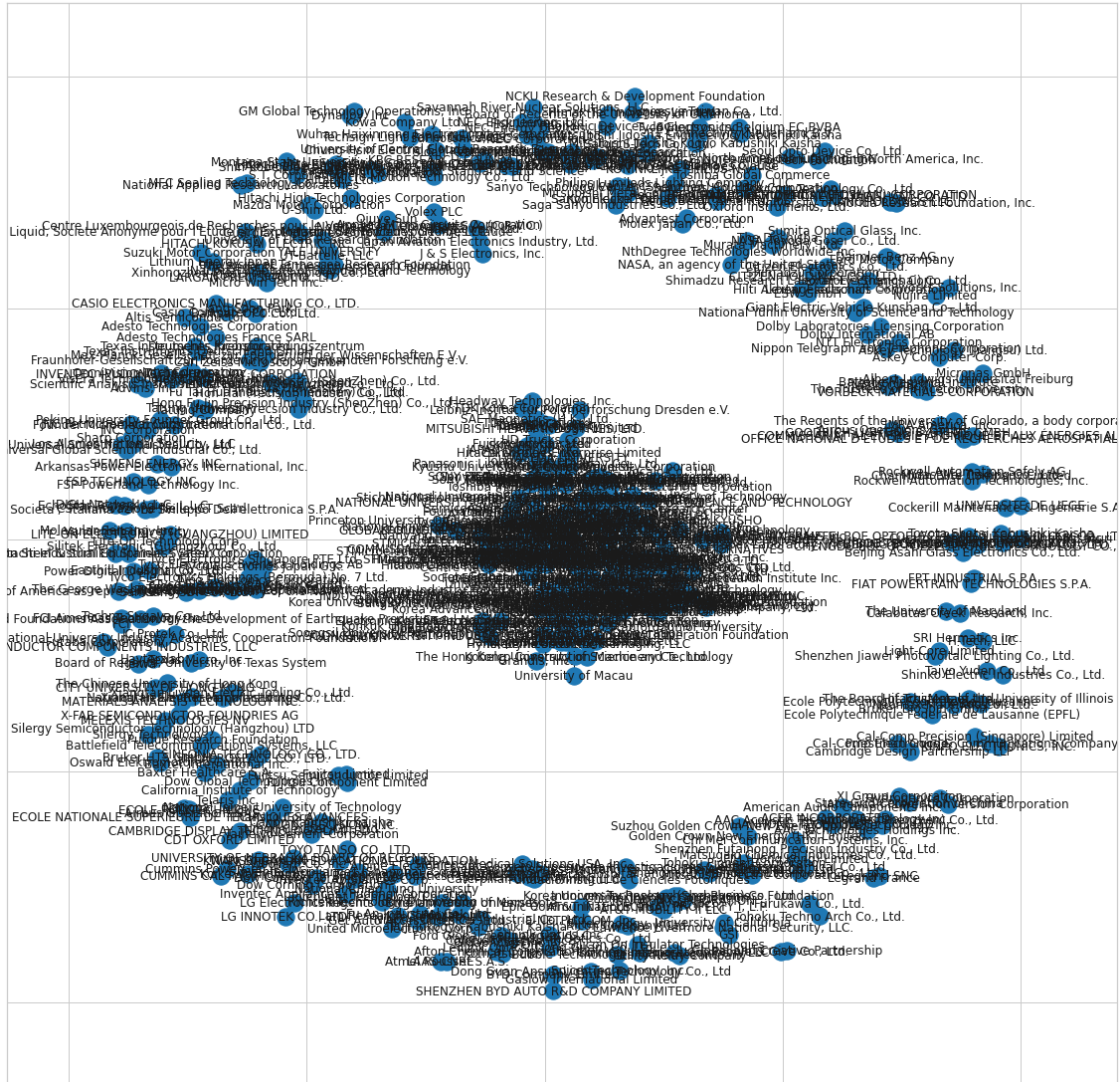
## 4 Data Visualizations and Network Analysis

Provided dataset edge list corresponds to: Number of nodes (companies): 638 and Number of edges (connections): 533. (Appendix 1)

From Figure 3, it shows the network is an industrial network- is a means of transferring information (Gilsing et al., 2008; Grus, 2015). Networks, on the other hand, differ depending on the amount of data being transported. Industrial networks are networks that deal with the flow of data on a big scale on a consistent basis.

```
[ ]: plt.figure(figsize=(20,20))
      nx.draw_networkx(us_graph)
      plt.title('Figure 3. Network visualization')
      plt.show()
```

Figure 3. Network visualization



From figure 4.0 we can see that the network has 2 communities(blue, red). The community detection was done using Girvan\_newman algorithm. Under the Girvan-Newman algorithm, the communities in a graph are discovered by iteratively removing the edges of the graph, based on the edge betweenness and centrality value. The edge with the highest edge betweenness is removed first. Samsung Electronics Co. Ltd. have number of degree = 25 which means it has total of 25 unique direct connections with companies (Appendix 2).

```
[ ]: from networkx.algorithms.community centrality import girvan_newman

G = us_graph
communities = girvan_newman(G)

node_groups = []
```

```

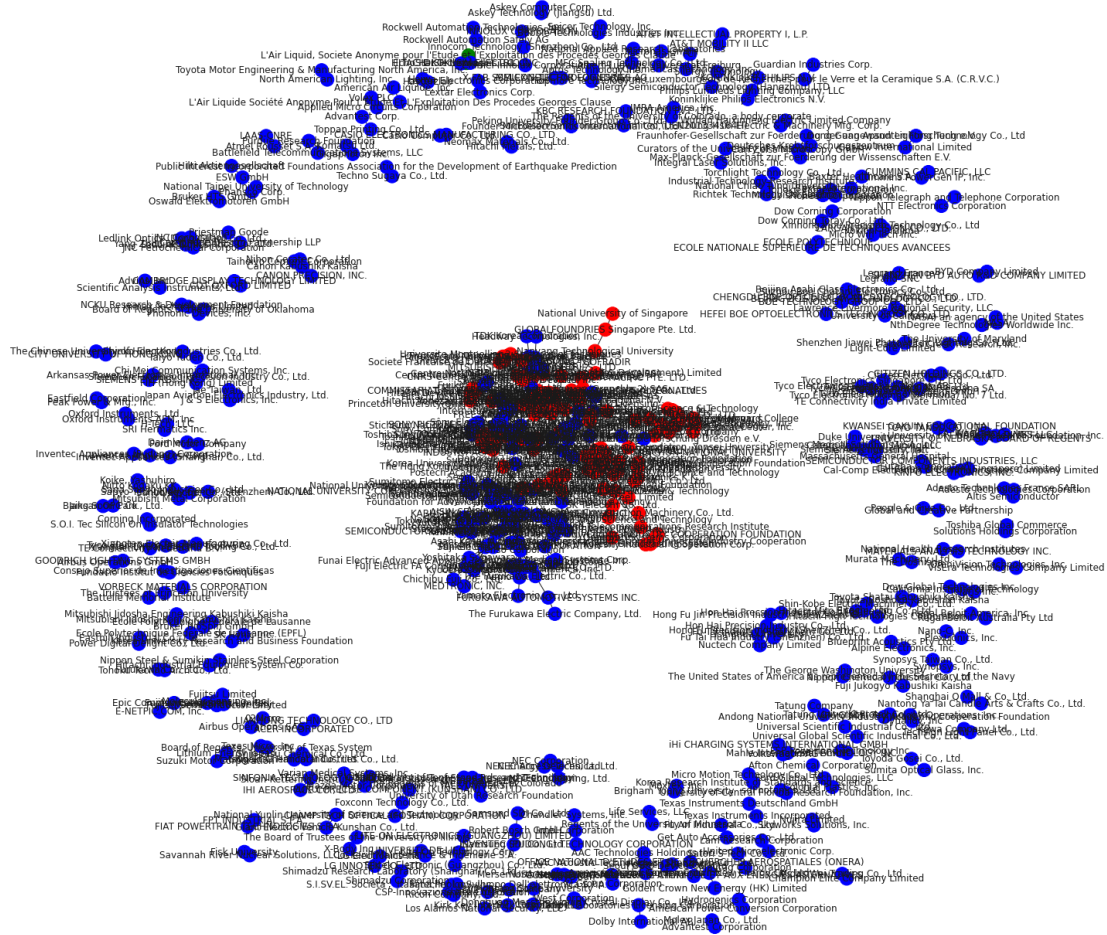
for com in next(communities):
    node_groups.append(list(com))

color_map = []
for node in G:
    if node in node_groups[0]:
        color_map.append('green')
    elif node in node_groups[1]:
        color_map.append('red')
    else:
        color_map.append('blue')

plt.figure(figsize=(20,20))
nx.draw(G, node_color=color_map, with_labels=True)
plt.title('Figure 4. girvan_newman community detection')
plt.show()

```

Figure 4. girvan\_newman community detection



## 5 Primary Data Interpretation

**Degree Centrality Identification:** it counts the total number of connections to identify node connectivity (Goncalves and Perra, 2015). For the dataset of edge list it can be seen that the top 3 best connected companies was: Samsung Electronics Co. Ltd. (0.03924646781789639), International Business Machines Corporation (0.03296703296703297), Toyota Jidosha Kabushiki Kaisha (0.02197802197802198). Meanwhile, Hitachi Displays, Ltd. (0.0015698587127158557), JAPAN DISPLAY INC. (0.0015698587127158557), Henkel Corporation (0.0015698587127158557) has a relatively lower degree centrality which means it has the lowest connections among other companies of the dataset.(Appendix 3)

**Eigenvector Centrality Measures:** Eigenvector centrality measures a node's effect on a network (Goncalves and Perra, 2015). A node's eigenvector centrality increases if numerous other nodes

point to it. International Business Machines Corporation (0.45813003028955307), Samsung Electronics Co. Ltd. (0.4316882680143975), STMICROELECTRONICS S.R.L. (0.33897072011146945) had the eigenvector centrality which indicates that they are the most important companies in the network. It can be seen that the ranking of companies based on Degree of centrality and eigenvector centrality is quite similar. It's because the most connected companies are the ones who are more important in the network. (Appendix 4)

**Betweenness Centrality Identification:** In the network Samsung Electronics Co. Ltd. (0.09045562104861295), IMEC (0.05288860585356546), International Business Machines Corporation (0.04846897636655047) had the highest betweenness score and they are the ones who influence the flow of information around the network. They are the ones whose removal from the network will most disrupt communications between other companies because they are the top connected companies. (Appendix 5)

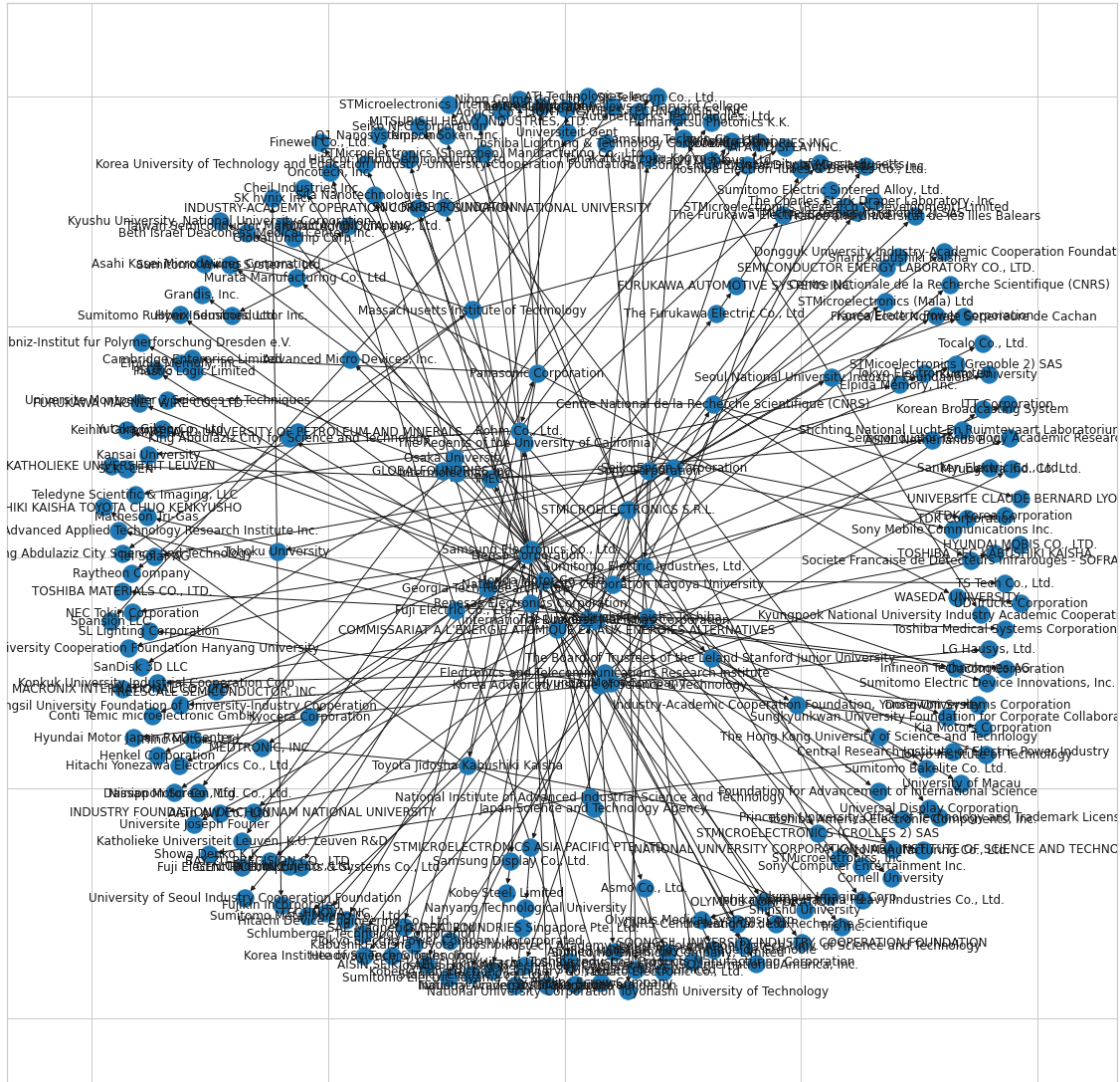
**Closeness Centrality Identification:** Top 4 closely centred Companies were : Samsung Electronics Co. Ltd. (0.11556670253543498), IMEC (0.10819312151476919), International Business Machines Corporation (0.10100503325834695). So, these companies with high closeness centrality is literally close to other companies. Companies with high closeness have, on average, short paths to many other companies, which can be helpful for disseminating resources quickly (Gilsing et al., 2008; Grus, 2015). (Appendix 6)

