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Disco Corporation

Ticker: 6146
Exchange: Tokyo
Sector/Industry: Semiconductor

Recommendation (buy/sell/hold): cBuy
Current Price (As of 9/30) : 25410
Target Price (%increase): 34064 (34%)

KEY FIGURES	
ANNUAL DIVIDEND (JAY)	411
DIVIDEND YIELD (JAY)	1.62%
52W LOW	17,570
52W HIGH	28,480
AVG. DAILY VOL. (3 MONTHS)	190,520
NUMBER OF SHARES (M)	36 MILLION
ENTERPRISE VALUE (BN JAY)	833
FREE FLOAT (%)	78%
TTM P/E	33X
BETA	1.28
EPS	769.55

VALUATION	
FCFF TARGET PRICE (75%)	35,761
P/E/G MULTIPLE TARGET PRICE (25%)	28,974
TARGET PRICE (12 MONTHS)	34,064
2020 DIVIDENDS (JAY)	411
TOTAL 12M RETURN %	21%

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Investment Summary

We issued a BUY Disco Corp (TYO:6146) with a target price of **JPY 34064** representing a 34% upside from the closing price of **JPY 25410** per share as of September 30th, 2020. Our recommendation is based on the following key factors: (1) strong growth in the semiconductor industry driven by 5G technology and expanding usage of semiconductor (2) strong competitive positioning, and (3) strong financial position.

(1) Strong market growth driven by 5G will benefit Disco significantly.

The 5G infrastructure market was estimated to be valued at 784 million USD in 2019 and is forecasted to reach 47,775 million USD by 2027 with a compound annual growth rate (CAGR) of 67.1%.¹ There are various factors to why the 5G industry is expanding. The prime driving factor is the growing phenomenon of virtual networking through telecommunications and in mobile data usage. Moreover, increasing M2M transactions between various sectors are also assumed to excel the rapid development of the 5G infrastructure market. Hence, Disco also in their forecasted years, is expected to experience continuous growth.

(2) Strong competitive positioning that will shield Disco's market share.

Throughout the timeline, Disco has been establishing their unique 'Disco values' - and ethos applied throughout the organization. The company aims to clarify their footprint under the rapidly evolving conditions of the semiconductor industry. Disco explicitly states that the company is achieving excellence in all of their corporate activities hence, the product of their company will be acknowledged and fulfill the needs of the stakeholders and society. With the net sales of 141.0 billion JPY in the FY 2019, Disco was able to pay back 438JPY per share as an annual dividend to its shareholders (Appx. 18). Disco also indicates that their accomplishment and aspirations for technology and services are set at an international standard which proves their strong and competitive positioning within the industry.

(3) Solid financial situation makes Disco resilient to market downturn.

Not only has Disco shown remarkable sales growth over the years, Disco possesses a very strong financial base of very high equity ratio (83%) which makes Disco resilient to the volatile characteristics of the semiconductor industry. Moreover, Disco has a massive current asset of 169 billion which also strengthens its resilience towards cyclical movement of the market as well as economic downturn.

However, there are risks associated with this recommendation. Although we project strong revenue growth which outperforms the global economic growth, the actual revenue growth may fall short of our expectation due to market disruption from the pandemic, loss of market shares, as well as foreign exchange. Moreover, Disco's very concentrated business domain can be risky in the long run as new technologies may make Disco's products obsolete. However, Disco has established a very strong competitive positioning and we have optimistis view on Disco's future growth as well as its R&D to develop products of the future.

ESG, which has been a growing concern of companies can be labeled as Disco's "strength." Although Japan is often associated with ideas such as "long-working hours", "gender inequality," Disco seems to be maintaining international standards in its employee benefits. Disco also promotes building good relationships with its suppliers as well as the local community through various means. Disco's environmental activities are also remarkable. Disco keeps track of emission across its entire supply chain and promotes environmentally friendly practices to them to reduce environmental impact. Although there seem to be some issues such as successor training and aptitude of the Board in Disco's governance, in general, Disco demonstrates international standard ESG practice.

¹ "5G Infrastructure Market." Market Research Firm. Accessed October 22, 2020.
<https://www.marketsandmarkets.com/Market-Reports/5g-technology-market-202955795.html>.

Figure 1.

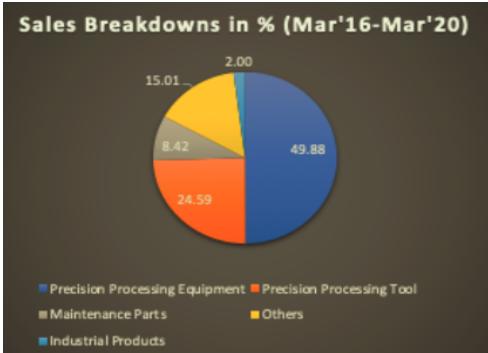


Figure 2.

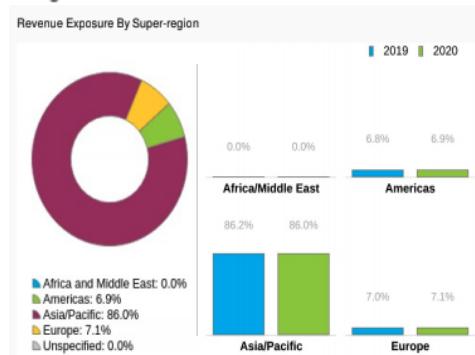


Figure 3.

Major Shareholders		
Top Insiders/Stakeholders	MV (MM)	%Out
Sekiya Keizo Family	68,562.3	6.8
Daiichi Holdings, Inc.	55,822.1	5.5
Sekiya Hideyuki Family	51,798.9	5.1
Sekiya Kazuma /Disco/	19,557.3	1.9
Sekiya Reiko Family	16,539.9	1.6
Sekiya Hideyuki	8,214.1	0.8
Hirogin Holdings, Inc.	1,397.0	0.1
Nanyo Corp.	209.5	0.0
Other Insiders/Stakeholders	181.6	0.0
Total Insiders/Stakeholders	222,283.0	22.1
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Business Description

Disco Corporation (6146) is a Japanese high quality precision equipment and tool maker, especially for cutting, grinding, and polishing materials mainly for semiconductor production. Disco explicitly states that its business will not deviate from these domains. Its equipment and tools are used in the post-processes in semiconductor manufacturing in which semiconductor wafers are reduced in thickness and are diced into small chips. Although it has branches and subsidiary companies (19) (Appx. 4) across the globe, its production facilities are concentrated in Japan to take advantage of the stable and high-level infrastructure. As of FY 2020, the company had an estimated number of 5,227 employees worldwide, yet the majority (79.6%) of them have their working environment in Japan.

Geographic and business segments. Although Disco does not disclose an exact end-market distribution, around 80% of the total sales is used for semiconductor manufacturing. The remaining 20% is for non-semiconductor use, such as electronic devices, ceramic capacitor, and glass components according to the IR meeting on August 25th, 2020. The business segments can be divided into three components: precision processing equipment (50%) followed by precision processing tools and parts (25%), service support & others (25%) (Fig. 1). The precision processing equipment mainly consists of dicing saw and laser saw which are used to cut silicon wafer in semiconductor manufacturing. The precision processing tools include dicing blade, grinding wheel, and polishing wheel. Lastly, the third major component, parts, service support & others include industrial products, maintenance service, etc. Geographically, Asia comprises the largest share (86%) of Disco's sales, followed by Europe (7%) and Americas (7%) according to FY 2020 data (Fig. 2). This skewed distribution is due to the rapid growth of the semiconductor industry in Asia, particularly China and Taiwan.

Networks. As mentioned above, Disco's customers are mainly semiconductor manufacturers and around 80% of sales are made abroad. Some of the main customers include Mimasu Semiconductor Inc, Intel, and Nanyo. Yet, their top customers tend to change year to year and even the top customer only shares up to 5% of Disco's total sales, making Disco more resilient to risks as there is no strong dependency on a particular customer.

Business and market strategies. Disco's focuses its business on high quality equipment and tools for cutting, grinding, and polishing. This has allowed Disco to produce quality products which ensure the success of the processings by the customers. Moreover, customers use Disco's products in the "post processings" where high value silicon wafers are processed and as a result, mistakes are not allowed. This contributed to Disco's high market share as there is no incentive for the customers to choose third-party products which have little credential. As a result, they rely on high-quality products by Disco as they have brought great results to the customers over the years. As a result, Disco's focus on high quality products allowed it to obtain high market share in its business domain and should have been serving as a protective method for new entrants. Disco offers its customers opportunities to bring their modern semiconductor wafer for a test cut for free. It not only allows Disco to develop strong relationships with customers by their service and order-made settings, but also allows Disco to utilise the opportunity for R&D for modern products which competitors may not have access to. As a result of these strategies, Disco could continuously sign contracts with new customers and maintain its current relationships.

Figure 4..



Industry Overview and Competitive Positioning

Figure 5.

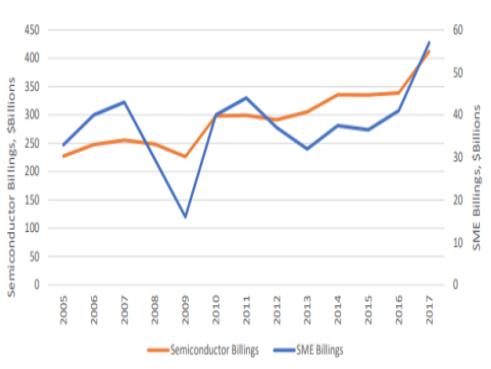
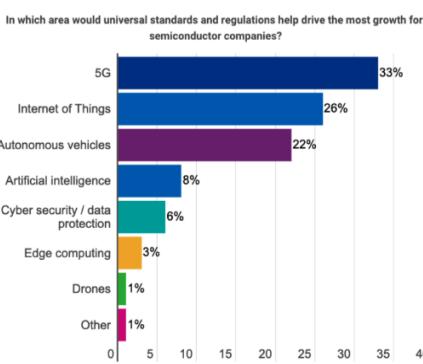


Figure 6.



Industry Overview.

Summary

The global semiconductor manufacturing equipment market is expected to grow by 6% from 2019, reaching 63.2 billion USD of market size. It is also estimated to grow at a rapid speed that it will be reaching the highest price of 70 billion USD in 2021. (SEMI) Meanwhile, SEAJ, estimated that the sales for Japanese Semiconductor Manufacturing Equipment companies will be up by 7% reaching 22.181 billion JPY. Thus, It is safely predicted that the global and domestic market for Semiconductor Manufacturing Equipment will be expanding. The reason behind such a growth can be attributed mainly to three facts; (1)Growth of semiconductor market, (2)Technological changes/advancements, especially 5G (3)Growth of foundries.

(1)Growth of the semiconductor market.

The growth of the semiconductor manufacturing equipment market is heavily dependent on the growth of the semiconductor market. As seen in the (Fig 5) the billings for semiconductor and semiconductor manufacturing equipment correlate to one another. However, in 2017, the market saw a steep rise in the growth of semiconductor manufacturing equipment. This is due to the rapid growth of the semiconductor market. The biggest impact was from the 3D NAND flash memory that is applied for servers required to support data centers. To handle more data, memory is getting more dense every year that its layer has increased from 96 to 128 recently. Due to the increasing density of 3D NAND, more manufacturing equipment in every stage of manufacturing is necessary and thus led to its steep rise in the semiconductor manufacturing equipment market. This trend of growing semiconductor market remains in 2020, that Global 3D NAND flash memory market is expected to grow at a CAGR of roughly 22.7% over the next five years, will reach 29200 million USD in 2024, from 8590 million USD in 2019, according to a new Research study², as more data centers are required with the advent of 5G.

(2)Technological changes/advancements, especially 5G

The biggest factor for the growth of the semiconductor market, thus for the growth of semiconductor manufacturing equipment is the 5G, according to the research drawn from a survey of 195 senior global semiconductor executives by KPMG in 2020 (Fig. 6).³ The reason behind this is the rising need of logic chips and high memory output to support 5G networks that transfer large amounts of data 100-200 times faster than 4G LTE. (Computer Society)⁴. Furthermore, the advent of 5G will certainly pave the way for the growth of the semiconductor equipment market because the 5G network will allow edge computing, IoT, smart cities, and fully autonomous vehicles which all rely on advanced semiconductor to function. The growth of 5G impact on the semiconductor market is estimated to be two phases by Accenture in 2020; in the first phase, demands for 5G smartphones will drive the revenue up from zero in 2018 to \$31.5 billion in 2023 while in the second phase the growth is estimated to be a CAGR of 285% between 2021-2023, driven by the number of new applications beyond smartphones such as automotive application.⁵

(3)Growth in Foundries.

As more high performance chips are demanded for 5G technology, semiconductor firms invest heavily in R&D of cutting edge semiconductor, especially foundries. Foundries specifically operate on outsourced manufacturing, and thus require abundant manufacturing equipment. For example, TSMC, the most dominant foundry based in Taiwan heavily contributes to the growth of the semiconductor manufacturing equipment market because they purchase more manufacturing equipment as their sales grow; TSMC recorded sales of approximately US\$4.10 billion, in June 2020, an increase of 28.8 percent from May 2020, and an increase of 40.8 percent from June 2019.