**Distance (Shortest Path) Identification:** Figure 5 below, shows the shortest path from Samsung Electronics Co. Ltd. to their connections. Attribute dataset had a total 215 companies with 11 features initially. Among them there was an unnecessary feature named Unnamed: 10. So we need to drop the column. Total shape of attributes (215, 10) (Appendix 7)

```
[ ]: group1 = nx.bfs_tree(us_graph,"Samsung Electronics Co., Ltd.")
plt.figure(figsize=(20,20))
nx.draw_networkx(group1)
plt.title('Figure 5. Shortest path from Samsung Electronics Co. Ltd. to their_
↪connections ')
plt.show()
```



Figure 5. Shortest path from Samsung Electronics Co. Ltd. to their connections



**Identification of Other Attributes:** Figure 6 below indicates that the attribute dataset had missing values in R&D\_2012, Employees\_2012, Turnover\_2012, Total\_assets\_2012, Turnover lay and Country code. Among them R&D\_2012 had the highest missing values with 58% and country code had the least with 12%

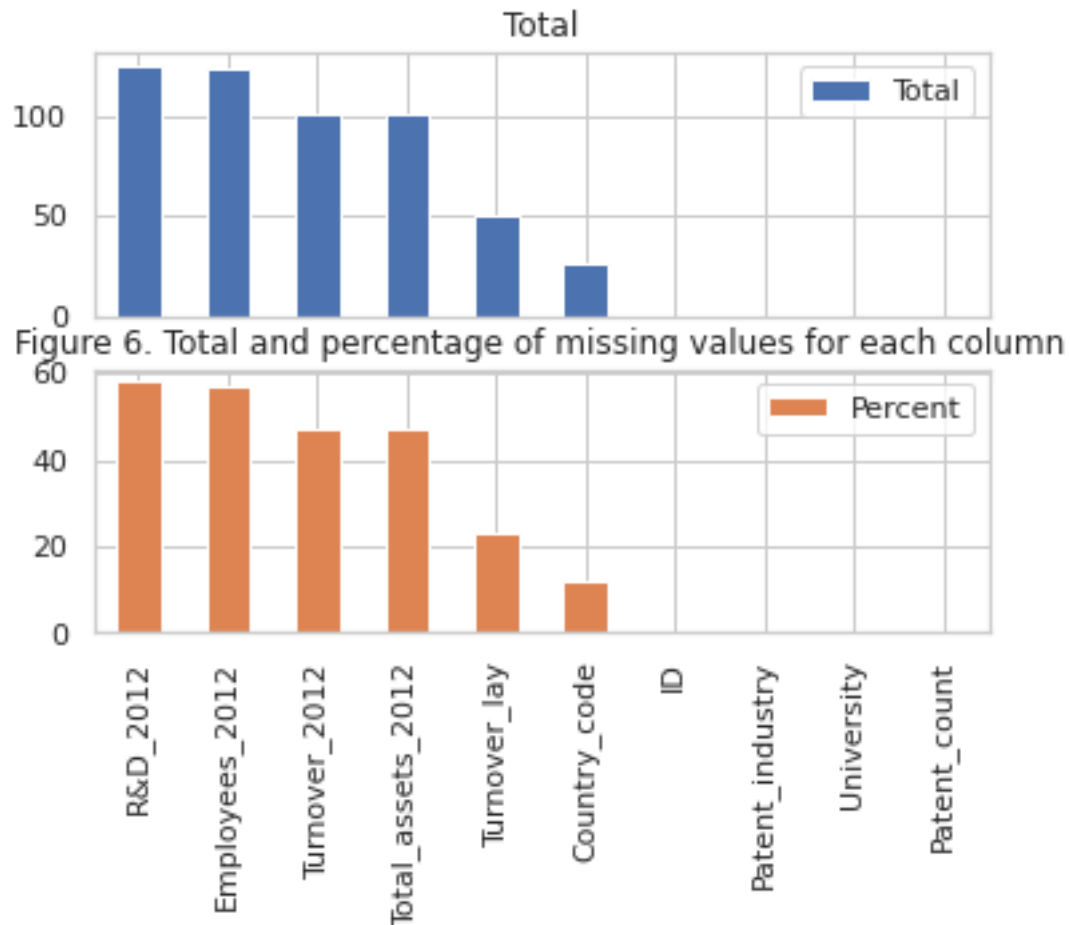
```
[ ]: total = df.isnull().sum().sort_values(ascending=False)
percent = ((df.isnull().sum()/df.isnull().count())*100).
        sort_values(ascending=False)
missing_data = pd.concat([total, percent], axis=1, keys=['Total', 'Percent'])

axes = missing_data.plot.bar( subplots=True)

plt.title('Figure 6. Total and percentage of missing values for each column')
axes[1].legend(loc=1)
```

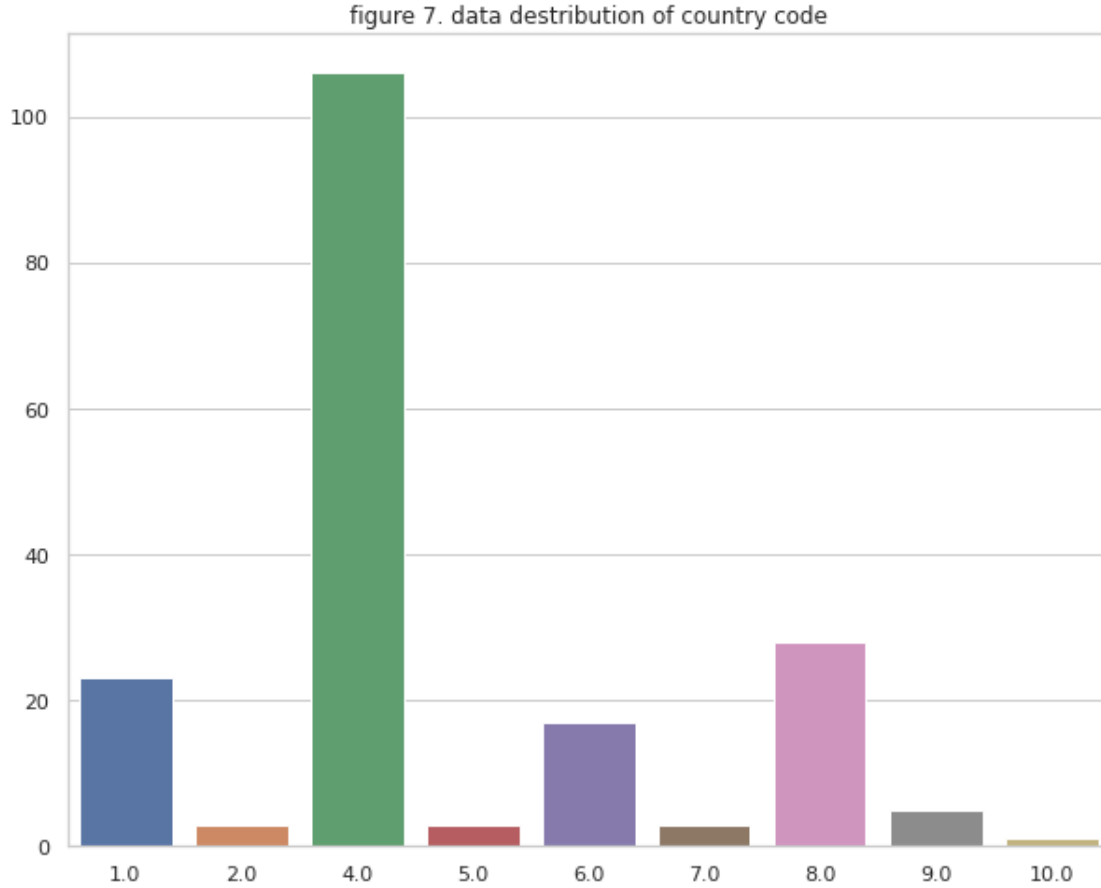


```
plt.show()
```



While Figure 7, below indicates that the dataset had the highest number of companies situated by Country code 4 and the lowest at Country code 10.

```
[ ]: plt.figure(figsize=(10,8))
plt.title('figure 7. data destribution of country code')
# Country_code
sns.barplot(x=df.Country_code.value_counts().index, y=df.Country_code.
↪value_counts().values)
plt.show()
```



## 6 Samsung Electronics Co. Ltd. innovation strategies and their Implication

### 6.1 Harvesting Innovation

Samsung Electronics has put innovation in the heart of their strategy, to acquire a worldwide competitive edge. This has allowed the organisation to develop value and profit from developing markets with predictable cash flows (Rosenbusch et al., 2011). Instead of growing semiconductor production, the company has created innovative products including flash memory, DRAM etc. Because these new products meet consumers' demands across various location in their operation. While companies in the PC and smartphone sector are also making significant benefits out of the innovation project. These remarkable outcomes of harvesting innovative culture in the firm have drew significant attention to its innovation harvesting technique across the sector. Company has taken an initiative called Value Innovation Program (VIP), which was established in 1998. It has helped companies to create new products. Staff in the research and development (R&D) sector benefited from these innovative ideas. Such ingenuity to develop and harvest innovative organisational culture amplified the company's consistent product development. According to various researchers, value innovation strategies have helped generate numerous innovative concepts. This approach was designed to help people transcend the previous success syndrome and see what is

achievable and push the boundary to the limit. ## Blue Ocean Strategy for Innovation Samsung Electronics' another strategy that helped the company to shape its innovation, hence, to achieve the competitive advantage, the ultimate goal is to create a completely new market by creating a demand. This strategy referred to a new product or market where less or no competition exists (Carton, 2017). This only is possible through the research and development for new kinds of products. Company's senior leadership has pushed this through to adopt this approach for value creation. As a result, the company successfully created new products that surprises and delight its consumers. The recent example of this Galaxy Folding Series, it is futuristic, consumers only were able to imagine it. But the company's innovative technology has created an entire new market of folding screen series of phones. .

## 7 Conclusion

This report illustrated Samsung Electronics' Internationalization strategy as a unique of its kind. The company has collaborated to supply components of handheld phone materials with other companies like Apple Inc. back in the 90s. From that collaborative approach, Samsung became a fireless competitor in the market. They have created a whole new demand and class of new consumers. This, only possible not only for their innovative approach but their regional leadership in management and manufacturing. Company's vast network has helped to make this even easier for them. From the given data it is imperative to mention that the company has close approximations with their suppliers and subsidiaries. The author believes their innovative and strong R&D expenditure has such strategies implementable. In the future, companies should focus on AI and Algorithm technology to create innovative products for physically challenged communities and tackle unsustainable practices within the industry.

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Jang, S., Lee, S., Kim, T. and Choi, D., 2019. Planting and harvesting innovation - an analysis of Samsung Electronics. International Journal of Quality Innovation, 5(1).

## 9 Appendix

[ ]: 1. Number of nodes and edges in the network

Number of nodes: 638

Number of edges: 533

[ ]: 2. Number of degree of Samsung Electronics Co., Ltd.

[ ]: 25

[ ]: 3. Degree of centrality for each company

Samsung Electronics Co., Ltd. 0.03924646781789639  
International Business Machines Corporation 0.03296703296703297  
Toyota Jidosha Kabushiki Kaisha 0.02197802197802198  
STMICROELECTRONICS S.R.L. 0.020408163265306124  
Kabushiki Kaisha Toshiba 0.020408163265306124  
Denso Corporation 0.01883830455259027  
Fuji Electric Co., Ltd. 0.017268445839874413  
Sumitomo Electric Industries, Ltd. 0.017268445839874413  
Sony Corporation 0.015698587127158558  
COMMISSARIAT A L'ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES  
0.015698587127158558  
Honda Motor Co., Ltd. 0.015698587127158558  
Hyundai Motor Company 0.0141287284144427  
Panasonic Corporation 0.0141287284144427  
Rohm Co., Ltd. 0.0141287284144427  
IMEC 0.012558869701726845  
Centre National de la Recherche Scientifique (CNRS) 0.01098901098901099  
National University Corporation Nagoya University 0.01098901098901099  
Electronics and Telecommunications Research Institute 0.009419152276295134  
The Regents of the University of California 0.009419152276295134  
FREESCALE SEMICONDUCTOR, INC. 0.009419152276295134  
Renesas Electronics Corporation 0.009419152276295134  
BOE TECHNOLOGY GROUP CO., LTD. 0.007849293563579279  
The University of Tokyo 0.007849293563579279

Tyco Electronics Corporation 0.007849293563579279  
 Samsung Display Co., Ltd. 0.007849293563579279  
 The Board of Trustees of the Leland Stanford Junior University  
 0.007849293563579279  
 Intermolecular, Inc. 0.007849293563579279  
 Massachusetts Institute of Technology 0.007849293563579279  
 National Institute of Advanced Industrial Science and Technology  
 0.007849293563579279  
 Hon Hai Precision Industry Co., Ltd. 0.007849293563579279  
 Kia Motors Corporation 0.006279434850863423  
 OLYMPUS CORPORATION 0.006279434850863423  
 Murata Manufacturing Co., Ltd. 0.006279434850863423  
 SNU R&DB FOUNDATION 0.006279434850863423  
 Industry-Academic Cooperation Foundation, Yonsei University 0.006279434850863423  
 GLOBALFOUNDRIES Inc. 0.006279434850863423  
 Seoul National University Industry Foundation 0.006279434850863423  
 Seiko Epson Corporation 0.006279434850863423  
 Sanyo Electric Co., Ltd. 0.006279434850863423  
 Sumitomo Metal Mining Co., Ltd. 0.006279434850863423  
 University of Tennessee Research Foundation 0.006279434850863423  
 Sharp Kabushiki Kaisha 0.006279434850863423  
 Siémens Aktiengesellschaft 0.006279434850863423  
 Tohoku University 0.006279434850863423  
 STMICROELECTRONICS (CROLLES 2) SAS 0.006279434850863423  
 Canon Kabushiki Kaisha 0.004709576138147567  
 Advanced Micro Devices, Inc. 0.004709576138147567  
 Hino Motors, Ltd. 0.004709576138147567  
 The Furukawa Electric Co., Ltd. 0.004709576138147567  
 Georgia Tech Research Corp. 0.004709576138147567  
 Korea Advanced Institute of Science & Technology 0.004709576138147567  
 Taiwan Semiconductor Manufacturing Company, Ltd. 0.004709576138147567  
 Osaka University 0.004709576138147567  
 Hitachi, Ltd. 0.004709576138147567  
 KING FAHD UNIVERSITY OF PETROLEUM AND MINERALS 0.004709576138147567  
 Autonetworks Technologies, Ltd. 0.004709576138147567  
 AISIN SEIKI KABUSHIKI KAISHA 0.004709576138147567  
 Sumitomo Wiring Systems, Ltd. 0.004709576138147567  
 Sanken Electric Co., Ltd. 0.004709576138147567  
 Nissan Motor Co., Ltd. 0.004709576138147567  
 YALE UNIVERSITY 0.004709576138147567  
 Kyocera Corporation 0.004709576138147567  
 SAE Magnetics (H.K.) Ltd. 0.004709576138147567  
 Showa Denko K.K. 0.004709576138147567  
 Kokichi Terajima 0.004709576138147567  
 Xinhongzhou Precision Technology Co., Ltd 0.004709576138147567  
 Micro Win Tech Inc. 0.004709576138147567  
 LARGAN PRECISION CO., LTD. 0.004709576138147567  
 ASML Netherlands B.V. 0.004709576138147567

TDK Corporation 0.004709576138147567  
 Tyco Electronics Japan G.K. 0.004709576138147567  
 National Chiao Tung University 0.004709576138147567  
 Panasonic Liquid Crystal Display Co., Ltd. 0.004709576138147567  
 Hyundai Motor Japan R&D Center 0.0031397174254317113  
 Nihon Ceratec Co., Ltd. 0.0031397174254317113  
 Taiheiyo Cement Corporation 0.0031397174254317113  
 Intel Corporation 0.0031397174254317113  
 Koito Manufacturing Co., Ltd. 0.0031397174254317113  
 Fuji Electric FA Components & Systems Co., Ltd. 0.0031397174254317113  
 FURUKAWA AUTOMOTIVE SYSTEMS INC. 0.0031397174254317113  
 FURUKAWA MAGNET WIRE CO., LTD. 0.0031397174254317113  
 Tsinghua University 0.0031397174254317113  
 Tokyo Electric Power Company, Incorporated 0.0031397174254317113  
 Ishikawajima-Harima Heavy Industries Co., Ltd. 0.0031397174254317113  
 University of California 0.0031397174254317113  
 GSI 0.0031397174254317113  
 Lawrence Livermore National Security, LLC. 0.0031397174254317113  
 Shenzhen Futaihong Precision Industry Co., Ltd. 0.0031397174254317113  
 Tanaka Kikinzoku Kogyo K.K. 0.0031397174254317113  
 France/Ecole Normale Seperieure de Cachan 0.0031397174254317113  
 France and Universitat de les Illes Balears 0.0031397174254317113  
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 WASEDA UNIVERSITY 0.0031397174254317113  
 Aisin AW Co., Ltd. 0.0031397174254317113  
 Kabushiki Kaisha Toyota Jidoshokki 0.0031397174254317113  
 Kyungpook National University Industry Academic Cooperation Foundation  
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 Northeastern University 0.0031397174254317113  
 Cal-Comp Electronics & Communications Company Limited 0.0031397174254317113  
 UT-Battelle, LLC 0.0031397174254317113  
 The Regents of the University of Colorado 0.0031397174254317113  
 National Institute of Standards and Technology 0.0031397174254317113  
 KATHOLIEKE UNIVERSITEIT LEUVEN 0.0031397174254317113  
 SanDisk 3D LLC 0.0031397174254317113  
 Elpida Memory, Inc. 0.0031397174254317113  
 Philips Lumileds Lighting Company, LLC 0.0031397174254317113  
 Volkswagen AG 0.0031397174254317113  
 iHi CHARGING SYSTEMS INTERNATIONAL GMBH 0.0031397174254317113  
 Mahle International GmbH 0.0031397174254317113  
 AAC Acoustic Technologies (Shenzhen) Co., Ltd. 0.0031397174254317113  
 Oncotech, Inc. 0.0031397174254317113  
 Japan Aviation Electronics Industry, Ltd. 0.0031397174254317113  
 Universal Display Corporation 0.0031397174254317113  
 Robert Bosch GmbH 0.0031397174254317113  
 STMicroelectronics (Grenoble 2) SAS 0.0031397174254317113  
 California Institute of Technology 0.0031397174254317113  
 Adesto Technologies Corporation 0.0031397174254317113



Fujitsu Limited 0.0031397174254317113  
 Central Research Institute of Electric Power Industry 0.0031397174254317113  
 Japan Science and Technology Agency 0.0031397174254317113  
 Sumitomo Chemical Company, Limited 0.0031397174254317113  
 Foxconn Technology Co., Ltd. 0.0031397174254317113  
 Universiteit Gent 0.0031397174254317113  
 Siemens Industry, Inc. 0.0031397174254317113  
 Caterpillar Global Mining LLC 0.0031397174254317113  
 Siemens Medical Solutions USA, Inc. 0.0031397174254317113  
 Tohoku Pioneer Corporation 0.0031397174254317113  
 Kyoto University 0.0031397174254317113  
 Myunghwa Ind. Co. Ltd. 0.0031397174254317113  
 Tyco Electronics Raychem GmbH 0.0031397174254317113  
 NthDegree Technologies Worldwide Inc. 0.0031397174254317113  
 Max-Planck-Gesellschaft zur Foerderung der Wissenschaften E.V.  
 0.0031397174254317113  
 Carl Zeiss Microscopy GmbH 0.0031397174254317113  
 Bruker BioSpin GmbH 0.0031397174254317113  
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 NEC Access Technica, Ltd. 0.0031397174254317113  
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 Hong Fu Jin Precision Industry (ShenZhen) Co., Ltd. 0.0031397174254317113  
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 Cambridge Enterprise Limited 0.0031397174254317113  
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 Lite-On Technology Corp. 0.0031397174254317113  
 STMICROELECTRONICS ASIA PACIFIC PTE. LTD. 0.0031397174254317113  
 Asmo Co., Ltd. 0.0031397174254317113  
 Lintec Corporation 0.0031397174254317113  
 Kyushu University, National University Corporation 0.0031397174254317113  
 HITACHI KOKUSAI ELECTRIC INC. 0.0015698587127158557

L'Air Liquid, Societe Anonyme pour l'Etude et l'Exploitation des Procedes  
 Georges Claude 0.0015698587127158557  
 STMicroelectronics (Mala) Ltd 0.0015698587127158557  
 ACER INCORPORATED 0.0015698587127158557  
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 The University of Maryland 0.0015698587127158557  
 Calabatas Creek Research, Inc. 0.0015698587127158557  
 University of Utah Research Foundation 0.0015698587127158557  
 NEC Energy Devices, Ltd. 0.0015698587127158557  
 United Microelectronic Corp. 0.0015698587127158557  
 Lam Research Corporation 0.0015698587127158557  
 Jang Soon Park 0.0015698587127158557  
 Baiksan OPC Co., Ltd. 0.0015698587127158557  
 Yoshitaka Sugawara 0.0015698587127158557  
 Seiko NPC Corporation 0.0015698587127158557  
 Casio Computer Co., Ltd. 0.0015698587127158557  
 CASIO ELECTRONICS MANUFACTURING CO., LTD. 0.0015698587127158557  
 Regal Beloit America, Inc. 0.0015698587127158557  
 Regal Beloit Australia Pty Ltd 0.0015698587127158557  
 Samsund SDI Co., Ltd. 0.0015698587127158557  
 National University of Singapore 0.0015698587127158557  
 Matsugaki Chemical Industries Co., Ltd. 0.0015698587127158557  
 Silitek Electronic (Guangzhou) Co., Ltd. 0.0015698587127158557  
 LITE-ON ELECTRONICS (GUANGZHOU) LIMITED 0.0015698587127158557  
 Duke University 0.0015698587127158557  
 E-NETPIC.COM, Inc. 0.0015698587127158557  
 Epic Communications, Inc. 0.0015698587127158557  
 STMicoelectronics (Grenoble 2) SAS 0.0015698587127158557  
 Battlefield Telecommunications Systems, LLC 0.0015698587127158557  
 Purdue Research Foundation 0.0015698587127158557  
 North American Lighting, Inc. 0.0015698587127158557  
 Toyota Motor Engineering & Manufacturing North America, Inc.  
 0.0015698587127158557  
 University of Central Florida Research Foundation, Inc. 0.0015698587127158557  
 sdPhotonics, LLC 0.0015698587127158557

STMicroelectronics (Shenzhen) Manufacturing Co., Ltd. 0.0015698587127158557  
 STMicroelectronics International N.V. 0.0015698587127158557  
 Airbus Operations GmbH 0.0015698587127158557  
 GOODRICH LIGHTING SYSTEMS GMBH 0.0015698587127158557  
 Ecole Polytechnique Fédérale de Lausanne 0.0015698587127158557  
 Hilti Aktiengesellschaft 0.0015698587127158557  
 ESW GmbH 0.0015698587127158557  
 Bruker HTS GmbH 0.0015698587127158557  
 Oswald Elektromotoren GmbH 0.0015698587127158557  
 Chung-Hsin Electric & Machinery Mfg. Corp. 0.0015698587127158557  
 Wuhan Haixinneng Electric Limited Company 0.0015698587127158557  
 Teledyne Scientific & Imaging, LLC 0.0015698587127158557  
 Tyco Electronics Amp Korea Ltd. 0.0015698587127158557  
 Albert-Ludwigs Universität Freiburg 0.0015698587127158557  
 Micronas GmbH 0.0015698587127158557  
 Centre Luxembourgeois de Recherches pour le Verre et la Ceramique S.A.  
 (C.R.V.C.) 0.0015698587127158557  
 Guardian Industries Corp. 0.0015698587127158557  
 Tyco Electronics Belgium EC BVBA 0.0015698587127158557  
 TE Connectivity Nederland B.V. 0.0015698587127158557  
 KONICA MINOLTA, INC. 0.0015698587127158557  
 U-Shin Ltd. 0.0015698587127158557  
 Mazda Motor Corporation 0.0015698587127158557  
 DENSO International America, Inc. 0.0015698587127158557  
 West Corporation 0.0015698587127158557  
 Dongguan Masstop Liquid Crystal Display Co., Ltd. 0.0015698587127158557  
 Torchlight Technology Co., Ltd. 0.0015698587127158557  
 Tyco Electronics Svenska Holdings AB 0.0015698587127158557  
 Advics Co., Ltd. 0.0015698587127158557  
 Synopsys, Inc. 0.0015698587127158557  
 Synopsys Taiwan Co., Ltd. 0.0015698587127158557  
 CDT OXFORD LIMITED 0.0015698587127158557  
 CAMBRIDGE DISPLAY TECHNOLOGY LIMITED 0.0015698587127158557  
 Beijing Asahi Glass Electronics Co., Ltd. 0.0015698587127158557  
 Suzhou Boe Chatani Electronics Co., Ltd. 0.0015698587127158557  
 Mitsubishi Jidosha Kogyo Kabushiki Kaisha 0.0015698587127158557  
 Mitsubishi Jidosha Engineering Kabushiki Kaisha 0.0015698587127158557  
 Toyota Boshoku Kabushiki Kaisha 0.0015698587127158557  
 Toyota Shatai Kabushiki Kaisha 0.0015698587127158557  
 Fraunhofer-Gesellschaft zur Foerderung der angewandten Forschung e.V.  
 0.0015698587127158557  
 Shin-Etsu Handotai Co., Ltd. 0.0015698587127158557  
 Stanley Electric Co., Ltd. 0.0015698587127158557  
 Chimei Innolux Corporation 0.0015698587127158557  
 Peking University Founder Group Co., Ltd. 0.0015698587127158557  
 Founder Microelectronics International Co., Ltd. 0.0015698587127158557  
 Texas Instruments Deutschland GmbH 0.0015698587127158557  
 Texas Instruments Incorporated 0.0015698587127158557