² “3D NAND Flash Memory Market 2020 : Top Countries Data, Market Size, Defination, Brief Analysis of Global Industry with Forecast Growth By 2024,” MarketWatch (MarketWatch, August 17, 2020), <https://www.marketwatch.com/press-release/3d-nand-flash-memory-market-2020-top-countries-data-market-size-defination-brief-analysis-of-global-industry-with-forecast-growth-by-2024-2020-08-17>.

³ Lincoln Clark, “Tech Convergence Powers Semiconductor Growth,” KPMG LLP (KPMG, February 11, 2020), <https://advisory.kpmg.us/articles/2020/seminconductor-growth.html>.

⁴ Lori Cameron, “Semiconductor Industry Making 5G World of ‘Smart Everything’ a Reality: IEEE Computer Society,” IEEE Computer Society As 5G Approaches Semiconductor Industry Must Combat Friction Points to Make World of Smart Everything a Reality Comments, accessed October 23, 2020, <https://www.computer.org/publications/tech-news/trends/5g-semiconductor-industry-drives-smart-everything-iot>.

⁵ Syed Alam, “5G Opportunities for Semiconductor Companies,” Accenture, July 8, 2020, <https://www.accenture.com/us-en/insights/high-tech/seminconductor-5g>.

Competitive Positioning

Threat of New Entry. Disco is the market leader in the semiconductor post-processing domain and constitutes 70-80% of market share in equipment for cutting, grinding and polishing, driven by its core value of bringing “values” to its customers. The market is characterized by a high entry barrier due to long-lasting and massive R&D and capital expenditure, high-requirements for legal and environmental consideration, as well as difficult and long-lasting customer procurement processes due to the expensive nature of silicon wafer. Disco is clearly ahead in the competition.

Supplier Power. Disco does not rely on outsourcing for parts or gadgets required for their machines. In fact, it only accounted for 6 billion yen in FY 2019, which is a minuscule amount compared to sales.

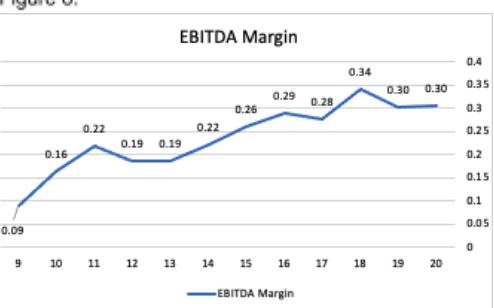
Buyers Power: Disco builds relations with its customers by providing a free experiment system where customers can bring its cutting edge silicon wafer to understand the best setting and equipment for processes. This allows Disco to do R&D effectively and ahead of its competitors as it can use the modern wafers brought by its customers. Moreover, Disco's proximity and foreign offices helps Disco provide high quality customer service including repair and maintenance. What is more, Disco has a very diversified customer base in which the top customer only represents 5% of total share. These factors contribute to Disco's risk resilient and competitive positioning in the landscape.

Threat of Substitution. Disco has constantly been spending budget on continuous innovation in the R&D center. In the field of semiconductor, there is no estimation to indicate the disruptive innovation that would replace the semiconductor, and it is safely said that the continuous investment in R&D center will guarantee the survival and growth of Disco.

Figure 7.



Figure 8.



Competitive Rivalry. Disco's main competitors are Kulicke and Soffa Industries, Inc (China) and Tokyo Seimitsu (Japan). While the major domestic competitor Tokyo Seimitsu spent 8.2 billion yen on R&D, Disco spent almost double the amount which is 15.6 billion yen. On the other hand, Kulicke and Soffa Industries spent 116,169 million dollars (roughly about 12 billion yen) as of 2019. The niche semiconductor manufacturing equipment industry requires massive R&D due to the rapid cycle of innovation driven by widening application and mass reduction. Therefore, although Disco already is the main player which shares 70 - 80% of the market, its continued efforts further strengthen its position. Currently, as stated in the IR meeting, Disco places effort on laser saw equipment which shows high potential for its wide usage despite the costly and relatively unstable nature. Since the 5G and other advanced technologies require precision processing, we strongly believe that Disco's products would be of high demand in the years ahead.

Financial Analysis

High historical revenue growth and positive outlook (Fig. 7). Although the revenue is often influenced by the fluctuating characteristic of the semiconductor industry, Disco has shown a steady CAGR of 3.53% from April 2011 to March 2020. For the semiconductor industry as a whole, according to WSTS statistics⁶, the CAGR of the same period was 3.58%. Therefore, although there can be fluctuations, we can estimate the revenue growth of Disco to be generally consistent with the growth of the semiconductor industry. We have projected sales based on the assumption above and will be discussed further in the valuation part. Currently, according to Statista, the end market breakdown in 2019 for semiconductors was as follows. Communication comprised 33%, pc/computer comprised 28.5%, consumer comprised 13.3%, automotive comprised 12.2%, and industry comprised 11.9% etc.⁷ However, we expect that the end use will expand not only in PC/communication but also for industrial and automotive uses due to the advent of 5G as discussed.⁸

⁶ “Market Statistics,” MARKET STATISTICS, accessed October 12, 2020, <https://www.wsts.org/61/MARKET-STATISTICS>.

⁷ <https://www.statista.com/statistics/498265/cagr-main-semiconductor-target-markets/#:~:text=The%20global%20semiconductor%20market%20is,16.4%20billion%20U.S.%20dollars%20respectively>.

⁸ Syed F Alam et al., “GAINING THE EDGE: Semiconductors and the 5G Opportunity.” Accenture Acnmedia (Accenture), accessed October 15, 2020, https://www.accenture.com/_acnmedia/PDF-128/Accenture-Gaining-the-Edge-Semi-and-5G-opportunity.pdf#zoom=40,6.

Higher profitability going forward (Fig. 8). We believe that Disco's profitability will improve in the years to come as there is no new capital expenditure announced at the moment and the construction of Kuwabata C factory has finished as well as that of Chino factory B building is about to finish. This will not only result in the reduction/stabilization of capital expenditures, but can also contribute to the reduction of variable costs with expanded production capacity by taking advantage of the economy of scale.

Will accounting. Disco started "will accounting" in 2003 in each department and in 2011, it initiated "individual will accounting" in addition. In this method, each employee and division would have an account in which they will calculate their resource spending and work contribution. Essentially, they will try to accumulate their will points by making contributions while minimizing their resource use. This unique management style has allowed each entity to have responsibility and rights for their works and decisions. As a result, although the employees would have the freedom to use the firm's resources, they started to nurture a sense of responsibility and "management mind." In fact, operating margin has gone up from 4.4% in fiscal year 2003 to 25.8% in 2020, although we acknowledge that there must have been other factors that contributed to the improvement, "will accounting" must have played an important role. We firmly believe that this tradition would positively impact firm's resource management going forward as well.

Domestic production. As discussed in the IR meeting, Disco does not have a manufacturing center abroad as it believes that Disco can still achieve cost minimization by utilising the stable infrastructure in Japan.

Sound cash flow and limited capital expenditure going forward (Fig. 9) (Appx. 15). Although there are fluctuations, Disco has a cash flow trend of a mature company. Net operating cash flow has more than doubled from fiscal year 2011 (14.51 billion yen) to 2020 (31.30 billion yen), presenting Disco's successful business operations. As for net investing cash flow, it has been expanding recently due to the increase in capex from the enlargement of Kuwabata and Chino factory. In fact, from FY 2018 to 2020, the average proportion of capital expenditure to net investing cash flow was 96%. As discussed in the financial results announcement of FY, payment for Chino plant's expansion and Kuwabata plant would end in FY 2020 and 2021, respectively. Thus, as there is no announcement for further large capital expenditure, we expect the capital expenditure may shrink as low as 7 billion yen, which corresponds to the annual expenditure for purchasing equipment and facilities. The net financing cash flow consists mainly of cash dividend payments (88.6%) based on FY 2018 to 2020. As Disco has a performance-based dividend policy, its trend has been consistent with that of sales. Overall, Disco has a very sound cash flow situation in which operating cash flow is used for investments and dividend payments, and we believe that this trend would continue for the years to come.

Very healthy financial condition - high equity ratio (Fig. 10). Disco has a very healthy financial condition as we can observe the deleveraging trend. As mentioned in the IR meeting, Disco does not have the idea to improve ROE through financial leverage. In fact, the equity ratio has increased by 12.6% from 2011 (70.1%) to (82.7%) although Disco had gone through major capital investment such as Kuwabata and Kure factory. Disco's policy for financing is self-financing, so as not to rely on debt financing. For instance, the capital expenditure for Kuwabata factory D-zone and Chino factory B building combined required 31,500 million yen yet it was financed through self-financing. This is made possible by the massive cash of 79.78 billion yen the company as of fiscal year 2019. Thus, we assume that for future capital investments, Disco would rely on self-financing and we will build upon our valuation analysis based on this assumption.

Improving ROA & ROE (Appx. 21). Disco's ROE and ROA have steadily been improving with very little difference between them. This demonstrates that its improvement in ROE is not driven by financial leverage.

Analysis with peers (Appx. 13). We compared Disco with both domestic and international companies as the semiconductor manufacturing equipment industry is very international and we believe that investors will not only look at Japan for investment opportunities.

Du Pong Analysis. We can see from the Du Pont comparison that although Disco has below average asset turnover, it has low financial leverage demonstrated through equity multiplier and the tiny difference between ROA and ROE. This demonstrates that although many companies, mostly international, tend to take on financial leverage, Disco has a very low financial leverage with very strong and successful business performance.

Operating Metrics. In comparison to its peers, Disco seems to have a slightly low inventory turnover ratio. However, Disco has stated in the IR meeting that Disco intends to have sufficient inventory as the semiconductor manufacturing industry is very volatile and Japan is very susceptible to natural disasters.

Figure 9.

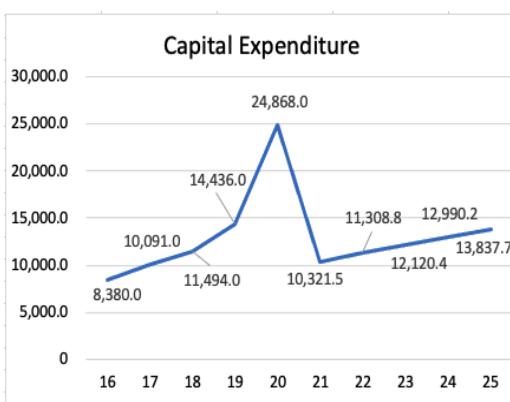


Figure 10.

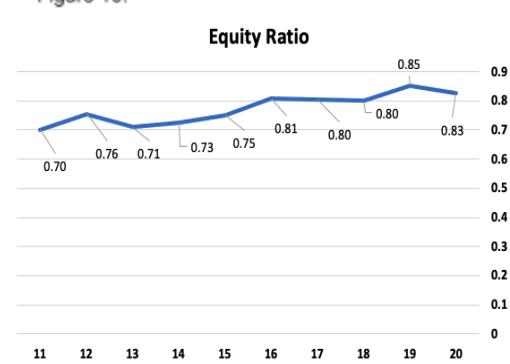


Figure 11,12.

WACC COMPUTATION		
10y Japanese Government Bond	0.02%	
Market Risk Premium=	6.95%	
Beta	1.28	
Cost of Equity	8.92%	
Pre-Tax Cost of Debt	2.1%	
Tax Rate	23.2%	
Target Net Debt (Bn JPY)	-87.9	
Market Capitalization (Bn JAY)	915.1	
Enterprise Value (Bn JAY)	832.57	
WACC	8.92%	
TERMINAL FCF GROWTH RATE		
Country	0.02%	Market Growth
Japan	5.40%	1.00%
China	60.50%	8.10%
USA	7.00%	4.30%
EU	7.00%	3.50%
Rest of world	20.10%	2.50%
Total	100.00%	6.00%

Profitability. Disco has a very high profitability ratio compared to its peers especially in gross margin. This shows that Disco has a very efficient system in collecting resources for manufacturing its goods. We can observe that Disco's policy of manufacturing domestically has been very effective in lowering the costs associated with production.

Valuation

Based on the valuation results, the target price is estimated to yield 34064 yen, which is 34% upside from the closing price of 25410 yen per share as of September 30, 2020.

The recommended approximation was calculated by considering a DCF model([Appx 30](#)) with a target price of ¥35761 and a P/E/G multiple with a target price of ¥28974 ([Appx. 31](#)). The reason for the low weighting of the multiple method is that there are only few companies that are comparable to Disco. In addition, the intrinsic FCFF method allowed us to take into account the cyclical nature of the market environment for precision machining tools.

The recommended approximation was calculated by considering the result from both the Discounted Cash Flow (DCF) to Equity model with a target price of JPY 35761 and P/E/G multiple with a target price of JPY 28974 ([Appx. 31,32](#)). The arrangement of the weighted ratio from both methods were based on the following grounds. We respectively attributed weights of 75% and 25% to each methodology. The choice of attributing less weight to multiples methodology is driven by the lack of comparable companies to DISCO. In addition, the intrinsic FCFF method allowed us to include the cyclicity of the market environment of Precision Processing Tools. We believe in the next financial year, DISCO will achieve a total revenue growth rate above 11.62% estimated recovery from COVID-19. We expect a total sales growth of 9.57% in FY22, 7.18% in FY23, 6.52% in FY24, and 6.21% in FY25. We believe a total sales growth of 6.52% will be sustained in the long term. In 2020, when a -6.9% growth is expected in the overall industry as coronavirus ravages the smartphone and automotive segments. DISCO is influenced by this drop and declined to 2.9% as a result in the first half of the FY20.

1) 9% CAGR in Semiconductors from 2019/23: We expect investments in semiconductors to continue, but at a lower rate than 6.3% in 2017, mainly driven by Dicing and Grinders or its Precision Processing Tools highly concentrated with a few players occupying the market share. Currently, important investments are being made in a new Building at Nagano Works Chino Plant expected completion of construction in December 2020 that will provide higher yields. After several years of completing this new plant, yields will hugely improve, thus creating a huge potential increasing supply by 2020/21, resulting in a huge reduction in new investment ([Appx. 15](#)). Since the Group manufactures and sells products to semiconductor manufacturers and electronic component manufacturers around the world, it is affected by the capital investment trends and production trends of its customers. In particular, semiconductors are a market that changes depending on the balance between supply and demand, and the performance of semiconductor manufacturers is affected by these movements, the so-called silicon cycle. Therefore, if a customer freezes capital investment or cuts production due to a downturn in the cycle or unexpected market fluctuations such as the impact of covid-19, the Group's business performance may be adversely affected. However, Disco's strong market share and a recovery of market and economy from the impact of covid-19 process are strong signs that Disco is able to overcome the cyclical behavior of capital markets with positive growth.

2) The increase of yields of Certain types of manual dicing saws will follow a path Nagano Works Chino Plant: Significant growth of sales will continue to be made in the medium-term, as the company's manual dicing saw production capacity is expected to increase by 1.5 times. After several years of gradual disappearance of COVID-19 and recovery of the market demand, sales will highly improve in next year and we believe that the growth of sales will be a slight decline but still continue to a relatively high growth in the future. The Dicing Saws and Grinders will continue to be dominant in the market share with 70-80% and 60-70%.

3) Also, products for DISCO, such as critical and peripheral parts and equipment manufactured by Daiichi Components, will be manufactured in DISCO Nagano Works Chino Plant from now on. The share of peripheral parts of all products of DISCO have been growing approximately 1% every year and we believe it will grow continually in the future. The total shares of 70-80% in peripheral parts by DISCO will be strongly dominant in the market continually.

21% Adjusted EBITDA margin achievable in a 5-year timeframe. We expect the progressing shift of sales mix including a more prominent role of sophisticated Dicing Saws and Grinders built for new semiconductor and Precision Processing Tools as an addition to

Figure 13.



Figure 14.

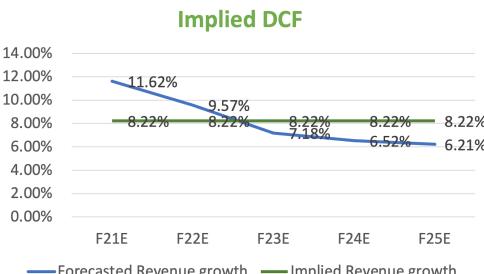


Figure 15.



Figure 16.

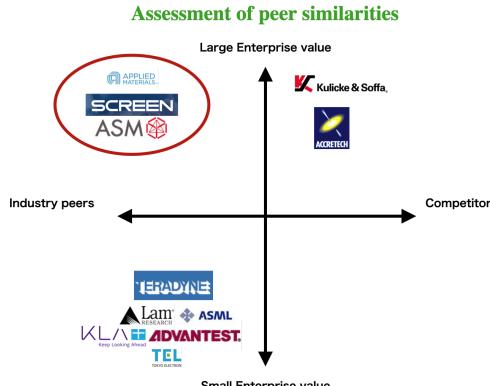
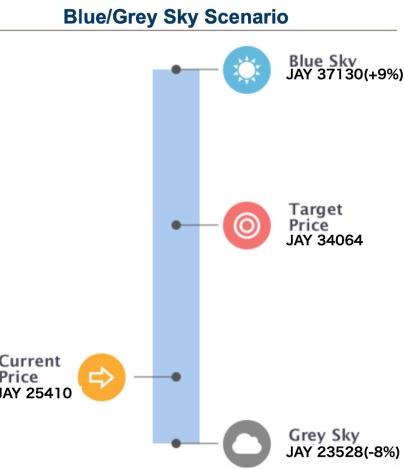


Figure 17.



the bigger increase of Cost of goods sold due to ongoing economies of scale. **Growing market share and positive volume growth are challenged by increased difficulty in finding and recruiting qualified staff in the future of an aging society , but close links to local universities and established training programs allows to find and train new employees.** Nevertheless, the ongoing outsourcing results in an expanding EBIT margin. We believe that the management guidance of 21% ([Appx. 25,28-29](#)).

In the following 3 years, we forecast capital expenditure to decrease from the current of 18%, reaching levels of 6%-7%, mainly due to the new Nagano Works Chino Plant finishiment in Japan. The expansion in Asia, by developing the Nagano Works Chino plant, is reflected in our CAPEX forecast, which exceeds annual D&A by approx. 75%. In addition, we forecast net working capital to remain at a constant level of sales (80-90%) as a target defined by management. The tax rate applied to our analysis has been kept constant at 20%, in line with DISCO expectations (reaffirmed in analyst call). The working capital to sales ratio shows a company's ability to pay costs related to generating new sales without the need to take on additional debt. Although borrowing money to finance new equipment or other initiatives to help increase sales is not bad on its own, a company must still be able to easily pay down its debt and maintain enough liquid assets to finance the ongoing operations of the company. Conversely, if a company maintains an exceedingly high working capital to sales ratio, it may be holding on to too many assets that would be better used to finance new growth or additional sales.

Estimating the risk-adjusted discount rate. We apply a **WACC of 8.9%** to discounting the FCFF. The company has a targeted level of Net Debt to EBITDA of 0 giving an optimum debt weight of 0% of enterprise value. The computation of cost of equity is based on the Capital Asset Pricing Model using the following inputs: a) risk-free rate equals 10-year Japanese Government bond rate b) Swiss market risk premium of 0.02% c) comparables raw beta unlevered using DISCO's current capital structure resulting in a **DISCO-Beta of 1.28** ([Appx. 27](#)).

Optimistic views on terminal growth. To calculate the terminal growth rate, we weighted long-term GDP growth projections of DISCO's main geographical markets by the current geographical revenue composition ([Fig. 12](#)). This approach results in a **positive terminal growth rate of 6%**. We believe that **this rate also reflects the rapid technological advances, increasing on Capital Expenditure and a maturing market with moderate volume growth and technological innovations**. However, the terminal value represents more than 80 percents of the firm value (~83%), so small changes to the perpetual growth rate will have an important impact on valuation, but considering that usually the terminal value represents much higher percentages, we acknowledge that a significant portion of firm value is derived from medium-term developments.

The FCFF model was selected because DISCO has a stable Free Cash Flow to Firm, which is expected to increase over time in three phases. The first phase of strong organic growth is based on a specific year-to-year forecast up to 2025 including the impact of the coronavirus in 2020. The second phase consists of constant growth of 6%. Based on our FCFF analysis, the estimated price is JPY 35761 ([Appx. 30](#)).

DCF analysis reveals an undervalued valued share price. To assess the robustness of our DCF valuation, we evaluated the sensitivity of our result for the most influential inputs, namely WACC and the terminal growth rate as well as **blue-grey sky scenarios** ([Fig. 17](#)), **sensitivity analysis**([Appx. 33](#)) **on the target price**. The most conservative scenario marks a downside of -8%.

To perform a more comparable and sound multiple valuation we chose Price to Earnings to Growth (PEG) as the most appropriate multiple to compare DISCO to its peers. We used the PEG approach mainly because DISCO operates in a high tech – high growth industry and one weakness of the P/E or EV/EBITDA ratios are that its calculations do not consider the future expected growth of a company.

Under management decisions, earnings and revenue growth can be the victim of different accounting treatments, but we use them to provide clearer visibility of the premium investors are willing to pay. For the composition of the peer group, we have selected a basket of peer groups for Disco and its clients in the industrial technology sector ([Appx. 31](#)). Within our index, the share prices of capital equipment manufacturers are not cheap. For trailing EPS, the median trailing P/E is 25.4 times and the forward-looking ratio is 33 times (based on Reuters and the team's assessment). Using these leading and forecasting indicators, the 2020/21 bottom line figure is even deeper, showing a 13% premium to the median trailing P/E, which represents a 13% premium to the median trailing P/E.

In our assessment, the discount can be explained by higher future EPS and EPS growth than peers since the forward PEG valuation reveals an even higher markup on the peers' median, improving EBITDA margins and growing market share reflected in sales. In addition, since

DISCO is the sector leader with a very positive outlook, investors are currently ready to pay a certain premium. Our final price recommendation for DISCO represents a fair price of JPY 35761, which is a weighted average of applied and described valuation techniques above.

Investment Risks

Monte Carlo simulation. In the income statement, we varied our sales growth projections, cost of sales and other operating expenses. For operating expenses, we focused on raw material prices and other factors. Simulations showed a 96% probability that the target price would increase by more than 12% or exceed JPY 28502 and only a 4% probability of being downgraded to SELL (Fig. 18).

Based on our insights we believe in DISCO's growing market share and end markets, so we consider it essential that we perform a sensitivity analysis on these primary variables of the model. DISCO must lose its four key customers together with a subsequent market share or end markets will have to contract by more than 17% to change our recommendation to a SELL. Similarly, a loss of 5% in market share (and one of its key customers) can deteriorate the company's revenue and change our recommendation. Given that DISCO is well protected against the loss of market share.

Value at Risk (VaR) and Expected Shortfall (CVaR). Value at Risk (VaR) and Expected Shortfall are risk measures a concept used in the field of financial risk measurement. We use the stock price of DISCO from the period Sep 30, 2012 to Sep 30, 2020 for our calculation and result in a relatively low risk of loss in both Var and CVaR (Appx. 34).

Strategic Risks.

Unsuccessful to meet targets set with specific strategies and mid/long-term management goals. Accomplishment in future goals in strategies and management are largely controlled by various internal and external factors. This can include the overall economic and industry conditions where Disco and its consumers meet, the level of demand for Disco's product, the fluctuations in foreign exchange rates, and the level of competition, etc. Consequently, it is best to make room for amendments for any strategies or management goals and not rely on them as future forecasts or results as there is no 100% assurance to its attainment and success. Yet, to achieve better and more realistic targets, the company should conduct risk analysis more frequently in order to add on and verify any upcoming scenarios of what new variables are having impact on current performance.

Very concentrated business domain. Disco business is heavily concentrated on manufacturing equipment for *kiru*(cutting), *kezuru*(grinding), and *migaku*(polishing). Although the highly focused business strategy allowed Disco to enhance the quality of its products and also made its business very efficient, it can be risky as it is vulnerable to market downturns as discussed in financial analysis.

Covid-19. Covid-19 has been disrupting businesses around the world and the semiconductor industry is no exception. As Disco's operates globally, the market volatility caused by the Covid-19 may potentially harm Disco's revenue. Yet, as discussed in industry overview, we believe that Covid -19 can benefit Disco as the spread of Covid-19 can strengthen the demand of electronic devices.

Keeping up with rapid technological advancements. Disco operates business in industries characterized by rapid technological advancement - semiconductor industry. For instance, the production process of semiconductors has become even more complicated and sophisticated than it was before, due to its new usage as well as the introduction of 3-dimensional semiconductor. Although Disco provides free test cuts and has been increasing R&D expenses, it may not be able to keep up with the advancement and may lose market share. Moreover, Disco's products have recently been used in non-semiconductor domains which require sophisticated manufacturing techniques. Thus, Disco's adaptability to key technological advancements is a key.

Highly volatile toward demands within the semiconductor industry. Disco's business highly depends upon capital expenditures of the companies within the semiconductor industry. These specific companies will examine their state of capital expenditures and later determine their investment levels based on current and anticipated market demand for semiconductors and products where semiconductors are a necessity. Overall demand in semiconductors can fluctuate generally by the situation of the global economy. The semiconductor industry has shown cyclical patterns with recurring periods of excess inventory which have had critical effects on the industry, including those of Disco.

Operational Risks.

Management difficulty. Disco has successfully instilled corporate philosophy to its employees through unique corporate management systems such as Will accounting and Performance Innovation Management activities. This allowed its employees to have a sense of

Figure 18.