INVENTEC (PUDONG) TECHNOLOGY CORPORATION 0.0015698587127158557  
 Richtek Technology Corporation 0.0015698587127158557  
 Infineon Technologies AG 0.0015698587127158557  
 American Air Liquide, Inc. 0.0015698587127158557  
 L'Air Liquide Société Anonyme Pour L'Étude Et L'Exploitation Des Procédés  
 Georges Clause 0.0015698587127158557  
 Stichting National Lucht-En Ruimtevaart Laboratorium 0.0015698587127158557  
 Yamato Electronic Co., Ltd. 0.0015698587127158557  
 Nippon Soken, Inc. 0.0015698587127158557  
 Fu An Industrial Co., Ltd. 0.0015698587127158557  
 Get Auto Accessories Co., Ltd. 0.0015698587127158557  
 UNIVERSITY OF NEBRASKA BOARD OF REGENTS 0.0015698587127158557  
 J.A. Woollam Co. Inc. 0.0015698587127158557  
 Topmore Technology Inc. 0.0015698587127158557  
 Aptos Technology Inc. 0.0015698587127158557  
 Hitachi Displays, Ltd. 0.0015698587127158557  
 JAPAN DISPLAY INC. 0.0015698587127158557  
 Henkel Corporation 0.0015698587127158557

[ ]: 4. Eigenvector centrality for each company

International Business Machines Corporation 0.45813003028955307  
 Samsung Electronics Co., Ltd. 0.4316882680143975  
 STMICROELECTRONICS S.R.L. 0.33897072011146945  
 COMMISSARIAT A L'ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES  
 0.24047786993028206  
 FREESCALE SEMICONDUCTOR, INC. 0.21000175507774457  
 GLOBALFOUNDRIES Inc. 0.20634328236519153  
 STMICROELECTRONICS (CROLES 2) SAS 0.16941578123418422  
 Kabushiki Kaisha Toshiba 0.16120311083141994  
 Centre National de la Recherche Scientifique (CNRS) 0.12871241958293347  
 Samsung Display Co., Ltd. 0.11558633904181562  
 IMEC 0.10138705794847949  
 Industry-Academic Cooperation Foundation, Yonsei University 0.09419447698017736  
 SNU R&DB FOUNDATION 0.09181066170812134  
 Korea Advanced Institute of Science & Technology 0.0897007605188954  
 STMicroelectronics Limited 0.08736606969814834  
 Taiwan Semiconductor Manufacturing Company, Ltd. 0.08704546490027698  
 Sumitomo Bakelite Co. Ltd. 0.0867079764713347  
 Dacom Corporation 0.0867079764713347  
 Renesas Electronics Corporation 0.08348029548942879  
 The Regents of the University of California 0.08187260081386839  
 Seoul National University Industry Foundation 0.07824270685112465  
 Advanced Micro Devices, Inc. 0.07679906195108382  
 King Abdulaziz City for Science and Technology 0.07491350181541453  
 GLOBALFOUNDRIES INC. 0.07290893371996789  
 Applied Materials, Inc. 0.07290893371996789  
 Toshiba America Electronic Components, Inc. 0.07290893371996789



Cornell University 0.07290893371996789  
 BAY ZU PRECISION CO., LTD. 0.07290893371996789  
 MACRONIX INTERNATIONAL CO., LTD. 0.07290893371996789  
 Matheson Tri-Gas 0.07290893371996789  
 Infineon Technologies AG 0.07290893371996789  
 Georgia Tech Research Corp. 0.07236954216993262  
 Osaka University 0.07236954216993262  
 University of Seoul Industry Cooperation Foundation 0.06870339967415455  
 GENITECH, INC. 0.06870339967415455  
 Korea Electric Power Corporation 0.06870339967415455  
 Sungkyunkwan University Foundation for Corporate Collaboration  
 0.06870339967415455  
 Dongguk University Industry-Academic Cooperation Foundation 0.06870339967415455  
 Korea University of Technology and Education Industry-University Cooperation  
 Foundation 0.06870339967415455  
 Postech Academy-Industry Foundation Postech Univ. of Science and Technology  
 0.06870339967415455  
 Industry-University Cooperation Foundation Hanyang University  
 0.06870339967415455  
 INDUSTRY FOUNDATION OF CHONNAM NATIONAL UNIVERSITY 0.06870339967415455  
 Cheil Industries Inc. 0.06870339967415455  
 Industry-Academic Cooperation Foundation 0.06870339967415455  
 INDUSTRY-ACADEMY COOPERATION CORPS OF SUNCHON NATIONAL UNIVERSITY  
 0.06870339967415455  
 Intermolecular, Inc. 0.06777081750179055  
 STMICROELECTRONICS ASIA PACIFIC PTE. LTD. 0.055385814446158664  
 STMicroelectronics (Grenoble 2) SAS 0.055347419443303604  
 STMicroelectronics (Mala) Ltd 0.053945633717555085  
 STMicroelectronics (Grenoble 2) SAS 0.053945633717555085  
 STMicroelectronics (Shenzhen) Manufacturing Co., Ltd. 0.053945633717555085  
 STMicroelectronics International N.V. 0.053945633717555085  
 Universite Joseph Fourier 0.04551361915658404  
 CNRS-Centre National de la Recherche Scientifique 0.04551361915658404  
 Institut Polytechnique de Grenoble 0.038270475726493475  
 ISORG 0.038270475726493475  
 Centre Nationale de la Recherche Scientifique (CNRS) 0.038270475726493475  
 SanDisk 3D LLC 0.03643961018154147  
 Conti Temic microelectronic GmbH 0.03342043598059326  
 Tokyo Electric Power Company, Incorporated 0.03050964015873904  
 Ishikawajima-Harima Heavy Industries Co., Ltd. 0.03050964015873904  
 The Board of Trustees of the Leland Stanford Junior University  
 0.030218506960651124  
 STMicroelectronics, Inc. 0.02696149611195337  
 Sony Corporation 0.025850208996698525  
 Toshiba Industrial Products Manufacturing Corporation 0.025654294928027427  
 Toshiba Medical Systems Corporation 0.025654294928027427  
 Toshiba Lightning & Technology Corporation 0.025654294928027427  
 TOSHIBA TEC KABUSHIKI KAISHA 0.025654294928027427

TOSHIBA MATERIALS CO., LTD. 0.025654294928027427  
 Toshiba Electron Tubes & Devices Co., Ltd. 0.025654294928027427  
 Toshiba Lighting & Technology Corporation 0.025654294928027427  
 France/Ecole Normale Seperieure de Cachan 0.024360473902886016  
 France and Universitat de les Illes Balears 0.024360473902886016  
 Hyundai Motor Company 0.0235786784414443  
 Panasonic Corporation 0.022396389044840058  
 Kia Motors Corporation 0.02100241351242177  
 ASML Netherlands B.V. 0.02077990029462191  
 Societe Francaise de Detecteurs Infrarouges - SOFRADIR 0.02048370035963474  
 Universite Montpellier 2 Sciences et Techniques 0.02048370035963474  
 UNIVERSITE CLAUDE BERNARD LYON I 0.02048370035963474  
 Kobe Steel, Limited 0.01887386988403148  
 Kyungpook National University Industry Academic Cooperation Foundation  
 0.01726249535358259  
 KATHOLIEKE UNIVERSITEIT LEUVEN 0.01655663260432348  
 Universiteit Gent 0.01655663260432348  
 Electronics and Telecommunications Research Institute 0.01634628907649445  
 Katholieke Universiteit Leuven, K.U. Leuven R&D 0.016137164499564472  
 Hynix Semiconductor Inc. 0.014991565455654362  
 SK Telecom Co., Ltd. 0.01461183099994617  
 Global Unichip Corp. 0.013853681688097226  
 Japan Science and Technology Agency 0.013431939732457638  
 Hitachi Tohbu Semiconductor Ltd. 0.013285367465408635  
 ITT Corporation 0.013285367465408635  
 Hitachi Device Engineering Co., Ltd. 0.013285367465408635  
 Hitachi ULSI Systems Co., Ltd. 0.013285367465408635  
 Hitachi Yonezawa Electronics Co., Ltd. 0.013285367465408635  
 University of Massachusetts 0.013030300945851213  
 Q1 Nanosystems, Inc 0.013030300945851213  
 Teledyne Scientific & Imaging, LLC 0.013030300945851213  
 KING FAHD UNIVERSITY OF PETROLEUM AND MINERALS 0.01259601314553718  
 Samsung Techwin Co., Ltd. 0.012452593136407364  
 Spansion LLC 0.012222104143213869  
 ATI Technologies, Inc. 0.012222104143213869  
 Phillips Screw Company 0.011517712758787563  
 Sila Nanotechnologies Inc. 0.011517712758787563  
 Dainippon Screen Mfg. Co., Ltd. 0.011517712758787563  
 Hamamatsu Photonics K.K. 0.011517712758787563  
 Elpida Memory, Inc. 0.011073042135950098  
 Elpidia Memory, Inc. 0.010785315253514038  
 Toyota Jidosha Kabushiki Kaisha 0.009861229011250914  
 Sumitomo Electric Industries, Ltd. 0.009111190513532319  
 Nanyang Technological University 0.009049523699672374  
 STMicroelectronics (Research & Development) Limited 0.008808262274915246  
 Honda Motor Co., Ltd. 0.007542350779655358  
 Hyundai Motor Japan R&D Center 0.007095281816084602  
 Myunghwa Ind. Co. Ltd. 0.007095281816084602

Rohm Co., Ltd. 0.00626621619632014  
 Tohoku University 0.005387841096783582  
 Kyoto University 0.005114427641046359  
 The Hong Kong University of Science and Technology 0.004934945898104303  
 Lintec Corporation 0.004242723913256142  
 Kyushu University, National University Corporation 0.004242723913256142  
 Sōny Electronics Inc. 0.004116143068560741  
 Sony Computer Entertainment Inc. 0.004116143068560741  
 Tel Solar AG 0.004116143068560741  
 Sony Mobile Communications Inc. 0.004116143068560741  
 SONY PICTURES TECHNOLOGIES INC. 0.004116143068560741  
 Panasonic Liquid Crystal Display Co., Ltd. 0.003757612102446119  
 LG Hausys, Ltd. 0.003752657837850895  
 Korea Institute of Science & Technology 0.003752657837850895  
 HYUNDAI MOBIS CO., LTD. 0.003752657837850895  
 SL Lighting Corporation 0.003752657837850895  
 Il Heung Co., Ltd. 0.003752657837850895  
 Cambridge Enterprise Limited 0.003662244133108439  
 WASEDA UNIVERSITY 0.0036597577108379367  
 Autonetwoks Technologies, Ltd. 0.0036083174045692724  
 Sumitomo Wiring Systems, Ltd. 0.0036083174045692724  
 National University Corporation Nagoya University 0.003591052269190269  
 Nihon Colmo Co., Ltd. 0.0035668761637707587  
 Fuji Electric Co., Ltd. 0.0034782588445674786  
 Stichting National Lucht-En Ruimtevaart Laboratorium 0.0033078557426458126  
 Sharp Kabushiki Kaisha 0.0032989794651176775  
 AISIN SEIKI KABUSHIKI KAISHA 0.0031104989410684976  
 Denso Corporation 0.003087378128731179  
 Kobelco Construction Machinery Co., Ltd. 0.003003836618804158  
 SCK.-CEN 0.002635290801312462  
 IMEC VZW 0.002635290801312462  
 SOONGSIL UNIVERSITY-INDUSTRY COOPERATION FOUNDATION 0.0026015653548026444  
 Konkuk University Industrial Cooperation Corp. 0.0026015653548026444  
 Korean Broadcasting System 0.0026015653548026444  
 Dongwon Systems Corporation 0.0026015653548026444  
 Soongsil University Foundation of University-Industry Cooperation  
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 Sumitomo Metal Mining Co., Ltd. 0.002499375672646654  
 Grandis, Inc. 0.002385951769810231  
 Massachusetts Institute of Technology 0.002230528612052467  
 Aisin AW Co., Ltd. 0.0020733555595960056  
 King Abdulaziz City Science and Technology 0.0020045680954466375  
 Hino Motors, Ltd. 0.0019272609085059314  
 Koito Manufacturing Co., Ltd. 0.0018846593232495737  
 Tokyo Electron Limited 0.0018079875010195412  
 Kabushiki Kaisha Toyota Jidoshokki 0.0016968976589754495

KABUSHIKI KAISHA TOYOTA CHUO KENKYUSHO 0.0015761899154973905  
 Shinshu University 0.0015761899154973905  
 GLOBALFOUNDRIES Singapore Pte. Ltd. 0.0014776033448941673  
 Sumitomo Electric Toyama Co., Ltd. 0.001454971675892045  
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 National University Corporation Toyohashi University of Technology  
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 Sumitomo Electric Sintered Alloy, Ltd. 0.001454971675892045  
 NATIONAL UNIVERSITY CORPORATION NARA INSTITUTE OF SCIENCE AND TECHNOLOGY  
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 TDK Corporation 0.0012245468019549085  
 SAE Magnetics (H.K.) Ltd. 0.001224546801954908  
 TS Tech Co., Ltd. 0.0012025697129131622  
 Tokyo Institute of Technology 0.0012025697129131622  
 Keihin Corporation 0.0012025697129131622  
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 Nissan Motor Co., Ltd. 0.0011405616551523896  
 Murata Manufacturing Co., Ltd. 0.0011279864787165975  
 Tadahiro Ohmi 0.0009982845724856178  
 Kansai University 0.0009982845724856178  
 MITSUBISHI HEAVY INDUSTRIES, LTD. 0.0009982845724856178  
 Finewell Co., Ltd. 0.0009982845724856178  
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 University of Macau 0.0007855291456752742  
 Showa Denko K.K. 0.0007563433822760645  
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 Seiko Epson Corporation 0.0006406084712227015  
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 OLYMPUS CORPORATION 0.0006283337318938422  
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 Hitachi Displays, Ltd. 0.0005985618113865256  
 JAPAN DISPLAY INC. 0.0005985618113865256  
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 UD Trucks Corporation 0.0005829662024182051  
 TECHNOVA INC. 0.0005746388648927304  
 Semiconductor Technology Academic Research Center 0.0005746388648927304  
 Foundation for Advancement of International Science 0.0005746388648927304  
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 Funai Electric Advanced Applied Technology Research Institute Inc.  
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 Yoshitaka Sugawara 0.0005570932942155983  
 SEMICONDUCTOR ENERGY LABORATORY CO., LTD. 0.0005272317585515378