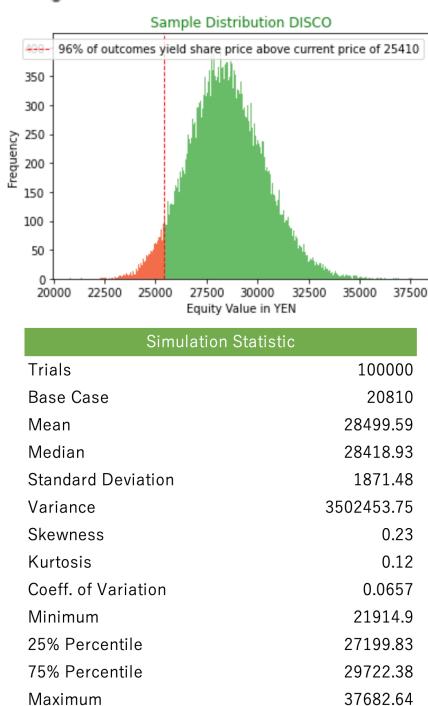


Figure 19.



Figure 20.



responsibility and management mind. As a result, we have seen an improving operating margin and a competitive yet healthy working culture where efforts of employees are rewarded. However, Disco has been increasing employees at CAGR 6.63% (Fy 2016-FY2020) and we project the trend to continue. If the installation of corporate philosophy stagnates as the number of employees increases, Disco may face problems such as decreasing profitability etc.

Financial/Regulatory and Legal Risks.

Foreign exchange (Fig. 19,20). The majority(85%) of sales of Disco is made abroad. Thus, the movements in foreign exchange markets have significant influence on Disco's revenue. If Japanese yen becomes strong relative to foreign currencies, Disco may need to lower the price of its products to maintain its sales volume and this may adversely affect Disco's profitability.

Legal risks. As Disco operates globally, its products need to meet country-specific legal requirements especially those pertaining to environmental preservations. For instance, Disco's products follow RoHS (restrictions on hazardous substances) after the directive was laid out in the EU in July 2006. The growing environmental concerns around the world would encourage countries to make new laws on this matter. Thus, failure to meet these global restrictions will not only tarnish Disco's brand image and will eventually harm its revenue.

Natural risks.

Concentrations of factories in Japan. All of the manufacturing facilities are in Japan, which often encounters natural disasters. Although Disco takes prevention measures such as inventory accumulation and factory expansion and diversification to minimize potential damage by natural disasters, large-scale natural disasters can halt Disco's business operations and can potentially damage Disco's revenue.

ESG

Environmental sustainability (Appx. 9). Overall, Disco appears to have a moderate sense of responsibility towards environmental issues. Disco has its key environmental management system and also promotes environmental activities and has environmental consideration in its products.

Environmental management system. Disco enforced core environmental principles in 1997 and has been operating its businesses under the principles. The principles state that Disco would proactively prevent environmental destruction and would also encourage its stakeholders to become more environmentally friendly. Moreover, Disco sets environmental goals known as "environmental vision" decadely to take more concrete approaches. The ones set in 2010 include CO₂ reduction, eradication of "MOTTAINAI," pollution prevention etc. According to the corporate website, these goals have been met and we can observe Disco's proactive initiatives. In addition to the "environmental vision," Disco has set a long term goal of reducing carbon dioxide emission down by 80% by 2050 from the emission made in 2010. As of 2016, Disco has reduced emission by 8.4% and we can observe that Disco is on the path for further decarbonization.

Environmental activities. Under the environmental management system, Disco promotes various environmental activities internally. For instance, Disco has introduced solar power systems to its facilities including Head office/R&D center, Kuwabata plant, Kure plant, Chino plant, and Disco HI-TEC Singapore customer center. As a result, in 2016, Disco reduced as much as 1300 tons of CO₂. Disco also promotes effective use of water resources. It introduced water processing equipment at its Head Office as well as at its manufacturing centers in Kure and Kuwabata. As a result, Disco reduced the input level of water by 40%. This is a remarkable achievement as the manufacturing of precision processing equipment and tools require a humongous amount of water and the 40% cut leads to a lot of water use reduction. Disco is also maintaining its manufacturing centers green to protect forest and biodiversity. Its works have been recognized and as a result, currency, Kuwabata plant has an excellence certificate from SEGES (Social and Environmental Green Evaluation System).

Environmental consideration in products. Disco initiated the Green Product Guideline in an effort to reduce the environmental impact of its products throughout their lifecycle (from resource procurement to disposal). For instance, Disco's philosophy is shown in the end-of-life product recycling initiative. Disco, amazingly, has become the first company in the production machinery industry to receive the qualification of Nationwide Recycler of Designated Industrial Reuse from the Ministry of the Environment. This allows customers in Japan to recognize that the machinery they use would be processed environmentally friendly. Moreover, countries around the world are enforcing strict laws on substance use such as China's ROHS. In response to this trend, Disco is designing its products to meet country-specific requirements. We believe that these initiatives would benefit Disco's business

as customers can use Disco's products without environmental concerns. Disco not only manages its own emission but is also keeping track of the emissions made by the entire supply chain Disco is directly associated with. Disco disclosed that CO2 emission for the supply chain was 817,835 tons for fiscal year 2018. Out of the total CO2 emission, 88% was from emission caused by the use of Disco's products by its customers. In response, Disco is designing products that are more eco-friendly to reduce CO2 emission.

Social responsibility.

High-level corporate ethical standard. Disco not only stipulates a Code of Ethics but also has an Ethical Support System which aims at supporting employees who are facing difficult ethical issues or are involved in a situation likely to violate the Code of Ethics. Although some companies tend to neglect ethical responsibility in search of profits, we observe that Disco has been installing high-level ethical standards to its employees.

High welfare standard. Disco promotes to create a friendly environment in which employees can enjoy their work. Moreover, Disco has great consideration on childcare for its employees. For instance, Disco started a program which provides 100,000 yen maximum up to twice a year for 5 years since FY2007. Moreover, Disco has had a daycare center since FY2009 to help its employees fully focus on their work. These activities are promoted under the principle that a company, which is a member of the society, is responsible for bringing up children who will shoulder the generations ahead.

Flexible internal mobility which allows employees to build their own career. Although many Japanese companies tend to have strict restrictions in regards to department transfers, Disco allows employees to transfer between departments as long as they could agree with the destination and does not need to obtain a consent with the current department. This system encourages and allows its employees to pursue the career they want to pursue.

Local community contribution activities. Disco presents great interest and care toward the local community. As the firm aims to build a healthy relationship, they contribute to the local community in the following ways. Disco has been supporting and fundraising for disaster relief, commonly in the form of donations. Furthermore, they have organized 'outreach classes' by visiting elementary and junior high schools to provide lectures in health & safety issues and environmental problems that we confront in our daily life. Last but not least, since 2008, Disco showed their concern to deforestation through appropriate actions. Within the Hiroshima prefecture, movements for reforestation have continued which led to the establishment of "DISCO Forest".

Supplier satisfaction survey. Not only does Disco display efficient communication skills internally with its employees, but also puts effort to further improve relationships with all of the suppliers. The firm regularly conducts a questionnaire survey and later provides appropriate solutions accordingly. According to figures provided by Disco, more than 95% of Disco's partner suppliers answered that compared to last year, Disco has become closer as a desirable partner. Moreover, approximately 50% additionally noted that there has been visible improvements and progressed more than expected since last year.

Governance (Appx. 2, 5). Disco has a governance doctrine aimed at improving Disco's social status and facilitating better value exchanges between its stakeholders. The board consists of corporate directors and corporate auditors out of which four are internal and six (two for directors and four for auditors) are external. The auditors are all external, ensuring fairness and transparency. There are no women on the board as of FY2019 and this should be questioned. The governance structure is as depicted in the appendix.

Audit. The members of the board of auditors are all external and the members all participated in all of the meetings for audit and representative evaluation and this shows how they have a very high sense of responsibility.

Board of directors/management. The board of directors consist of 4 internal and 6 external directors. We believe that they have enough external directors meeting international standards. Although more than 50% of the board of directors are external, Kazuma Sekiya, the representative director is also the CEO of the company. This may not be an ideal situation since he has influence on managing directors, the board of directors may not have absolute independence in its decision making. Moreover, there does not seem to be any leader of the external directors although the representative of the board of directors is an internal member, Kazuma Sekiya. This situation is questionable since it may be difficult for the external directors to carry the voice of the shareholders. Overall, although there is no legal violation in terms of the independence of the board of directors, Disco shows a room for improvement in terms of independence between the board of directors and the managing directions.

Aptitude of board of directors (Appx. 2). All of the four managing directors and have reached the position by making progression. This seems to ensure the aptitude of directors in terms of product and industry knowledge, as well as business strategy spanning from product

Figure 21.

CORPORATE GOVERNANCE ASSESSMENT	
	GOVERNANCE QUALITY %
I. SHAREHOLDERS AND THE GENERAL	84%
II. MANAGEMENT BOARD	16.5%
III. SUPERVISORY BOARD	0%
IV. TRANSPARENCY & GOVERNANCE	40%
V. REPORTING & AUDIT	100%

Figure 22.

DISCO BOARD OF DIRECTORS	
KAZUMA SEKIYA	- REPRESENTATIVE DIRECTOR AND PRESIDENT, - CHIEF EXECUTIVE OFFICER (CEO), - CHIEF OPERATING OFFICER (COO), - CHIEF INFORMATION OFFICER (CIO), - GENERAL MANAGER, ENGINEERING R&D DIVISION
NOBORU YOSHINAGA	- SENIOR EXECUTIVE DIRECTOR, - GENERAL MANAGER, SALES DIVISION
HIDEYUKI SEKIYA	- EXECUTIVE DIRECTOR, - CHIEF SAFETY OFFICER (CSO), - GENERAL MANAGER, HIROSHIMA WORKS
TAKAO TAMURA	- EXECUTIVE DIRECTOR, - CHIEF FINANCIAL OFFICER (CFO), - CHIEF PRIVACY OFFICER (CPO), - GENERAL MANAGER, CORPORATE SUPPORT DIVISION

development to business management. On the other hand, the external directors cover finance, high-level science as well as accounting but legal domain. Though they cover most of the realms necessary for corporate governance, they seem to lack knowledge on legal issues. As Disco operates business internationally, it seems necessary to have a person with a speciality in international/environmental law.

APPENDIX 1a		Major growth trends	
	Technology	Explanation	Forecast
Vision		The topics page highlights the latest Kiru, Kezuru and Migaku technologies. Introducing DISCO's accumulated advanced application technologies in response to customers' needs.	-The latest Kiru, Kezuru and Migaku technologies will be improved to 10nm in the future bringing the continued growth of revenue.
Blade Dicing		Introducing various processing technologies to further improve quality and productivity with the current blade dicing, such as thin silicon dicing and measures to prevent contamination of the processing surface.	-The latest Kiru, Kezuru and Migaku technologies are able to enhance the quality of its products and also made its business very efficient it can be risky as it is vulnerable to market downturns as we discussed in financial analysis.
Laser Dicing		Laser dicing is a technology that DISCO has focused on in recent years as a pillar of Kiru technology, alongside blade dicing. Introducing processing technologies that utilize the special characteristics of lasers, such as improved processing speed and cutting of compound material.	-Strong market growth driven by 5G will benefit Disco significantly, because DISCO's quality of its products and also made its business very efficient.
Grinding		Introducing various grinding wheels and handling mechanisms to support the increase in demand for less than 100 µm thin grinding, and newly developed wafer grinding technologies.	
Stress Relief		Introducing various stress relief techniques with potential to compensate for die strength decline and increase in warpage amount, which are major issues associated with wafer thinning.	
DBG / SDBG		DBG/SDBG is a process that first half-cuts or stealth-dices the wafer and then separates the die during backside grinding. This is a reverse of the standard process where backside grinding is carried out before wafer cutting. It is capable of significantly lowering the risk of wafer breakage during grinding and handling, and of lowering chipping during die separation.	
Others		Introducing processing methods other than existing processes. DISCO continues to focus on the cutting edge of Kiru, Kezuru and Migaku technologies.	