Central Research Institute of Electric Power Industry 0.0005223465300844822  
 Asmo Co., Ltd. 0.0005082985258460908  
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 Advics Co., Ltd. 0.0004951448417603794  
 Nippon Soken, Inc. 0.0004951448417603794  
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 The Charles Stark Draper Laboratory, Inc. 0.0003549702382754391  
 The President and Fellows of Harvard College 0.0003549702382754391  
 Raytheon Company 0.0003549702382754391  
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 Chichibu Fuji Co., Ltd. 9.173561295888772e-05  
 Yamato Electronic Co., Ltd. 8.167700813907773e-05  
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 University of Utah Research Foundation 1.0947032245339941e-14  
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 Siémens Aktiengesellschaft 2.015774997285506e-15  
 Tyco Electronics Japan G.K. 1.957480889296755e-15  
 Tyco Electronics Raychem GmbH 1.5449302684550563e-15  
 Siemens Industry, Inc. 1.4608355354140517e-15

Caterpillar Global Mining LLC 1.4608355354140517e-15  
 Hon Hai Precision Industry Co., Ltd. 1.3823205081103573e-15  
 TE Connectivity India Private Limited 1.2760047633066684e-15  
 Tyco Electronics Holdings (Bermuda) No. 7 Ltd. 1.2760047633066684e-15  
 Tyco Electronics Amp Korea Ltd. 1.2760047633066684e-15  
 Siemens Medical Solutions USA, Inc. 1.0286200881738171e-15  
 Massachusetts General Hospital 8.470076587027285e-16  
 Tyco Electronics Singapore PTE Ltd. 8.166934825238591e-16  
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 Tsinghua University 7.252311691851026e-16  
 Tyco Electronics AMP Espana SA 6.445705190163019e-16  
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 Fu Tai Hua Industry (Shenzhen) Co., Ltd. 5.921487700214671e-16  
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 Canon Kabushiki Kaisha 1.1421052329037462e-16  
 Nihon Ceratec Co., Ltd. 9.760861662431706e-17  
 Taiheiyo Cement Corporation 9.760861662431706e-17  
 CANON PRECISION, INC. 5.2629479974295725e-17  
 Sanyo Electric Co., Ltd. 1.4251380805948534e-17  
 University of California 9.500920537299017e-18  
 GSI 9.500920537299017e-18  
 Lawrence Livermore National Security, LLC. 9.500920537299017e-18  
 Volkswagon AG 9.500920537299017e-18  
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 Mahle International GmbH 9.500920537299017e-18  
 Ledlink Optics (Dong Guan) Co. Ltd. 9.500920537299017e-18  
 Yang Zhou LedLink Optics Co., Ltd. 9.500920537299017e-18  
 LedLink Optics, Inc. 9.500920537299017e-18  
 Ulvac, Inc. 7.125690402974268e-18  
 Sanyo Technology Center (Shenzhen) Co., Ltd. 7.125690402974268e-18  
 Saga Sanyo Industries Co., Ltd. 7.125690402974268e-18  
 Mitsubishi Metal Corporation 7.125690402974268e-18  
 Hitachi, Ltd. 2.5507046309727877e-19  
 National Chiao Tung University 2.5507046309727877e-19  
 Hitachi Mito Engineering Co., Ltd. 1.4726500053153642e-19  
 Hitachi High-Technologies Corporation 1.4726500053153642e-19  
 Shin-Kobe Electric Machinery Co., Ltd. 1.4726500053153642e-19  
 Industrial Technology Research Institute 1.4726500053153642e-19



Torchlight Technology Co., Ltd. 1.4726500053153642e-19  
 Richtek Technology Corporation 1.4726500053153642e-19  
 Max-Planck-Gesellschaft zur Foerderung der Wissenschaften E.V.  
 3.648589860698905e-20  
 Carl Zeiss Microscopy GmbH 3.648589860698905e-20  
 NEC Access Technica, Ltd. 3.648589860698905e-20  
 NEC Corporation 3.648589860698905e-20  
 Deutsches Krebsforschungszentrum 2.2549525449201677e-20  
 NEC Engineering, Ltd. 2.2549525449201677e-20  
 NEC Energy Devices, Ltd. 2.2549525449201677e-20  
 Fraunhofer-Gesellschaft zur Foerderung der angewandten Forschung e.V.  
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 Intel Corporation 1.2502517221708469e-21  
 Shenzhen Futaihong Precision Industry Co., Ltd. 1.2502517221708469e-21  
 Northeastern University 1.2502517221708469e-21  
 Cal-Comp Electronics & Communications Company Limited 1.2502517221708469e-21  
 Philips Lumileds Lighting Company, LLC 1.2502517221708469e-21  
 AAC Acoustic Technologies (Shenzhen) Co., Ltd. 1.2502517221708469e-21  
 Japan Aviation Electronics Industry, Ltd. 1.2502517221708469e-21  
 Robert Bosch GmbH 1.2502517221708469e-21  
 California Institute of Technology 1.2502517221708469e-21  
 Adesto Technologies Corporation 1.2502517221708469e-21  
 Fujitsu Limited 1.2502517221708469e-21  
 Foxconn Technology Co., Ltd. 1.2502517221708469e-21  
 Tohoku Pioneer Corporation 1.2502517221708469e-21  
 NthDegree Technologies Worldwide Inc. 1.2502517221708469e-21  
 Bruker BioSpin GmbH 1.2502517221708469e-21  
 The Trustees of Princeton University 1.2502517221708469e-21  
 Ford Global Technologies, LLC 1.2502517221708469e-21  
 Inventec Appliances Corp. 1.2502517221708469e-21  
 Innocom Technology (Shenzhen) Co., Ltd. 1.2502517221708469e-21  
 Shin-Etsu Chemical Co., Ltd. 1.2502517221708469e-21  
 Lite-On Technology Corp. 1.2502517221708469e-21  
 Chandler Systems, Inc. 8.840614709371652e-22  
 FIH (Hong Kong) Limited 8.840614709371652e-22  
 Chi Mei Communication Systems, Inc. 8.840614709371652e-22  
 Mersen USA Newburyport-MA, LLC 8.840614709371652e-22  
 Cal-Comp Precision (Singapore) Limited 8.840614709371652e-22  
 Koninklijke Philips Electronics N.V. 8.840614709371652e-22  
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 American Audio Components Inc. 8.840614709371652e-22  
 Jae Taiwan, Ltd. 8.840614709371652e-22  
 J & S Electronics, Inc. 8.840614709371652e-22  
 Samsung SDI Co., Ltd. 8.840614709371652e-22  
 Telaris Inc. 8.840614709371652e-22  
 Adesto Technologies France SARL 8.840614709371652e-22  
 Altis Semiconductor 8.840614709371652e-22  
 Fujitsu Component Limited 8.840614709371652e-22

Fujitsu Semiconductor Limited 8.840614709371652e-22  
 FURUI PRECISE COMPONENT (KUNSHAN) CO., LTD. 8.840614709371652e-22  
 Mitsubishi Electric Corporation 8.840614709371652e-22  
 Pioneer Corporation 8.840614709371652e-22  
 CHAMP TECH OPTICAL (FOSHAN) CORPORATION 8.840614709371652e-22  
 NASA, an agency of the United States 8.840614709371652e-22  
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 Ecole Polytechnique Federale de Lausanne (EPFL) 8.840614709371652e-22  
 Battelle Memorial Institute 8.840614709371652e-22  
 KINPO ELECTRONICS, INC. 8.840614709371652e-22  
 Colonial Plastics, Inc. 8.840614709371652e-22  
 Dow Global Technologies Inc. 8.840614709371652e-22  
 Inventec Appliances (Shanghai) Co., Ltd. 8.840614709371652e-22  
 INNOLUX CORPORATION 8.840614709371652e-22  
 Qiuye Sun 8.840614709371652e-22  
 AAC Technologies Holdings Inc. 8.840614709371652e-22  
 Afton Chemical Corporation 8.840614709371652e-22  
 VORBECK MATERIALS CORPORATION 8.840614709371652e-22  
 Inventec Appliances (Pudong) Corporation 8.840614709371652e-22  
 Samsund SDI Co., Ltd. 8.840614709371652e-22  
 Matsugaki Chemical Industries Co., Ltd. 8.840614709371652e-22  
 Silitek Electronic (Guangzhou) Co., Ltd. 8.840614709371652e-22  
 LITE-ON ELECTRONICS (GUANGZHOU) LIMITED 8.840614709371652e-22  
 Ecole Polytechnique Fédérale de Lausanne 8.840614709371652e-22  
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 Chimei Innolux Corporation 8.840614709371652e-22  
 INVENTEC (PUDONG) TECHNOLOGY CORPORATION 8.840614709371652e-22  
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 L'Air Liquid, Societe Anonyme pour l'Etude et l'Exploitation des Procédes  
 Georges Claude 3.8188518056149906e-25  
 ACER INCORPORATED 3.8188518056149906e-25  
 LIANHONG TECHNOLOGY CO., LTD 3.8188518056149906e-25  
 MATERIALS ANALYSIS TECHNOLOGY INC. 3.8188518056149906e-25  
 National Health Research Institutes 3.8188518056149906e-25  
 Dynalloy, Inc 3.8188518056149906e-25  
 GM Global Technology Operations, Inc. 3.8188518056149906e-25  
 Cummins PowerGen IP, Inc. 3.8188518056149906e-25  
 CUMMINS CAL PACIFIC, LLC 3.8188518056149906e-25  
 XJ Group Corporation 3.8188518056149906e-25  
 State Grid Corporation of China 3.8188518056149906e-25  
 Volex PLC 3.8188518056149906e-25  
 Applied Micro Circuits Corporation 3.8188518056149906e-25  
 Advins, Inc. 3.8188518056149906e-25  
 Scientific Analysis Instruments, Ltd. 3.8188518056149906e-25  
 Toshiba Global Commerce 3.8188518056149906e-25  
 Solutions Holdings Corporation 3.8188518056149906e-25  
 Varian Medical Systems, Inc. 3.8188518056149906e-25  
 Sloan-Kettering Institute for Cancer Research 3.8188518056149906e-25

NANOHOLDINGS LLC 3.8188518056149906e-25  
 University of Florida Research Foundation, Inc. 3.8188518056149906e-25  
 Suzhou Golden Crown New Energy Co., Ltd 3.8188518056149906e-25  
 Golden Crown New Energy (HK) Limited 3.8188518056149906e-25  
 Postech Foundation 3.8188518056149906e-25  
 Seoul Opto Device Co., Ltd. 3.8188518056149906e-25  
 Xiangtan Electric Manufacturing Co., Ltd. 3.8188518056149906e-25  
 Xiangtan Liyuan Electric Tooling Co., Ltd. 3.8188518056149906e-25  
 Vanderbilt University 3.8188518056149906e-25  
 Molecular Sensing, Inc. 3.8188518056149906e-25  
 Neomax Materials Co., Ltd. 3.8188518056149906e-25  
 Hitachi Metals, Ltd. 3.8188518056149906e-25  
 CITIZEN HOLDINGS CO., LTD. 3.8188518056149906e-25  
 Citizen Electronics Co., Ltd. 3.8188518056149906e-25  
 Curators of the University of Missouri 3.8188518056149906e-25  
 Integral Laser Solutions, Inc. 3.8188518056149906e-25  
 Silergy Semiconductor Technology (Hangzhou) LTD 3.8188518056149906e-25  
 Silergy Technology 3.8188518056149906e-25  
 KBC RESEARCH FOUNDATION PVT. LTD. 3.8188518056149906e-25  
 SunEdison Semiconductor Limited (UEN201334164H) 3.8188518056149906e-25  
 Lextar Electronics Corp. 3.8188518056149906e-25  
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 H-Tech, LLC 3.8188518056149906e-25  
 SRI Hermatics Inc. 3.8188518056149906e-25  
 American Power Conversion Corporation 3.8188518056149906e-25  
 Hydrogenics Corporation 3.8188518056149906e-25  
 Alpine Electronics, Inc. 3.8188518056149906e-25  
 Blueprint Acoustics Pty Ltd. 3.8188518056149906e-25  
 JC Protek Co., Ltd. 3.8188518056149906e-25  
 Andong National University Industry Academic Cooperation Foundation  
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 Shimadzu Corporation 3.8188518056149906e-25  
 Shimadzu Research Laboratory (Shanghai) Co. Ltd. 3.8188518056149906e-25  
 FCI Americas Technology, Inc. 3.8188518056149906e-25  
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 Askey Computer Corp. 3.8188518056149906e-25  
 Askey Technology (Jiangsu) Ltd. 3.8188518056149906e-25  
 Toppan Printing Co., Ltd. 3.8188518056149906e-25  
 Advantest Corp. 3.8188518056149906e-25  
 FSP-Powerland Technology Inc. 3.8188518056149906e-25  
 FSP TECHNOLOGY INC. 3.8188518056149906e-25  
 Kirk Key Interlock Company LLC 3.8188518056149906e-25  
 Utility Relay Company 3.8188518056149906e-25  
 Eastfield Corporation 3.8188518056149906e-25  
 Peak Power & Mfg., Inc. 3.8188518056149906e-25  
 Fuji Jukogyo Kabushiki Kaisha 3.8188518056149906e-25  
 Nippon Chemical Industrial Co., Ltd. 3.8188518056149906e-25  
 X-FAB SEMICONDUCTOR FOUNDRIES AG 3.8188518056149906e-25