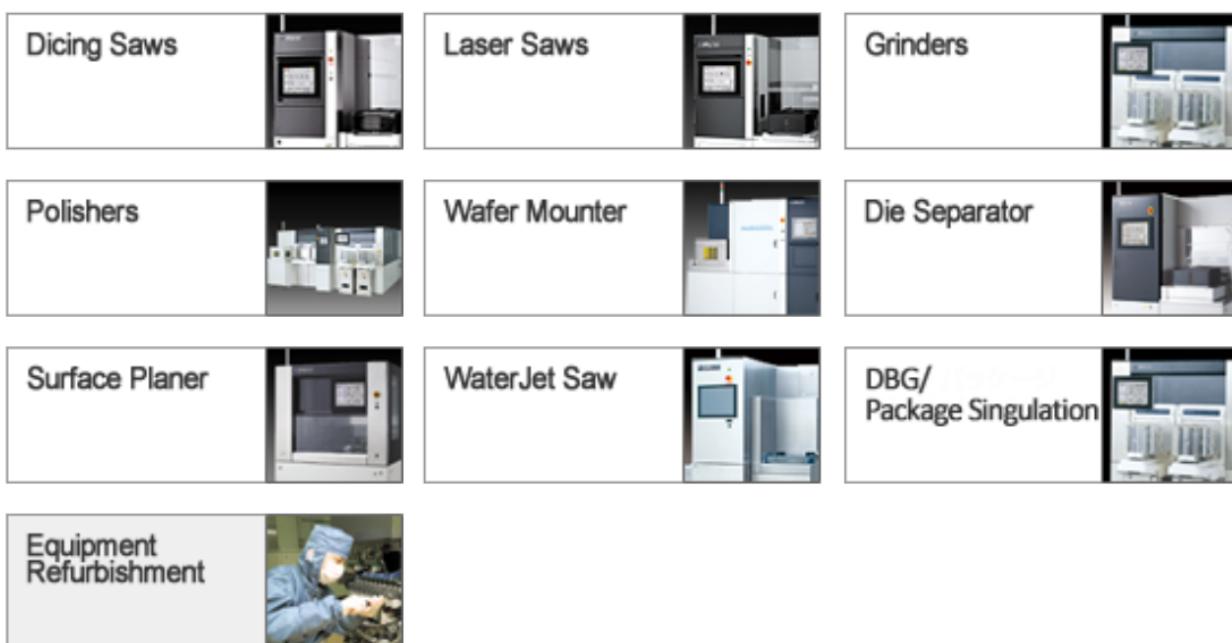
APPENDIX 2 Group Executive Committee and Board of Directors

Board of Directors		Title	Aptitude
Kazuma Sekiya		President, CEO, COO & Representative Director	Member of founding family
Noboru Yoshinaga		Senior Managing Director & General Manager-Sales	Expertise in marketing and customer relation
Hideyuki Sekiya		Managing Director & Chief Safety Officer	Member of founding family Industry and finance expertise
Takao Tamura		CFO, Managing Director & Chief Privacy Officer	Finance and management expertise
Ichiro Inasaki		Independent Outside Director	Ph.D in engineering Expertise on manufacturing engineering
Shinichi Tamura		Independent Outside Director	Expertise on biomedicine
Tsutomu Mimata		Corporate Auditor (external)	Finance and advertisement background
Tadao Takayanagi		Corporate Auditor (external)	Finance background
Yuusei Yamaguchi		Corporate Auditor (external)	Finance and management background
Kazuyoshi Tokimaru		Corporate Auditor (external)	Finance and compliance background

APPENDIX 3

Product Types

Precision Machines



Precision Processing Tools



 For Your Safety

[Rotation Speed Limit](#) >>

Other Products



APPENDIX 4

DISCO Subsidiaries

Identifier	Name	Country	Type
05HWQT-E	(0) DISCO Corp.	Japan	Public Company
081B84-E	(1) DISCO HI-TEC EUROPE GmbH	Germany	Subsidiary
081CKV-E	(1) Disco Hi-Tec UK Ltd.	United Kingdom	Subsidiary
083PWP-E	(1) Disco Hi-Tec America, Inc.	United States	Subsidiary
08LNQG-E	(1) Disco Technology Shanghai Co. Ltd.	China	Subsidiary
096D16-E	(1) Daiichi Components Ltd.	Japan	Subsidiary
09G7JF-E	(1) Disco Hi-Tec (Singapore) Pte Ltd.	Singapore	Subsidiary
0B5CV2-E	(1) Disco Hi-Tec Taiwan Co. Ltd.	Taiwan	Subsidiary
0B5JJR-E	(1) Disco Abrasive Systems KK	Japan	Subsidiary
0B5JN6-E	(1) KKM Investment Co., Ltd.	Japan	Subsidiary
0BHC26-E	(1) DSD Ltd.	Japan	Subsidiary
0BNP1Z-E	(1) Disco Engineering Service Ltd.	Japan	Subsidiary
0FQNG0-E	(1) Disco Hi-Tec (Thailand) Co. Ltd.	Thailand	Subsidiary
0FQWXT-E	(1) Disco Hi-Tec (Vietnam) Co. Ltd.	Vietnam	Subsidiary
0FR5X7-E	(1) Disco Hi-Tec Korea Corp.	South Korea	Subsidiary
0FRFNH-E	(1) Disco Hi-Tec (Malaysia) Sdn. Bhd.	Malaysia	Subsidiary
0FRLNH-E	(1) Disco Hi-Tec (China) Co. Ltd.	China	Subsidiary
0FRLTT-E	(1) Disco Hi-Tec Morocco SARL	Morocco	Subsidiary
0FRLWZ-E	(1) Disco Hi-Tec Philippines, Inc.	Philippines	Subsidiary
0JFNTG-E	(1) Disco Corp. /Subsidiaries 2/	Japan	Subsidiary

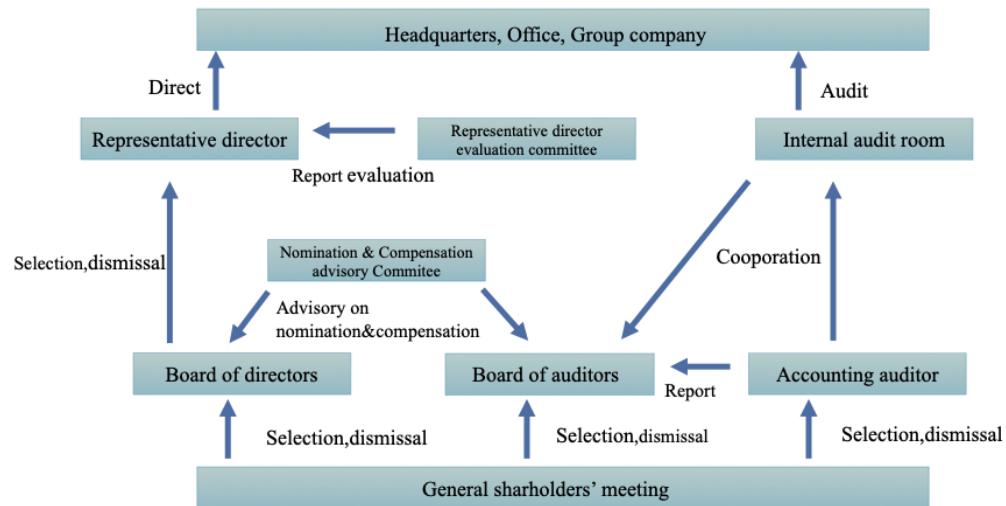
APPENDIX 5

Corporate Governance Assessment

Total Score for Social Responsibility:	Points	Max. points	(%)
Management Board	18.00	25.00	72%
Supervisory Board	15.00	25.00	60%
Transparency & Governance	20.00	25.00	80%
Reporting & Audit	20.00	25.00	80%
Total:	73.00	100.00	73%

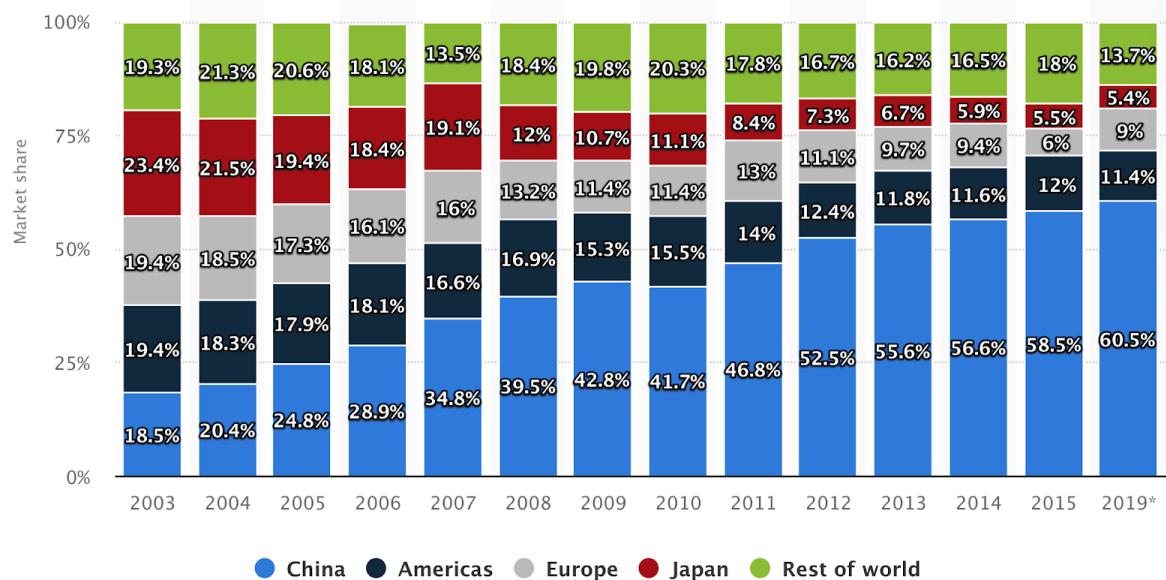
Assessment	
Management Board	It is generally good, but we believe that authority is concentrated too much on the CEO, Kazuma Sekiya.
Supervisory Board	It has great expertise in the semiconductor industry and finance yet does not seem to have as much expertise in law.
Transparency & Governance	It has great expertise in the semiconductor industry and finance yet does not seem to have as much expertise in law.
Reporting & Audit	All(4) the auditors and we can observe their sense of responsibility through 100% attendance rate of their meetings.

Governance Structure (Simplified)



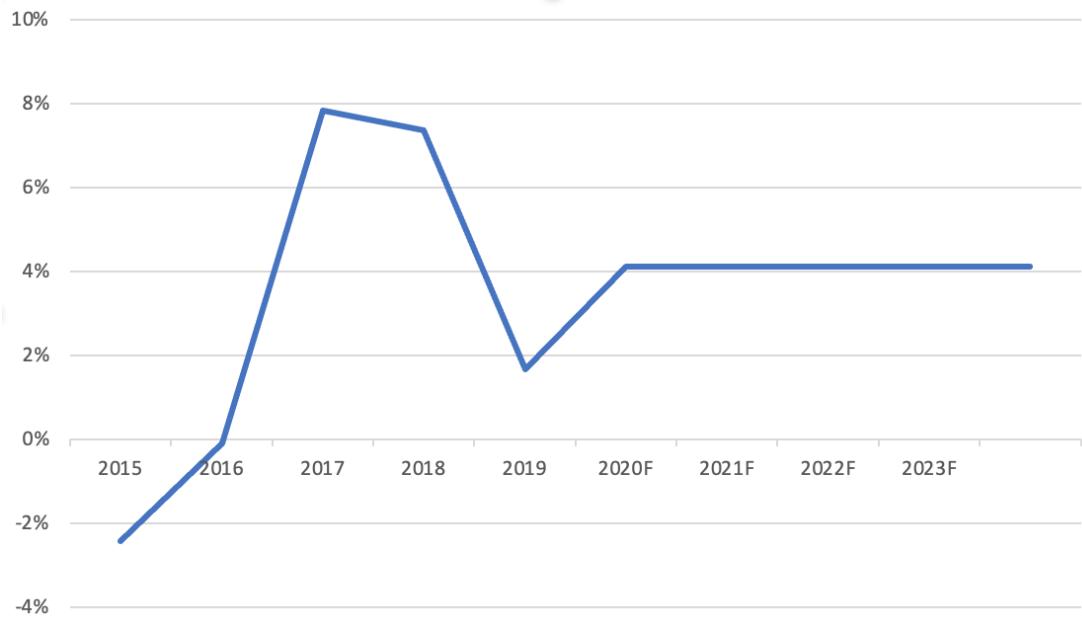
APPENDIX 6

Semiconductor Consumption Market Share Worldwide (%)



APPENDIX 7

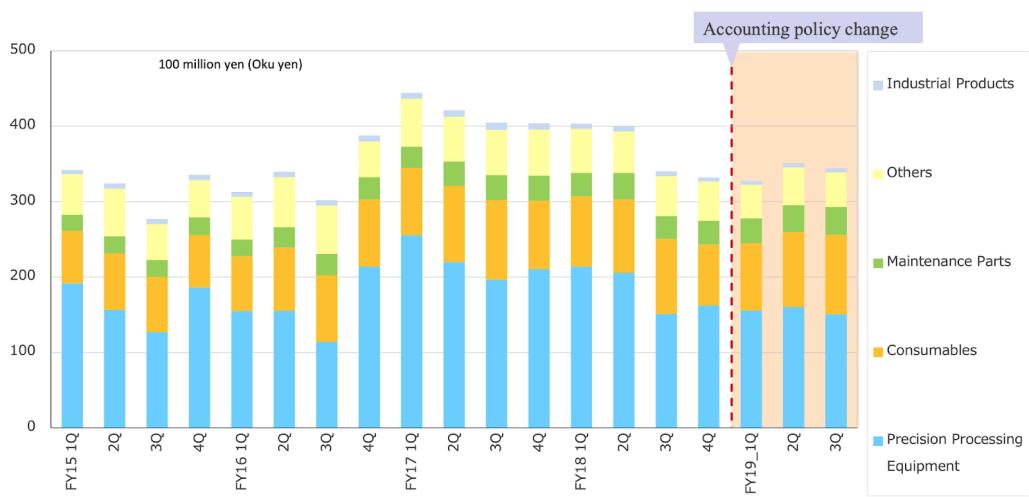
Sub-markets Growth Rate Comparison (%)



Source: Passport GMID Academic

APPENDIX 8

Sales Sub-market Breakdown



Source: DISCO

APPENDIX 9

Environmental Assessment

Total Score for Environmental Responsibility:	Points	Max. points	(%)
Environmental Management	19.00	25.00	76%
Environmental Activities	22.00	25.00	88%
Environmental Consideration in Products	23.00	25.00	92%
Data (energy usage and emission)	20.00	25.00	80%
Total:	85.00	100.00	85%

Environmental Management	Overall, Disco has been implementing various acts of management to ensure that they practice appropriate environmental responsibility.
Environmental Activities	Disco shows great effort into environmental activities. For instance, introducing solar power and reducing 1300 tons of CO2 can be counted toward to one of their major establishment.
Environmental Consideration in Products	Disco initiated guidelines to ensure environmental considerations and has noticed for its accomplishments. Hence, they are performing excellently.
Data (energy usage and emission)	Generally good. Yet, further improvement in statistics are believed to be reached in the future.

APPENDIX 10

Value Chain

Value Chain	Suppliers Mkt Cap(Million\$)	Competitors Mkt Cap(Million\$)	Partner Mkt Cap(Million\$)	Key customers Mkt Cap(Million\$)				
Semiconductors	1, SHIL-Japan 2, Aval Data 3, Hirata 4, Shanon 5, PlatHome 6, Lumentum Holdings	132 236 623 36 20 6782	1, TOKYO SEIMITSU CO., LTD. 2, Kulicke and Soffa Industries Inc.	1427 1680 3, Master Trust Bank of Japan, Ltd. 4, Muhlbauer holding	1, Sumitomo Mitsui Trust Hld 2, Daichi(Grocery stores) 3, Nanyo (4%) 4, Siliconware Precision Industries(%)	10,609 87 6,782	1, Mimasu Semiconductor Ind (5%) 2, Intel (5%) 3, Nanyo (4%) 4, Siliconware Precision Industries(%)	725 208,099 95 5376

Source: Factset

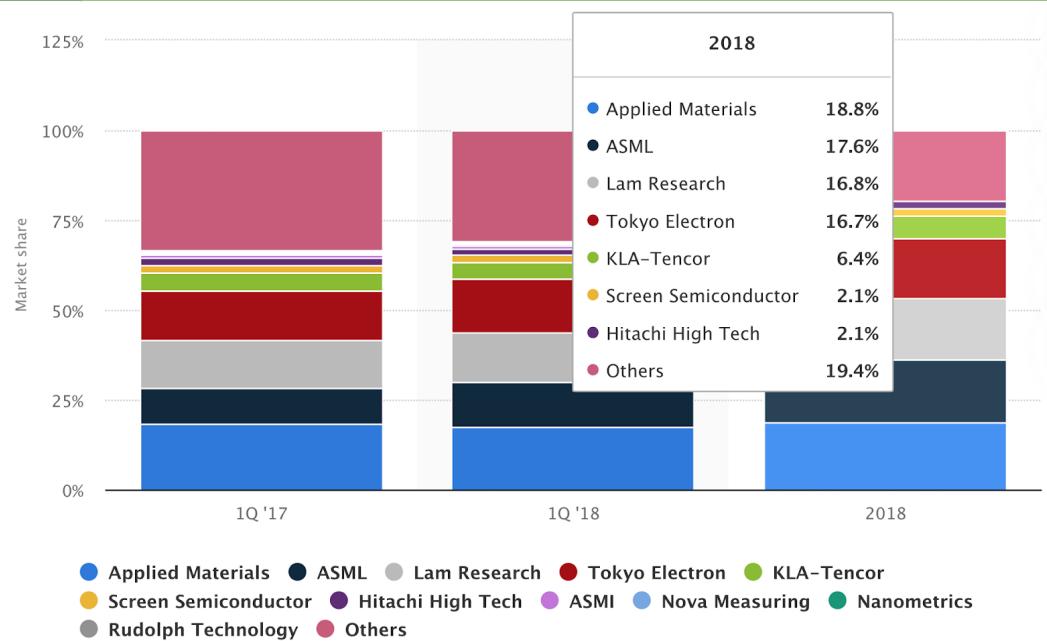
APPENDIX 11

SWOT Analysis

Strengths	Weakness
March 2016, Disco was awarded with the PSQ (Preferred Quality Supplier) for the third consecutive term	Boasts an extremely low rate of outsourced processing
Has an extremely low rate of outsourced processing	Heavy reliance on Asian, especially into the Chinese, market
Opportunities	Threats
Expanding trend in 5G, medical devices, auto-driving, phone, and computer industries	The growth of the semiconductor manufacturing equipment market is heavily dependent on the growth of the semiconductor market
Opportunities to penetrate and expand into the Western market	Economic fluctuations, such as the US-China trade war
	Competitive rivalry within the semiconductor industry

APPENDIX 12

Semiconductor Original Manufacturing Equipment Suppliers (Worldwide)



Source: Statista

APPENDIX 13

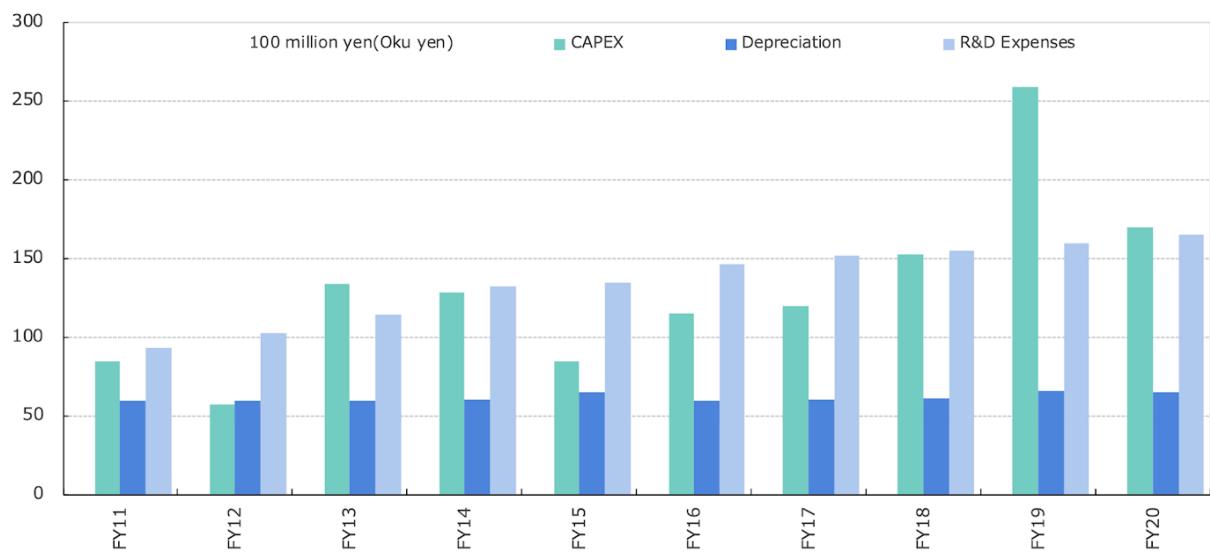
Various Metrics Versus Competitors

	Du Pont Analysis							
	Asset Turnover	Pretax Margin,(%)	Equity Multiplier	ROA(%)	ROE(%)	Earning Retention(%)	Reinvestment Rate(%)	
DISCO Corporation	0.53	27.13	1.19	10.39	12.38	43.08	7.57	
Tokyo Electron(Japan)	0.89	21.70	1.48	14.61	21.56	49.77	10.44	
Advantest(Japan)	0.84	21.23	1.54	16.21	24.89	69.64	17.30	
SCREEN(Japan)	0.89	2.65	2.06	1.40	2.84	72.06	0.27	
Applied Materials, Inc. (USA)	0.79	22.38	2.45	14.70	35.95	71.01	25.71	
Lam Research(USA)	0.76	25.65	2.70	16.96	45.74	69.54	32.40	
KLA(USA)	0.63	22.69	3.43	13.31	45.70	57.15	26.08	
Teradyne(USA)	0.84	22.91	1.83	17.02	31.14	86.18	27.05	
ASML(Netherlands)	0.55	23.40	1.76	12.12	21.39	61.04	10.45	
ASM International(Netherlands)	0.63	29.47	1.17	16.24	19.02	77.47	13.28	
Peer Average(Japan)	0.79	18.18	1.57	10.65	15.42	58.64	8.90	
Peer Average(International)	0.70	24.42	2.22	15.06	33.16	70.40	22.50	
Peer Average(All)	0.74	21.82	1.95	13.22	25.77	65.50	16.83	
	Profitability(%)							
	Gross margin	Operating Margin	Pretax Margin		Net profit margin			
DISCO Corporation	60.1	25.8	27.1		19.6			
Tokyo Electron(Japan)	40.1	21.0			21.7			16.4
Advantest(Japan)	53.9	21.3			21.2			19.4
SCREEN(Japan)	27.4	3.9			2.7			1.5
Applied Materials, Inc. (USA)	43.5	22.9			22.4			18.5
Lam Research(USA)	45.9	26.6			25.6			22.4
KLA(USA)	56.5	30.9			22.7			21.0
Teradyne(USA)	57.2	23.4			22.9			20.4
ASML(Netherlands)	43.4	23.6			23.4			21.9
ASM International(Netherlands)	49.7	29.9			29.5			25.6
Peer Average(Japan)	45.4	18.0			18.2			14.2
Peer Average(International)	49.4	26.2			24.4			21.6
Peer Average(All)	47.8	22.9			21.9			18.7
	Operating Metrics							
	Receivables turnover	Inventory turnover	Fixed Assets turnover	Total Assets turnover				
DISCO Corporation	4.7	1.3	1.7	0.5				
Tokyo Electron(Japan)	6.2	1.8	6.9	0.9				
Advantest(Japan)	5.6	2.2	7.2	0.8				
SCREEN(Japan)	3.5	2.1	5.3	0.9				
Applied Materials, Inc. (USA)	5.6	2.3	10.0	0.8				
Lam Research(USA)	5.7	3.2	8.7	0.8				
KLA(USA)	5.1	2.0	10.9	0.6				
Teradyne(USA)	7.0	5.6	7.0	0.8				
ASML(Netherlands)	4.5	1.7	5.8	0.6				
ASM International(Netherlands)	5.5	3.7	5.9	0.6				
Peer Average(Japan)	5.0	1.8	5.3	0.8				
Peer Average(International)	5.6	3.1	8.0	0.7				
Peer Average(All)	5.3	2.6	6.9	0.7				

Source: Factset

APPENDIX 14

R&D/CAPEX Forecast

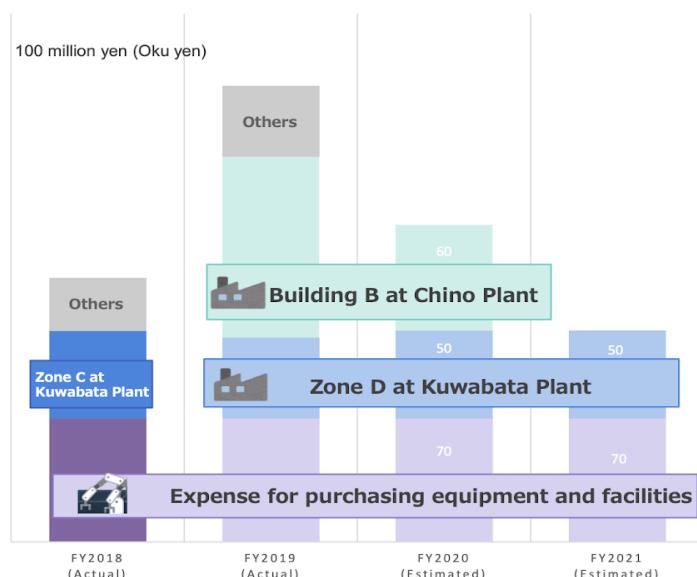


Forecast for FY20:

- Facilities investments: Approx. JPY 18 B, including construction of new buildings at Kuwabata and Chino (JPY 25.9 B in FY19).
- Depreciation: Approx. JPY 6.5 B. Expected to be similar to last year (JPY 6.6 B in FY19).
- R&D: Approx. JPY 16.5 B. We plan to invest proactively in R&D (JPY 15.9 B in FY19).