MELEXIS TECHNOLOGIES NV 3.8188518056149906e-25  
 Spicer Technology, Inc. 3.8188518056149906e-25  
 Bubble Technologies Industries Inc. 3.8188518056149906e-25  
 Tatung University 3.8188518056149906e-25  
 Tatung Company 3.8188518056149906e-25  
 Board of Regents, University of Texas System 3.8188518056149906e-25  
 Texas Micro, Inc. 3.8188518056149906e-25  
 Korea University Research and Business Foundation 3.8188518056149906e-25  
 SK Hynix Inc. 3.8188518056149906e-25  
 IHI AEROSPACE CO., LTD. 3.8188518056149906e-25  
 SINFONIA TECHNOLOGY CO., LTD. 3.8188518056149906e-25  
 Suzuki Motor Corporation 3.8188518056149906e-25  
 Lithium Energy Japan 3.8188518056149906e-25  
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 Easthill Industrial Co., Ltd. 3.8188518056149906e-25  
 LAAS-CNRE 3.8188518056149906e-25  
 Atmel Rousset S.A.S. 3.8188518056149906e-25  
 Kowa Company Ltd. 3.8188518056149906e-25  
 Techsign Light Panel Co., Ltd. 3.8188518056149906e-25  
 ECOLE NATIONALE SUPERIEURE DE TECHNIQUES AVANCEES 3.8188518056149906e-25  
 ECOLE POLYTECHNIQUE 3.8188518056149906e-25  
 Maytag Corporation 3.8188518056149906e-25  
 Satori S-Tech Co., Ltd. 3.8188518056149906e-25  
 Priestman Goode 3.8188518056149906e-25  
 Cambridge Design Partnership LLP 3.8188518056149906e-25  
 BYD Company Limited 3.8188518056149906e-25  
 SHENZHEN BYD AUTO R&D COMPANY LIMITED 3.8188518056149906e-25  
 Hayterzlab 3.8188518056149906e-25  
 Heiwa 3.8188518056149906e-25  
 Champion Elite Company Limited 3.8188518056149906e-25  
 Midas Wei Trading Co., Ltd. 3.8188518056149906e-25  
 Korea Research Institute of Standards and Science 3.8188518056149906e-25  
 Micro Motion Technology Co., Ltd. 3.8188518056149906e-25  
 S.T. Corporation 3.8188518056149906e-25  
 Montana State University 3.8188518056149906e-25  
 Plextronics, Inc. 3.8188518056149906e-25  
 Nano-C, Inc. 3.8188518056149906e-25  
 SEMICONDUCTOR COMPONENTS INDUSTRIES, LLC 3.8188518056149906e-25  
 Futaba Corporation 3.8188518056149906e-25  
 OFFICE NATIONAL D'ETUDES ET DE RECHERCHES AEROSPATIALES (ONERA)  
 3.8188518056149906e-25  
 COMMISSARIAT À L'ÉNERGIE ATOMIQUE ET AUX ÉNERGIES ALTERNATIVES  
 3.8188518056149906e-25  
 Nitto Kogaku KK 3.8188518056149906e-25  
 Koike, Yashuhiro 3.8188518056149906e-25  
 Hitachi Industrial Equipment System Co. 3.8188518056149906e-25  
 Nippon Steel & Sumikin Stainless Steel Corporation 3.8188518056149906e-25  
 Board of Regents of the University of Oklahoma 3.8188518056149906e-25

Phononic Devices, Inc. 3.8188518056149906e-25  
 Daimler-Benz AG 3.8188518056149906e-25  
 Ford Motor Company 3.8188518056149906e-25  
 IMRA America, Inc. 3.8188518056149906e-25  
 The Regents of the University of Colorado, a body corporate  
 3.8188518056149906e-25  
 EchoStar Technologies, L.L.C. 3.8188518056149906e-25  
 DISH Network L.L.C. 3.8188518056149906e-25  
 KWANSEI GAKUIN EDUCATIONAL FOUNDATION 3.8188518056149906e-25  
 TOYO TANSO CO., LTD. 3.8188518056149906e-25  
 Furukawa Co., Ltd. 3.8188518056149906e-25  
 Tohoku Techno Arch Co., Ltd. 3.8188518056149906e-25  
 Baxter International Inc. 3.8188518056149906e-25  
 Baxter Healthcare S.A. 3.8188518056149906e-25  
 Nujira Limited 3.8188518056149906e-25  
 Skyworks Solutions, Inc. 3.8188518056149906e-25  
 Nantong Ya Tai Candle Arts & Crafts Co., Ltd. 3.8188518056149906e-25  
 Shanghai Q Mall & Co. Ltd. 3.8188518056149906e-25  
 Giant Electric Vehicle Kunshan Co., Ltd. 3.8188518056149906e-25  
 National Yunlin University of Science and Technology 3.8188518056149906e-25  
 CSP-Innovazione Nelle ICT Scarl 3.8188518056149906e-25  
 S.I.SV.EL. Societa', Italiana Per Lo Sviluppo Dell'elettronica S.P.A.  
 3.8188518056149906e-25  
 Legrand France 3.8188518056149906e-25  
 Legrand SNC 3.8188518056149906e-25  
 Dolby Laboratories Licensing Corporation 3.8188518056149906e-25  
 Dolby International AB 3.8188518056149906e-25  
 National Taipei University of Technology 3.8188518056149906e-25  
 Phansco Corp. 3.8188518056149906e-25  
 AT&T MOBILITY II LLC 3.8188518056149906e-25  
 AT&T INTELLECTUAL PROPERTY I, L.P. 3.8188518056149906e-25  
 Oxford Instruments, Ltd. 3.8188518056149906e-25  
 Oxford Instruments AFM, Inc 3.8188518056149906e-25  
 Fundació Institut de Ciències Fotòniques 3.8188518056149906e-25  
 Consejo Superior de Investigaciones Cientificas 3.8188518056149906e-25  
 X-Body Inc. 3.8188518056149906e-25  
 The Board of Trustees of the University of Illinois 3.8188518056149906e-25  
 Toyota Gosei Co., Ltd. 3.8188518056149906e-25  
 Sumita Optical Glass, Inc. 3.8188518056149906e-25  
 Los Alamos National Security, LLC 3.8188518056149906e-25  
 Sharp Corporation 3.8188518056149906e-25  
 NCKU Research & Development Foundation 3.8188518056149906e-25  
 Himax Technologies Limited 3.8188518056149906e-25  
 Shinko Electric Industries Co., Ltd. 3.8188518056149906e-25  
 Taiyo Yuden Co., Ltd. 3.8188518056149906e-25  
 The George Washington University 3.8188518056149906e-25  
 The United States of America as represented by the Secretary of the Navy  
 3.8188518056149906e-25

Airbus Operations SAS 3.8188518056149906e-25  
02Micro 3.8188518056149906e-25  
Ricoh Company, Ltd. 3.8188518056149906e-25  
Sijtechnology, Inc. 3.8188518056149906e-25  
Moxtek, Inc. 3.8188518056149906e-25  
Brigham Young University 3.8188518056149906e-25  
Shenzhen Jiawei Photovoltaic Lighting Co., Ltd. 3.8188518056149906e-25  
Light-Core Limited 3.8188518056149906e-25  
Corning Incorporated 3.8188518056149906e-25  
S.O.I. Tec Silicon On Insulator Technologies 3.8188518056149906e-25  
SIEMENS ENERGY, INC. 3.8188518056149906e-25  
Arkansas Power Electronics International, Inc. 3.8188518056149906e-25  
The Chinese University of Hong Kong 3.8188518056149906e-25  
CITY UNIVERSITY OF HONG KONG 3.8188518056149906e-25  
Regents of the University of Minnesota 3.8188518056149906e-25  
Life Services, LLC 3.8188518056149906e-25  
FIAT POWERTRAIN TECHNOLOGIES S.P.A. 3.8188518056149906e-25  
FPT INDUSTRIAL S.P.A. 3.8188518056149906e-25  
Murata Machinery, Ltd. 3.8188518056149906e-25  
The Doshisha 3.8188518056149906e-25  
JNC Petrochemical Corporation 3.8188518056149906e-25  
JNC Corporation 3.8188518056149906e-25  
People & Give Co., Ltd. 3.8188518056149906e-25  
Global and Creative Partnership 3.8188518056149906e-25  
Universal Scientific Industrial Co., Ltd. 3.8188518056149906e-25  
Universal Global Scientific Industrial Co., Ltd. 3.8188518056149906e-25  
Gaslow International Limited 3.8188518056149906e-25  
Dong Guan Apsun Lighting Technology Co., Ltd 3.8188518056149906e-25  
LG INNOTEK CO., LTD. 3.8188518056149906e-25  
LG Electronics Inc. 3.8188518056149906e-25  
National Applied Research Laboratories 3.8188518056149906e-25  
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Molex Japan Co., Ltd. 3.8188518056149906e-25  
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VisEra Technologies Company Limited 3.8188518056149906e-25  
OmniVision Technologies, Inc. 3.8188518056149906e-25  
Dow Corning Corporation 3.8188518056149906e-25  
Dow Corning Toray Co., Ltd. 3.8188518056149906e-25  
Nippon Telegraph and Telephone Corporation 3.8188518056149906e-25  
NTT Electronics Corporation 3.8188518056149906e-25  
Gigaphoton Inc. 3.8188518056149906e-25  
Komatsu Ltd. 3.8188518056149906e-25  
Savannah River Nuclear Solutions, LLC 3.8188518056149906e-25  
Fisk University 3.8188518056149906e-25  
Rockwell Automation Technologies, Inc. 3.8188518056149906e-25  
Rockwell Automation Safely AG 3.8188518056149906e-25  
Public Interest Incorporated Foundations Association for the Development of  
Earthquake Prediction 3.8188518056149906e-25

Techno Sugaya Co., Ltd. 3.8188518056149906e-25  
 UNIVERSITE DE LIEGE 3.8188518056149906e-25  
 Cockerill Maintenance & Ingénierie S.A. 3.8188518056149906e-25  
 The University of Maryland 3.8188518056149906e-25  
 Calabatas Creek Research, Inc. 3.8188518056149906e-25  
 United Microelectronic Corp. 3.8188518056149906e-25  
 Lam Research Corporation 3.8188518056149906e-25  
 Jang Soon Park 3.8188518056149906e-25  
 Baikan OPC Co., Ltd. 3.8188518056149906e-25  
 Casio Computer Co., Ltd. 3.8188518056149906e-25  
 CASIO ELECTRONICS MANUFACTURING CO., LTD. 3.8188518056149906e-25  
 Regal Beloit America, Inc. 3.8188518056149906e-25  
 Regal Beloit Australia Pty Ltd 3.8188518056149906e-25  
 E-NETPIC.COM, Inc. 3.8188518056149906e-25  
 Epic Communications, Inc. 3.8188518056149906e-25  
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 Purdue Research Foundation 3.8188518056149906e-25  
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 Toyota Motor Engineering & Manufacturing North America, Inc.  
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 University of Central Florida Research Foundation, Inc. 3.8188518056149906e-25  
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 Airbus Operations GmbH 3.8188518056149906e-25  
 GOODRICH LIGHTING SYSTEMS GMBH 3.8188518056149906e-25  
 Hilti Aktiengesellschaft 3.8188518056149906e-25  
 ESW GmbH 3.8188518056149906e-25  
 Bruker HTS GmbH 3.8188518056149906e-25  
 Oswald Elektromotoren GmbH 3.8188518056149906e-25  
 Chung-Hsin Electric & Machinery Mfg. Corp. 3.8188518056149906e-25  
 Wuhan Haixinneng Electric Limited Company 3.8188518056149906e-25  
 Albert-Ludwigs Universität Freiburg 3.8188518056149906e-25  
 Micronas GmbH 3.8188518056149906e-25  
 Centre Luxembourgeois de Recherches pour le Verre et la Ceramique S.A.  
 (C.R.V.C.) 3.8188518056149906e-25  
 Guardian Industries Corp. 3.8188518056149906e-25  
 Tyco Electronics Belgium EC BVBA 3.8188518056149906e-25  
 TE Connectivity Nederland B.V. 3.8188518056149906e-25  
 U-Shin Ltd. 3.8188518056149906e-25  
 Mazda Motor Corporation 3.8188518056149906e-25  
 West Corporation 3.8188518056149906e-25  
 Dongguan Masstop Liquid Crystal Display Co., Ltd. 3.8188518056149906e-25  
 Synopsys, Inc. 3.8188518056149906e-25  
 Synopsys Taiwan Co., Ltd. 3.8188518056149906e-25  
 CDT OXFORD LIMITED 3.8188518056149906e-25  
 CAMBRIDGE DISPLAY TECHNOLOGY LIMITED 3.8188518056149906e-25  
 Mitsubishi Jidosha Kogyo Kabushiki Kaisha 3.8188518056149906e-25  
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 Toyota Boshoku Kabushiki Kaisha 3.8188518056149906e-25

Toyota Shatai Kabushiki Kaisha 3.8188518056149906e-25  
 Peking University Founder Group Co., Ltd. 3.8188518056149906e-25  
 Founder Microelectronics International Co., Ltd. 3.8188518056149906e-25  
 Texas Instruments Deutschland GmbH 3.8188518056149906e-25  
 Texas Instruments Incorporated 3.8188518056149906e-25  
 American Air Liquide, Inc. 3.8188518056149906e-25  
 L'Air Liquide Société Anonyme Pour L'Étude Et L'Exploitation Des Procédés  
 Georges Clause 3.8188518056149906e-25  
 Fu An Industrial Co., Ltd. 3.8188518056149906e-25  
 Get Auto Accessories Co., Ltd. 3.8188518056149906e-25  
 UNIVERSITY OF NEBRASKA BOARD OF REGENTS 3.8188518056149906e-25  
 J.A. Woollam Co. Inc. 3.8188518056149906e-25  
 Topmore Technology Inc. 3.8188518056149906e-25  
 Aptos Technology Inc. 3.8188518056149906e-25