APPENDIX 15

CAPEX Expenses



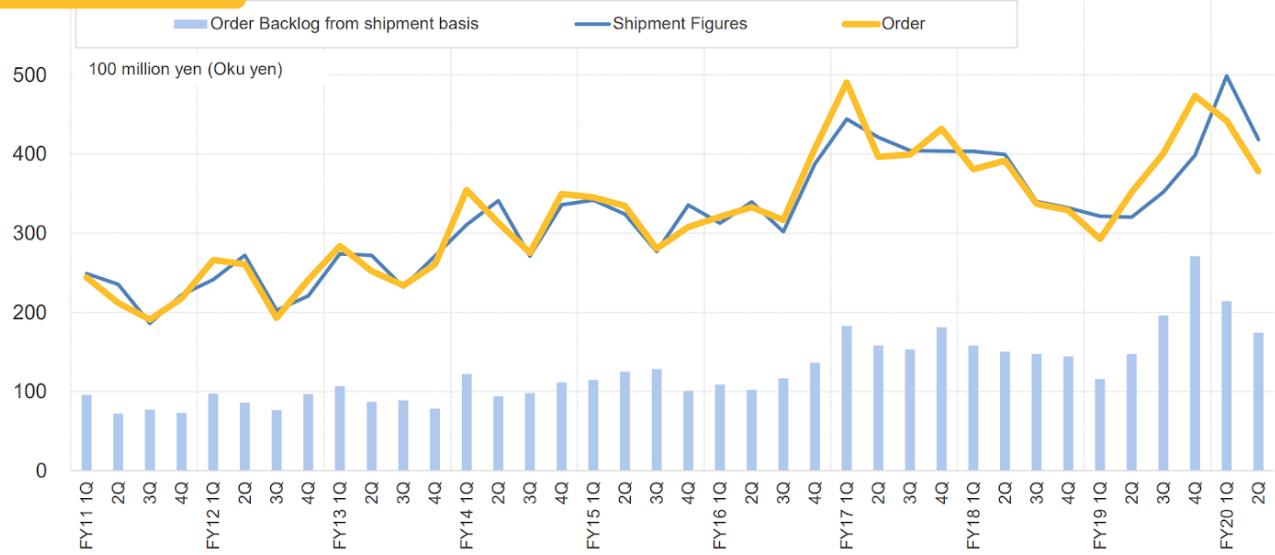
Forecast for FY20

- Expense for purchasing equipment and facilities
- Zone D at Kuwabata Plant: Plan to pay 1/3 of cost, corresponding to construction period
- Building B at Chino Plant: Plan to pay final payment upon completion.

APPENDIX 16

Quarterly Consolidated Shipment/Orders

Shipment Basis



Orders for 2Q in FY20:

Shipments:

Order backlog:

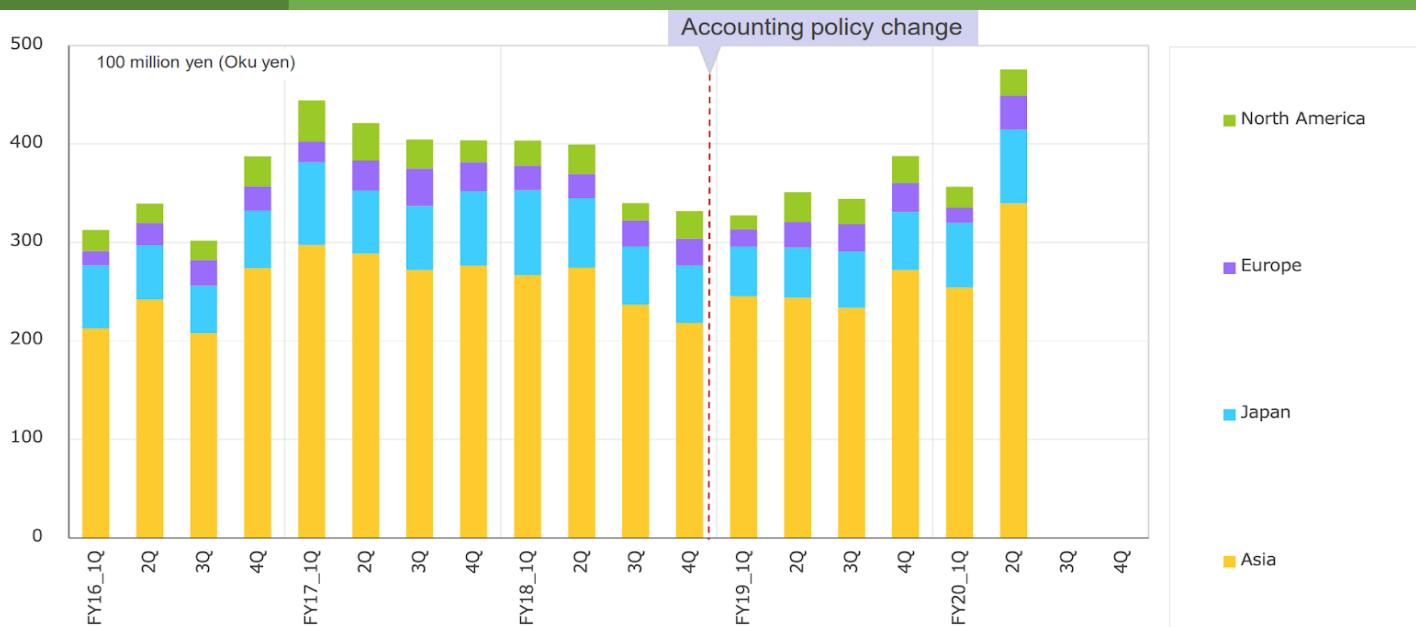
Approx. JPY 37,800 million,

Approx. JPY 41,800 million,

Approx. JPY 17,400 million (shipped amount excluded)

APPENDIX 17

Consolidated Sales Breakdown by Region



FY2020_2Q Overseas sales accounted for 84.3% of the total sales.

Source: Disco

APPENDIX 18

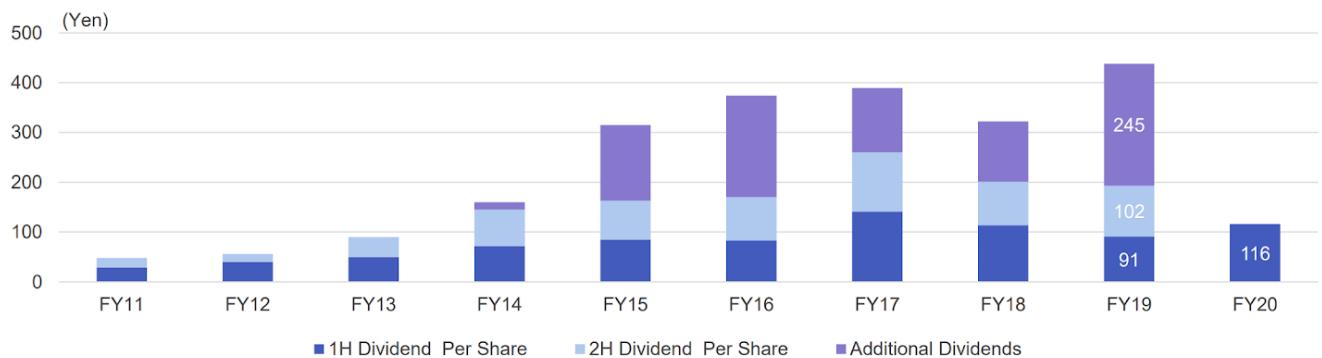
Dividend Policy and Dividend Payments

Dividend Policy

- Decisions concerning the distribution of surpluses are made at the general shareholders meetings, in the case of final dividends, and by the Board of Directors, in the case of interim dividends.
- 1. Adopting a performance-linked dividend policy and aiming at giving clearer priority to shareholder returns, our target dividend payout ratio is 25% of the consolidated half-yearly net income. There will be interim and final dividends, each of which will be equivalent to 25% of the half-yearly consolidated net income.
- 2. Irrespective of the level of income, a reliable dividend of ¥10 per half-year will be maintained. This means that the minimum yearly dividend will be ¥20.
- 3. Unless there is a loss, if the year-end balance of cash and deposits after payment of dividends and income taxes is greater than the projected funding requirements for the acquisition of technology resources, such as through patent purchases and investments in venture businesses, facility expansion, the retirement of interest-bearing debt, and other purposes, one-third of that surplus will be added to dividends.

[Remarks]

The ¥20 payout stipulated in our stable dividend policy may be reviewed if there are consolidated net losses for three consecutive years.



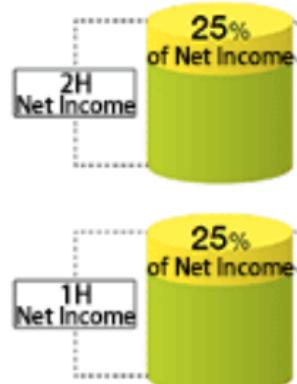
Current forecast:

FY20 interim JPY 116 (Actual), FY20 year-end Undetermined

Results from the previous year:

FY19 interim JPY 91, FY19 year-end JPY 347 (Additional dividend: JPY 245)

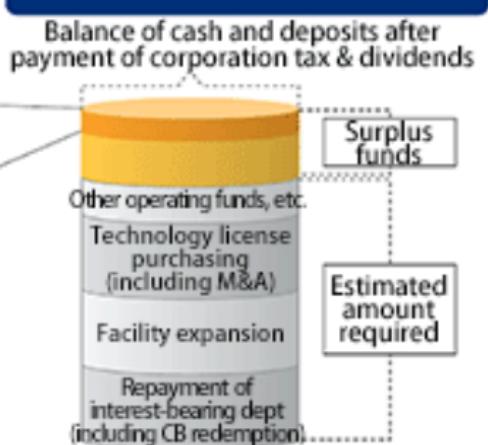
Income distribution linked to financial results



Annual dividend



Distribution of surplus funds

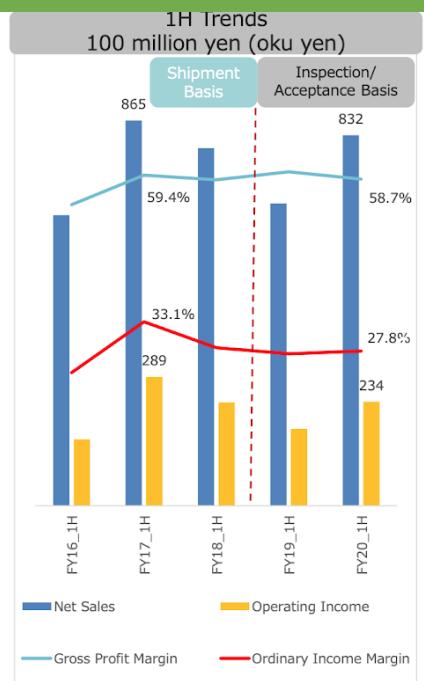
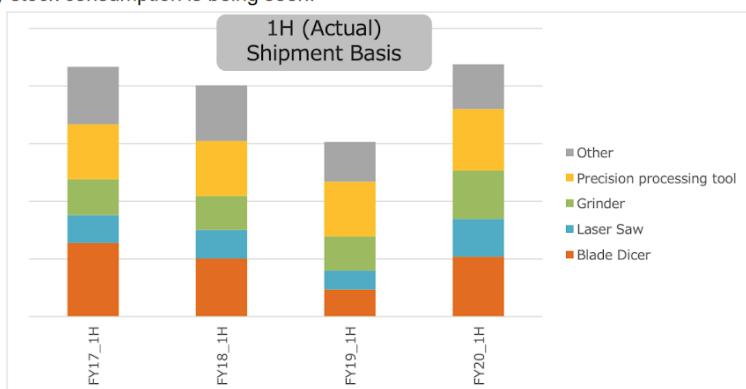


Source: Disco

APPENDIX 19

Summary of Business Environment and Results

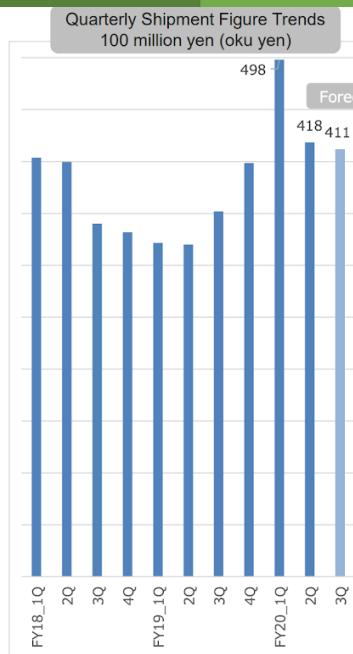
- Shipment trends: A new record was set for the half quarter total.
- Equipment: Mass production use by Asia OSATs was consistently steadily.
- Consumables: Customer demand for stock building was seen at the beginning of FY2020, but currently stock consumption is being seen.



- Sales remain high due to steadily shipment and smooth inspection.(second highest half quarter).
- High profitability has been maintained throughout the COVID-19 pandemic (1H GP margin: 58.7%).
- Midterm dividends are JPY 116, based on the dividend policy (JPY 91 in the previous year).