[ ]: 5. Betweenness centrality for each company

Samsung Electronics Co., Ltd. 0.09045562104861295  
 IMEC 0.05288860585356546  
 International Business Machines Corporation 0.04846897636655047  
 Panasonic Corporation 0.04114988036820923  
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 Molex Japan Co., Ltd. 0.0  
 Advantest Corporation 0.0  
 Matheson Tri-Gas 0.0  
 VisEra Technologies Company Limited 0.0  
 OmniVision Technologies, Inc. 0.0  
 Dow Corning Corporation 0.0  
 Dow Corning Toray Co., Ltd. 0.0  
 Tocalo Co., Ltd. 0.0  
 Nippon Telegraph and Telephone Corporation 0.0  
 NTT Electronics Corporation 0.0  
 VORBECK MATERIALS CORPORATION 0.0  
 University of Macau 0.0  
 Gigaphoton Inc. 0.0  
 Komatsu Ltd. 0.0  
 Savannah River Nuclear Solutions, LLC 0.0  
 Fisk University 0.0  
 Inventec Appliances (Pudong) Corporation 0.0  
 Fujikin Incorporated 0.0  
 Rockwell Automation Technologies, Inc. 0.0  
 Rockwell Automation Safely AG 0.0  
 Public Interest Incorporated Foundations Association for the Development of  
 Earthquake Prediction 0.0  
 Techno Sugaya Co., Ltd. 0.0  
 UNIVERSITE DE LIEGE 0.0  
 Cockerill Maintenance & Ingénierie S.A. 0.0  
 The University of Maryland 0.0  
 Calabatas Creek Research, Inc. 0.0  
 University of Utah Research Foundation 0.0  
 NEC Energy Devices, Ltd. 0.0  
 United Microelectronic Corp. 0.0  
 Lam Research Corporation 0.0  
 Jang Soon Park 0.0  
 Baiksan OPC Co., Ltd. 0.0

Yoshitaka Sugawara 0.0  
 Seiko NPC Corporation 0.0  
 Casio Computer Co., Ltd. 0.0  
 CASIO ELECTRONICS MANUFACTURING CO., LTD. 0.0  
 Regal Beloit America, Inc. 0.0  
 Regal Beloit Australia Pty Ltd 0.0  
 Samsund SDI Co., Ltd. 0.0  
 National University of Singapore 0.0  
 Matsugaki Chemical Industries Co., Ltd. 0.0  
 Silitek Electronic (Guangzhou) Co., Ltd. 0.0  
 LITE-ON ELECTRONICS (GUANGZHOU) LIMITED 0.0  
 Duke University 0.0  
 E-NETPIC.COM, Inc. 0.0  
 Epic Communications, Inc. 0.0  
 STMicoelectronics (Grenoble 2) SAS 0.0  
 Battlefield Telecommunications Systems, LLC 0.0  
 Purdue Research Foundation 0.0  
 North American Lighting, Inc. 0.0  
 Toyota Motor Engineering & Manufacturing North America, Inc. 0.0  
 University of Central Florida Research Foundation, Inc. 0.0  
 sdPhotonics, LLC 0.0  
 STMicroelectronics (Shenzhen) Manufacturing Co., Ltd. 0.0  
 STMicroelectronics International N.V. 0.0  
 Airbus Operations GmbH 0.0  
 GOODRICH LIGHTING SYSTEMS GMBH 0.0  
 Ecole Polytechnique Fédérale de Lausanne 0.0  
 Hilti Aktiengesellschaft 0.0  
 ESW GmbH 0.0  
 Bruker HTS GmbH 0.0  
 Oswald Elektromotoren GmbH 0.0  
 Chung-Hsin Electric & Machinery Mfg. Corp. 0.0  
 Wuhan Haixinneng Electric Limited Company 0.0  
 Teledyne Scientific & Imaging, LLC 0.0  
 Tyco Electronics Amp Korea Ltd. 0.0  
 Albert-Ludwigs Universität Freiburg 0.0  
 Micronas GmbH 0.0  
 Centre Luxembourgeois de Recherches pour le Verre et la Ceramique S.A.  
 (C.R.V.C.) 0.0  
 Guardian Industries Corp. 0.0  
 Tyco Electronics Belgium EC BVBA 0.0  
 TE Connectivity Nederland B.V. 0.0  
 KONICA MINOLTA, INC. 0.0  
 U-Shin Ltd. 0.0  
 Mazda Motor Corporation 0.0  
 DENSO International America, Inc. 0.0  
 West Corporation 0.0  
 Dongguan Masstop Liquid Crystal Display Co., Ltd. 0.0  
 Torchlight Technology Co., Ltd. 0.0

Tyco Electronics Svenska Holdings AB 0.0  
 Advics Co., Ltd. 0.0  
 Synopsys, Inc. 0.0  
 Synopsys Taiwan Co., Ltd. 0.0  
 CDT OXFORD LIMITED 0.0  
 CAMBRIDGE DISPLAY TECHNOLOGY LIMITED 0.0  
 Beijing Asahi Glass Electronics Co., Ltd. 0.0  
 Suzhou Boe Chatani Electronics Co., Ltd. 0.0  
 Mitsubishi Jidosha Kogyo Kabushiki Kaisha 0.0  
 Mitsubishi Jidosha Engineering Kabushiki Kaisha 0.0  
 Toyota Boshoku Kabushiki Kaisha 0.0  
 Toyota Shatai Kabushiki Kaisha 0.0  
 Fraunhofer-Gesellschaft zur Foerderung der angewandten Forschung e.V. 0.0  
 Shin-Etsu Handotai Co., Ltd. 0.0  
 Stanley Electric Co., Ltd. 0.0  
 Chimei Innolux Corporation 0.0  
 Peking University Founder Group Co., Ltd. 0.0  
 Founder Microelectronics International Co., Ltd. 0.0  
 Texas Instruments Deutschland GmbH 0.0  
 Texas Instruments Incorporated 0.0  
 INVENTEC (PUDONG) TECHNOLOGY CORPORATION 0.0  
 Richtek Technology Corporation 0.0  
 Infineon Technologies AG 0.0  
 American Air Liquide, Inc. 0.0  
 L'Air Liquide Société Anonyme Pour L'Étude Et L'Exploitation Des Procédés  
 Georges Clause 0.0  
 Stichting National Lucht-En Ruimtevaart Laboratorium 0.0  
 Yamato Electronic Co., Ltd. 0.0  
 Nippon Soken, Inc. 0.0  
 Fu An Industrial Co., Ltd. 0.0  
 Get Auto Accessories Co., Ltd. 0.0  
 UNIVERSITY OF NEBRASKA BOARD OF REGENTS 0.0  
 J.A. Woollam Co. Inc. 0.0  
 Topmore Technology Inc. 0.0  
 Aptos Technology Inc. 0.0  
 Lintec Corporation 0.0  
 Kyushu University, National University Corporation 0.0  
 Hitachi Displays, Ltd. 0.0  
 JAPAN DISPLAY INC. 0.0  
 Henkel Corporation 0.0

[ ]: 6. Closeness centrality for each company

Samsung Electronics Co., Ltd. 0.11556670253543498  
 IMEC 0.10819312151476919  
 International Business Machines Corporation 0.10100503325834695  
 Panasonic Corporation 0.1005443489561424  
 The Regents of the University of California 0.09775764305381031

STMICROELECTRONICS S.R.L. 0.09732604198072504  
 Taiwan Semiconductor Manufacturing Company, Ltd. 0.0968982352027878  
 Sony Corporation 0.09615855401803369  
 GLOBALFOUNDRIES Inc. 0.09574092729048522  
 Seoul National University Industry Foundation 0.09491646290047027  
 Toyota Jidosha Kabushiki Kaisha 0.09175587308484588  
 Samsung Display Co., Ltd. 0.09053120537426786  
 Industry-Academic Cooperation Foundation, Yonsei University 0.09016093459564099  
 Korea Advanced Institute of Science & Technology 0.08961117279932611  
 SNU R&DB FOUNDATION 0.08906807478236049  
 Georgia Tech Research Corp. 0.0886204965171225  
 Osaka University 0.0886204965171225  
 Sumitomo Electric Industries, Ltd. 0.08853152011499688  
 University of Seoul Industry Cooperation Foundation 0.08826565969423113  
 GENITECH, INC. 0.08826565969423113  
 Korea Electric Power Corporation 0.08826565969423113  
 Sungkyunkwan University Foundation for Corporate Collaboration  
 0.08826565969423113  
 Dongguk University Industry-Academic Cooperation Foundation 0.08826565969423113  
 Korea University of Technology and Education Industry-University Cooperation  
 Foundation 0.08826565969423113  
 Postech Academy-Industry Foundation Postech Univ. of Science and Technology  
 0.08826565969423113  
 Industry-University Cooperation Foundation Hanyang University  
 0.08826565969423113  
 INDUSTRY FOUNDATION OF CHONNAM NATIONAL UNIVERSITY 0.08826565969423113  
 Cheil Industries Inc. 0.08826565969423113  
 Industry-Academic Cooperation Foundation 0.08826565969423113  
 INDUSTRY-ACADEMY COOPERATION CORPS OF SUNCHON NATIONAL UNIVERSITY  
 0.08826565969423113  
 ASML Netherlands B.V. 0.08800139125203282  
 The Board of Trustees of the Leland Stanford Junior University  
 0.08730435052924444  
 KATHOLIEKE UNIVERSITEIT LEUVEN 0.08405852624836692  
 Universiteit Gent 0.08405852624836692  
 Katholieke Universiteit Leuven, K.U. Leuven R&D 0.0838985671118334  
 Honda Motor Co., Ltd. 0.083659766636183  
 FREESCALE SEMICONDUCTOR, INC. 0.08225503174863516  
 Kabushiki Kaisha Toshiba 0.0819492509614655  
 COMMISSARIAT A L'ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES  
 0.08187316066345116  
 Japan Science and Technology Agency 0.08157020724749019  
 Rohm Co., Ltd. 0.0814195697456481  
 Kyungpook National University Industry Academic Cooperation Foundation  
 0.08111995771346539  
 STMICROELECTRONICS (CROLES 2) SAS 0.08097097707487318  
 Centre National de la Recherche Scientifique (CNRS) 0.08067465144971353  
 King Abdulaziz City for Science and Technology 0.08052730048816155

Renesas Electronics Corporation 0.08023420749275423  
Advanced Micro Devices, Inc. 0.07979854663758994  
Sumitomo Bakelite Co. Ltd. 0.07958248559073726  
Dacom Corporation 0.07958248559073726  
GLOBAL FOUNDRIES INC. 0.07951072500859954  
Applied Materials, Inc. 0.07951072500859954  
Toshiba America Electronic Components, Inc. 0.07951072500859954  
Cambridge Enterprise Limited 0.07951072500859954  
Cornell University 0.07951072500859954  
BAY ZU PRECISION CO., LTD. 0.07951072500859954  
MACRONIX INTERNATIONAL CO., LTD. 0.07951072500859954  
Matheson Tri-Gas 0.07951072500859954  
Infineon Technologies AG 0.07951072500859954  
Panasonic Liquid Crystal Display Co., Ltd. 0.07951072500859954  
WASEDA UNIVERSITY 0.07936759139022223  
Lintec Corporation 0.07929621765695764  
Kyushu University, National University Corporation 0.07929621765695764  
Nihon Colmo Co., Ltd. 0.07922497217837995  
Denso Corporation 0.0789412659216982  
Tohoku University 0.07880017339994361  
Kyoto University 0.07851949602363036  
Intermolecular, Inc. 0.07837990580847724  
STMicroelectronics Limited 0.07810220906513454  
STMICROELECTRONICS ASIA PACIFIC PTE. LTD. 0.0776209454529374  
University of Massachusetts 0.07748452902859129  
Q1 Nanosystems, Inc 0.07748452902859129  
Teledyne Scientific & Imaging, LLC 0.07748452902859129  
STMicroelectronics (Grenoble 2) SAS 0.0773485912583657  
STMicroelectronics (Mala) Ltd 0.07721312962744036  
STMicroelectronics (Grenoble 2) SAS 0.07721312962744036  
STMicroelectronics (Shenzhen) Manufacturing Co., Ltd. 0.07721312962744036  
STMicroelectronics International N.V. 0.07721312962744036  
Global Unichip Corp. 0.07694362481198681  
AISIN SEIKI KABUSHIKI KAISHA 0.07660937796223882  
National University Corporation Nagoya University 0.07654287676609105  
Sōny Electronics Inc. 0.0764764909232757  
Sony Computer Entertainment Inc. 0.0764764909232757  
Tel Solar AG 0.0764764909232757  
Sony Mobile Communications Inc. 0.0764764909232757  
SONY PICTURES TECHNOLOGIES INC. 0.0764764909232757  
Sharp Kabushiki Kaisha 0.07641022013391412  
Sumitomo Metal Mining Co., Ltd. 0.07614628154968643  
Fuji Electric Co., Ltd. 0.0760805815656056  
Samsung Techwin Co., Ltd. 0.07568875024423767  
Autonetwoks Technologies, Ltd. 0.07498077724025246  
Sumitomo Wiring Systems, Ltd. 0.07498077724025246  
Aisin AW Co., Ltd. 0.07478998645847064  
Kabushiki Kaisha Toyota Jidoshokki 0.07466333110460363

National Institute of Advanced Industrial Science and Technology  
 0.07428592589261744  
 Hino Motors, Ltd. 0.07385041376426875  
 Koito Manufacturing Co., Ltd. 0.0737886142548426  
 KABUSHIKI KAISHA TOYOTA CHUO KENKYUSHO 0.07366532500796732  
 Shinshu University 0.07366532500796732  
 Hyundai Motor Company 0.07354244706800407  
 Kia Motors Corporation 0.0732370382346652  
 Kobe Steel, Limited 0.07299453148554379  
 Electronics and Telecommunications Research Institute 0.07287387936738586  
 Hynix Semiconductor Inc. 0.07204035460337982  
 SK Telecom Co., Ltd. 0.07192283363339062  
 Phillips Screw Company 0.07163070189645564  
 Sila Nanotechnologies Inc. 0.07163070189645564  
 Dainippon Screen Mfg. Co., Ltd. 0.07163070189645564  
 Hamamatsu Photonics K.K. 0.07163070189645564  
 Sumitomo Electric Toyama Co., Ltd. 0.07157256009296825  
 Sumitomo Electric Device Innovations, Inc. 0.07157256009296825  
 National University Corporation Toyohashi University of Technology  
 0.07157256009296825  
 Sumitomo Electric Sintered Alloy, Ltd. 0.07157256009296825  
 NATIONAL UNIVERSITY CORPORATION NARA INSTITUTE OF SCIENCE AND TECHNOLOGY  
 0.07157256009296825  
 Stichting National Lucht-En Ruimtevaart Laboratorium 0.07122568177264692  
 The Hong Kong University of Science and Technology 0.07088214954544766  
 Showa Denko K.K. 0.0694310189248322  
 SCK.-CEN 0.06862054010469798  
 IMEC VZW 0.06862054010469798  
 The University of Tokyo 0.06851390367873884  
 TS Tech Co., Ltd. 0.06835456901902084  
 Tokyo Institute of Technology 0.06835456901902084  
 Keihin Corporation 0.06835456901902084  
 Sumitomo Rubber Industries, Ltd. 0.06835456901902084  
 Yutaka Giken Co., Ltd. 0.06835456901902084  
 Stanley Electric Co., Ltd. 0.06835456901902084  
 SanDisk 3D LLC 0.06751714704022732  
 Conti Temic microelectronic GmbH 0.06741390981233707  
 Tokyo Electric Power Company, Incorporated 0.06725964457249191  
 Ishikawajima-Harima Heavy Industries Co., Ltd. 0.06725964457249191  
 Toshiba Industrial Products Manufacturing Corporation 0.06720837959949458  
 Toshiba Medical Systems Corporation 0.06720837959949458  
 Toshiba Lightning & Technology Corporation 0.06720837959949458  
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 TOSHIBA MATERIALS CO., LTD. 0.06720837959949458  
 Toshiba Electron Tubes & Devices Co., Ltd. 0.06720837959949458  
 Toshiba Lighting & Technology Corporation 0.06720837959949458  
 Universite Joseph Fourier 0.06720837959949458  
 CNRS-Centre National de la Recherche Scientifique 0.06720837959949458



Institut Ploytechnique de Grenoble 0.06715719271480342  
 ISORG 0.06715719271480342  
 Centre Nationale de la Recherche Scientifique (CNRS) 0.06715719271480342  
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 TDK Corporation 0.06705505249774668  
 KING FAHD UNIVERSITY OF PETROLEUM AND MINERALS 0.06685170131503934  
 Tadahiro Ohmi 0.06685170131503934  
 Kansai University 0.06685170131503934  
 MITSUBISHI HEAVY INDUSTRIES, LTD. 0.06685170131503934  
 Finewell Co., Ltd. 0.06685170131503934  
 STMicroeletronics, Inc. 0.06654897662983916  
 OLYMPUS CORPORATION 0.06649878886465829  
 France/Ecole Normale Seperieure de Cachan 0.06639864008624766  
 France and Universitat de les Illes Balears 0.06639864008624766  
 Societe Francaise de Detecteurs Infrarouges - SOFRADIR 0.06634867873178096  
 Universite Montpellier 2 Sciences et Techniques 0.06634867873178096  
 UNIVERSITE CLAUDE BERNARD LYON I 0.06634867873178096  
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 ITT Corporation 0.06605048242287408  
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 Hitachi ULSI Systems Co., Ltd. 0.06605048242287408  
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 Sanken Electric Co., Ltd. 0.0656081800852209  
 Nissan Motor Co., Ltd. 0.0656081800852209  
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 JAPAN DISPLAY INC. 0.06555940076917241  
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 FURUKAWA MAGNET WIRE CO., LTD. 0.06531658817373102  
 Asmo Co., Ltd. 0.06526824132830265  
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 Tris Inc. 0.06517176203587353  
 DENSO International America, Inc. 0.06517176203587353  
 Advics Co., Ltd. 0.06517176203587353  
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 Elpidia Memory, Inc. 0.06478868040744812  
 Seiko Epson Corporation 0.06474111162594486  
 Central Research Institute of Electric Power Industry 0.06459882346852519  
 Nanyang Technological University 0.06445715938197141  
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 Sumitomo Chemical Company, Limited 0.0638041924996649

TECHNOVA INC. 0.06352838186926289  
 Semiconductor Technology Academic Research Center 0.06352838186926289  
 Foundation for Advancement of International Science 0.06352838186926289  
 SEMICONDUCTOR ENERGY LABORATORY CO., LTD. 0.0634369741255661  
 Kyocera Corporation 0.06334582904779949  
 Fuji Electric FA Components & Systems Co., Ltd. 0.0633003546550875  
 Oncotech, Inc. 0.0633003546550875  
 Funai Electric Advanced Applied Technology Research Institute Inc.  
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 Yoshitaka Sugawara 0.06320960145844938  
 Tanaka Kikinzoku Kogyo K.K. 0.06174887537432555  
 Henkel Corporation 0.061662513310864954  
 Hyundai Motor Japan R&D Center 0.06149051187903548  
 Myunghwa Ind. Co. Ltd. 0.06149051187903548  
 LG Hausys, Ltd. 0.06144766134810933  
 Korea Institute of Science & Technology 0.06144766134810933  
 HYUNDAI MOBIS CO., LTD. 0.06144766134810933  
 SL Lighting Corporation 0.06144766134810933  
 Il Heung Co., Ltd. 0.06144766134810933  
 Kobelco Construction Machinery Co., Ltd. 0.06106467730923607  
 SOONGSIL UNIVERSITY-INDUSTRY COOPERATION FOUNDATION 0.060980217174645156  
 Konkuk University Industrial Cooperation Corp. 0.060980217174645156  
 Korean Broadcasting System 0.060980217174645156  
 Dongwon Systems Corporation 0.060980217174645156  
 Soongsil University Foundation of University-Industry Cooperation  
 0.060980217174645156  
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 University of Macau 0.059579320293606006  
 Schlumberger Technology Corporation 0.05789717270816605  
 Massachusetts Institute of Technology 0.056998961883992824  
 Asahi Kasei Microdevices Corporation 0.05688864131260444  
 KONICA MINOLTA, INC. 0.05688864131260444  
 Headway Technologies, Inc. 0.056851962627038614  
 TDK Korea Corporation 0.056851962627038614  
 King Abdulaziz City Science and Technology 0.05670571963635813  
 Olympus Imaging Corp. 0.056451596693045385  
 Olympus Medical Systems Corp. 0.056451596693045385  
 Leibniz-Institut für Polymerforschung Dresden e.V. 0.05584382142782577  
 FURUKAWA AUTOMOTIVE SYSTEMS INC. 0.05573792290425846  
 Yamato Electronic Co., Ltd. 0.05556231508162375  
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 Universal Display Corporation 0.0552489937559755  
 Seiko NPC Corporation 0.05517984607918454  
 GLOBALFOUNDRIES Singapore Pte. Ltd. 0.0550420686857284  
 MEDTRONIC, INC. 0.05416301844873273  
 Chichibu Fuji Co., Ltd. 0.05412976920474947  
 Beth Israel Deaconess Medical Center, Inc. 0.04945451151684626  
 The Charles Stark Draper Laboratory, Inc. 0.04945451151684626

The President and Fellows of Harvard College 0.04945451151684626  
 Raytheon Company 0.04945451151684626  
 The Furukawa Electric Company, Ltd. 0.04850241696069136  
 Tocalo Co., Ltd. 0.04826348879832342  
 Princeton University Office of Technology and Trademark Licensing  
 0.048131765302694814  
 National University of Singapore 0.047974643109106034  
 Tyco Electronics Corporation 0.009133723419437707  
 Hon Hai Precision Industry Co., Ltd. 0.008547008547008548  
 BOE TECHNOLOGY GROUP CO., LTD. 0.007849293563579277  
 Tyco Electronics Japan G.K. 0.00717649697241534  
 University of Tennessee Research Foundation 0.006541077969649398  
 Siémons Aktiengesellschaft 0.006541077969649398  
 Sanyo Electric Co., Ltd. 0.006279434850863423  
 Tyco Electronics Raychem GmbH 0.006279434850863423  
 Tsinghua University 0.005917159763313609  
 Hong Fu Jin Precision Industry (ShenZhen) Co., Ltd. 0.005917159763313609  
 YALE UNIVERSITY 0.005606638259699484  
 TE Connectivity India Private Limited 0.005581719867434153  
 Tyco Electronics Holdings (Bermuda) No. 7 Ltd. 0.005581719867434153  
 Tyco Electronics Amp Korea Ltd. 0.005581719867434153  
 Fu Tai Industry (Shenzhen) Co., Ltd. 0.005128205128205129  
 Hong Fu Precision Industry (ShenZhen) Co., Ltd. 0.005128205128205129  
 Fu Tai Hua Industry (Shenzhen) Co., Ltd. 0.005128205128205129  
 UT-Battelle, LLC 0.004905808477237048  
 Siemens Medical Solutions USA, Inc. 0.004905808477237048  
 Tyco Electronics Singapore PTE Ltd. 0.00478433131494356  
 Tyco Electronics Svenska Holdings AB 0.00478433131494356  
 Canon Kabushiki Kaisha 0.004709576138147566  
 Hitachi, Ltd. 0.004709576138147566  
 Kokichi Terajima 0.004709576138147566  
 Xinhongzhou Precision Technology Co., Ltd 0.004709576138147566  
 Micro Win Tech Inc. 0.004709576138147566  
 LARGAN PRECISION CO., LTD. 0.004709576138147566  
 National Chiao Tung University 0.004709576138147566  
 Tyco Electronics AMP Espana SA 0.004368302504948468  
 HEFEI BOE OPTOELECTRONICS TECHNOLOGY CO., LTD. 0.004360718646432932  
 BEIJING BOE DISPLAY TECHNOLOGY CO., LTD. 0.004360718646432932  
 The Regents of the University of Colorado 0.004360718646432932  
 National Institute of Standards and Technology 0.004360718646432932  
 Siemens Industry, Inc. 0.004360718646432932  
 Caterpillar Global Mining LLC 0.004360718646432932  
 CHENGDU BOE OPTOELECTRONICS TECHNOLOGY CO., LTD. 0.004360718646432932  
 Beijing Asahi Glass Electronics Co., Ltd. 0.004360718646432932  
 Suzhou Boe Chatani Electronics Co., Ltd. 0.004360718646432932  
 Nuctech Company Limited 0.004048582995951417  
 Hon Hai Precsion Industry Co., Ltd. 0.004048582995951417  
 Massachusetts General Hospital 0.003924646781789639

Ulvac, Inc. 0.00358824848620767  
 Sanyo Technology Center (Shenzhen) Co., Ltd. 0.00358824848620767  
 Saga Sanyo Industries Co., Ltd. 0.00358824848620767  
 Mitsubishi Metal Corporation 0.00358824848620767  
 University of Utah Research Foundation 0.003567860710717853  
 Nihon Ceratec Co., Ltd. 0.0035321821036106748  
 Taiheiyo Cement Corporation 0.0035321821036106748  
 Max-Planck-Gesellschaft zur Foerderung der Wissenschaften E.V.  
 0.0035321821036106748  
 Carl Zeiss Microscopy GmbH 0.0035321821036106748  
 NEC Access Technica, Ltd. 0.0035321821036106748  
 NEC Corporation 0.0035321821036106748  
 Duke University 0.003270538984824699  
 Intel Corporation 0.0031397174254317113  
 University of California 0.0031397174254317113  
 GSI 0.0031397174254317113  
 Lawrence Livermore National Security, LLC. 0.0031397174254317113  
 Shenzhen Futaihong Precision Industry Co., Ltd. 0.0031397174254317113  
 Northeastern University 0.0031397174254317113  
 Cal-Comp Electronics & Communications Company Limited 0.0031397174254317113  
 Philips Lumileds Lighting Company, LLC 0.0031397174254317113  
 Volkswagen AG 0.0031397174254317113  
 iHi CHARGING SYSTEMS INTERNATIONAL GMBH 0.0031397174254317113  
 Mahle International GmbH 0.0031397174254317113  
 AAC Acoustic Technologies (Shenzhen) Co., Ltd. 0.0031397174254317113  
 Japan Aviation Electronics Industry, Ltd. 0.0031397174254317113  
 Robert Bosch GmbH 0.0031397174254317113  
 California Institute of Technology 0.0031397174254317113  
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 Tohoku Pioneer Corporation 0.0031397174254317113  
 NthDegree Technologies Worldwide Inc. 0.0031397174254317113  
 Bruker BioSpin GmbH 0.0031397174254317113  
 The Trustees of Princeton University 0.0031397174254317113  
 Ford Global Technologies, LLC 0.0031397174254317113  
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