APPENDIX 20

Future Prospects for FY2020



- Shipment forecast: Relatively high level will continue.
- Equipment: OSAT willingness to invest for mass production is firm.
- Consumables: Customer facility operation rates and demands for end product should be monitored.
- Due to the trade friction between the US and China, some customers are re-examining their production base. Movement of facility investment and changes in supply chain should be monitored hereafter.
- COVID-19's effects on DISCO's performance have been minimal.
- To keep employee safe and maintain manufacturing and shipment systems, strict rules regarding coming in to the office and infection prevention have been adopted.
- Focus on strategies to maintain and strengthen the company during COVID-19
“BCM activities” “Will accounting” “PIM” “DISCO Values”

Source: Disco

APPENDIX 21

Financial Analysis



APPENDIX 22

Growth Forecast – Base Case

Income Statement

For the Fiscal Period Ending

Currency	2016 JPY	2017 JPY	2018 JPY	2019 JPY	2020 JPY	2021E JPY	2022E JPY	2023E JPY	2024 JPY	2025 JPY
Revenue	127,850.0	134,204.0	167,364.0	147,500.0	141,083.0	157,469.87	172,533.81	184,915.4	198,185.5	211,115.0
Annual Growth	2%	5%	25%	-12%	-4%	11.62%	9.57%	7.18%	6.52%	6.21%

APPENDIX 23

Growth Forecast – Grey Sky

Income Statement

For the Fiscal Period Ending

Currency	2016 JPY	2017 JPY	2018 JPY	2019 JPY	2020 JPY	2021E JPY	2022E JPY	2023E JPY	2024 JPY	2025 JPY
Revenue	127,850.0	134,204.0	167,364.0	147,500.0	141,083.0	149,596.38	163,907.12	175,669.63	187,130.19	198,757.09
Annual Growth	2%	5%	25%	-12%	-4%	6.03%	9.57%	7.18%	6.52%	6.21%

APPENDIX 24

Growth Forecast – Blue Sky

Income Statement

For the Fiscal Period Ending

Currency	2016 JPY	2017 JPY	2018 JPY	2019 JPY	2020 JPY	2021E JPY	2022E JPY	2023E JPY	2024 JPY	2025 JPY
Revenue	127,850.0	134,204.0	167,364.0	147,500.0	141,083.0	165,343.36	181,160.5	194,161.17	206,828.11	219,678.89
Annual Growth	2%	5%	25%	-12%	-4%	17.20%	9.57%	7.18%	6.52%	6.21%

Source: Team Analysis

APPENDIX 25 P&L Statement

Income Statement

	2016	2017	2018	2019	2020	2021E	2022E	2023E	2024E	2025E
Revenue	127,850.0	134,204.0	167,364.0	147,500.0	141,083.0	157,469.87	172,533.81	184,915.4	196,979.15	209,217.99
Cost Of Goods Sold	55,552.0	59,709.0	68,239.0	60,589.0	56,290.0	62,828.1	68,838.4	73,778.5	78,591.7	83,474.8
Gross Profit	72,298.0	74,495.0	99,125.0	86,911.0	84,793.0	94,641.8	103,695.4	111,136.9	118,387.4	125,743.2
EBITDA	36,797.0	37,276.0	56,999.0	44,733.0	43,018.0	51,351.33	59,183.43	67,511.21	74,262.3	80,203.3
EBIT	30,252.0	31,289.0	50,946.0	38,638.0	36,406.0	44,179.01	51,316.77	57,657.18	63,422.9	68,496.73
Effective Tax Rate %	24.6%	20.7%	26.6%	24.6%	27.6%	27.6%	27.6%	27.6%	27.6%	27.6%
Depreciation & Amort.	60.0	53.0	49.0	9.0	46.0	46.0	46.0	46.0	46.0	46.0
Net Income	23,092.0	24,203.0	37,171.0	28,824.0	27,653.0	27,653.0	27,653.0	27,653.0	27,653.0	27,653.0

APPENDIX 26 Forecast Assumptions

Forecast Assumptions											
For the Fiscal Period Ending		2016	2017	2018	2019	2020	2021E	2022E	2023E	2024	2025
Sale	% growth	2%	5%	25%	-12%	-4%	11.62%	9.57%	7.18%	6.52%	6.21%
EBIT	% growth	2%	5%	25%	-12%	-4%	21.4%	16%	12%	10%	8%
Depreciation & Amort.	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Effective Tax Rate %	24.6%	20.7%	26.6%	24.6%	27.6%	27.6%	27.6%	27.6%	27.6%	27.6%	27.6%
Capital Expenditure	-7%	-8%	-7%	-10%	-18%	-7%	-7%	-7%	-7%	-7%	-7%
Change in Net Working Capital	1.83%	-0.29%	-3.04%	2.51%	-3.99%	-4.02%	-4.10%	-4.10%	-4.10%	-4.10%	-4.10%

APPENDIX 27 Beta & WACC Calculation

Beta & WACC

Risk Free Rate	0%	2020/9/30
β	1.28	2020/9/30
Market Risk Premium	6.95%	2020/9/30

Cost of Equity = Risk Free Rate + β X Market Risk 8.916000%

Cost of Equity (rE)	8.916000%
Equity (E)	220681
Cost of Debt (rD)	0
Debt (D)	0
Corp. Tax (T)	23.20%
10y Japanese Government Bond	0.02%
$WACC = rE \times \{E/(E+D)\} + rD \times (1-T) \times \{D/(E+D)\}$	0.08916

Source: WACC, Risk Free Rate: market-risk-premia.com

Beta: Reuters

Calculation: WACC <http://www.market-risk-premia.com/theoretical-background.html>

Beta: The beta displayed on Reuters.com is calculated based on trailing 5-year prices, on a monthly basis, relative to the S&P 500.

Source: Reuters, WACC

APPENDIX 28

Balance Sheet

Balance Sheet						
Balance Sheet as of:						
	Mar-31-2016	Mar-31-2017	Mar-31-2018	Mar-31-2019	Mar-31-2020	Jun-30-2020
ASSETS						
Cash And Equivalents	67,188.0	77,718.0	91,574.0	91,380.0	87,909.0	82,382.0
Total Cash & ST Investments	67,188.0	77,718.0	91,574.0	91,380.0	87,909.0	82,382.0
Accounts Receivable	33,257.0	38,824.0	43,595.0	34,843.0	25,558.0	28,243.0
Total Receivables	33,257.0	38,824.0	43,595.0	34,843.0	25,558.0	28,243.0
Inventory	30,691.0	30,334.0	33,692.0	38,591.0	50,368.0	56,027.0
Deferred Tax Assets, Curr.	3,806.0	3,734.0	4,361.0	-	-	-
Other CurrentAssets	3,391.0	4,029.0	5,812.0	4,981.0	6,155.0	4,294.0
Total Current Assets	138,333.0	154,639.0	179,034.0	169,795.0	169,390.0	170,946.0
Net Property, Plant & Equipment	64,834.0	66,223.0	69,264.0	76,866.0	93,415.0	94,536.0
Long-term Investments	4,185.0	4,029.0	7,635.0	6,694.0	5,547.0	9,288.0
Other Intangibles	509.0	588.0	511.0	400.0	319.0	286.0
Deferred Tax Assets, LT	91.0	267.0	109.0	4,122.0	5,052.0	-
Other Long-TermAssets	1.0	2.0	2.0	1.0	2.0	2.0
Total Assets	267,953.0	285,748.0	266,555.0	268,189.0	274,325.0	275,659.0
LIABILITIES						
Accounts Payable	13,294.0	17,828.0	20,516.0	16,546.0	16,027.0	19,186.0
Accrued Exp.	4,487.0	5,737.0	8,810.0	7,967.0	9,992.0	6,481.0
Curr. Port of LT Debt	1,876.0	8,989.0	-	-	-	-
Curr. Income Taxes Payable	4,272.0	3,323.0	10,209.0	1,782.0	3,509.0	2,800.0
Other CurrentLiabilities	6,517.0	7,845.0	10,822.0	11,321.0	17,377.0	25,362.0
Total Current Liabilities	30,246.0	43,722.0	50,357.0	37,616.0	46,905.0	53,829.0
Working capital turnover rate	1.2	1.2	1.3	1.1	1.1	1.2
Long-Term Debt	8,583.0	-	-	-	-	-
Pension & Other Post-Retire.Benefits	13.0	14.0	-	-	-	-
Other Non-CurrentLiabilities	1,078.0	696.0	935.0	456.0	531.0	548.0
Total Liabilities	39,920.0	44,432.0	51,292.0	38,072.0	47,436.0	54,377.0
Common Stock	20,063.0	20,374.0	20,651.0	20,663.0	20,793.0	20,926.0
Additional Paid In Capital	22,051.0	22,362.0	22,639.0	22,651.0	22,781.0	22,914.0
Retained Earnings	123,245.0	136,247.0	157,919.0	173,739.0	181,239.0	175,237.0
Treasury Stock	(15.0)	(18.0)	(25.0)	(25.0)	(29.0)	(29.0)
Comprehensive Inc. and Other	2,633.0	2,258.0	3,969.0	2,932.0	1,967.0	1,480.0
Total Common Equity	167,977.0	181,223.0	205,153.0	219,960.0	226,751.0	220,528.0
Minority Interest	56.0	93.0	110.0	148.0	138.0	153.0
Total Equity	168,033.0	181,316.0	205,263.0	220,108.0	226,889.0	220,681.0
Total Liabilities And Equity	267,953.0	285,748.0	266,555.0	268,189.0	274,325.0	275,659.0
Supplemental Items						
Total Shares Out on Filing Date	35.8	35.9	35.9	35.9	36.0	36.0
Total Shares Out on Balance Sheet Date	35.8	35.9	35.9	35.9	36.0	36.0
Book Value/Share	4,694.06	5,052.79	5,710.97	6,122.54	6,307.26	6,124.81
Tangible Book Value	167,468.0	180,635.0	204,642.0	219,560.0	226,432.0	220,242.0
Tangible Book Value/Share	4,679.84	5,036.39	5,696.74	6,111.41	6,298.39	6,116.87
Total Debt	10,259.0	8,989.0	0	0	0	0
NetDebt	(56,929.0)	(68,729.0)	(91,574.0)	(91,380.0)	(87,909.0)	(82,382.0)
DebtEquiv. of Unfunded Proj. Benefit Obligation	(419.0)	(531.0)	(613.0)	(822.0)	(911.0)	NA
Total Minority Interest	56.0	93.0	110.0	148.0	138.0	153.0
Raw Materials Inventory	12,343.0	13,108.0	16,943.0	19,066.0	18,677.0	19,723.0
Work in Progress Inventory	10,366.0	10,394.0	9,656.0	12,585.0	14,373.0	14,087.0
Finished Goods Inventory	7,962.0	6,852.0	7,093.0	6,940.0	17,518.0	22,217.0
Full Time Employees	3,027	3,119	3,306	3,619	3,863	NA
Accum.Allowance for Doubtful Accts	208.0	71.0	52.0	57.0	56.0	55.0
Order Backlog	10,067.0	13,649.0	18,102.0	14,443.0	48,996.0	NA

Source: Factset

APPENDIX 29

Cash Flow Projections

Cash Flow

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Net Income	30,612.0	30,566.0	50,724.0	38,256.0	38,277.0	46,387.96	46,387.96	60,540.04	66,594.0	71,921.56
Cash from Investing	(7,174.0)	(6,342.0)	(12,673.0)	(14,513.0)	(25,660.0)	(13,272.4)	(14,492.1)	(16,122.1)	(16,811.9)	(17,271.7)
Cash from Financing	(6,734.0)	(11,956.0)	(24,053.0)	(12,982.0)	(10,580.0)	(11,808.9)	(12,938.5)	(13,867.0)	(14,771.7)	(15,689.5)
Net Increase(decrease) in cash	¥ 16,704.0	¥ 12,268.0	¥ 13,998.0	¥ 10,761.0	¥ 2,037.0	¥ 21,306.7	¥ 18,957.3	¥ 30,550.9	¥ 35,010.4	¥ 38,960.3
Opening Cash Balance	¥ 42,177	¥ 58,881.0	¥ 71,149.0	¥ 85,147.0	¥ 95,908.0	¥ 97,945.0	¥ 119,251.7	¥ 138,209.0	¥ 168,759.9	¥ 203,770.3
Closing Cash Balance	¥ 58,881.0	¥ 71,149.0	¥ 85,147.0	¥ 95,908.0	¥ 97,945.0	¥ 119,251.7	¥ 138,209.0	¥ 168,759.9	¥ 203,770.3	¥ 242,730.6
Unlevered Free Cash Flow	12,164.4	15,163.2	31,025.7	11,029.3	7,151.3	25,594.1	28,038.1	30,046.9	32,004.1	33,989.8

APPENDIX 30

DCF Calculation

Income Statement

	2016	2017	2018	2019	2020	2021E	2022E	2023E	2024E	2025E	Term. Val.
Revenue	127,850.0	134,204.0	167,364.0	147,500.0	141,083.0	157,469.87	172,533.81	184,915.4	196,979.15	209,217.99	
Cost Of Goods Sold	55,552.0	59,709.0	68,239.0	60,589.0	56,290.0	62,828.1	68,838.4	73,778.5	78,591.7	83,474.8	
Gross Profit	72,298.0	74,495.0	99,125.0	86,911.0	84,793.0	94,641.8	103,695.4	111,136.9	118,387.4	125,743.2	
EBITDA	36,797.0	37,276.0	56,999.0	44,733.0	43,018.0	51,351.33	59,183.43	67,511.21	74,262.3	80,203.3	
EBIT	30,252.0	31,289.0	50,946.0	38,638.0	36,406.0	44,179.01	51,316.77	57,657.18	63,422.9	68,496.73	
Effective Tax Rate %	24.6%	20.7%	26.6%	24.6%	27.6%	27.6%	27.6%	27.6%	27.6%	27.6%	
Depreciation & Amort.	60.0	53.0	49.0	9.0	46.0	46.0	46.0	46.0	46.0	46.0	
Net Income	23,092.0	24,203.0	37,171.0	28,824.0	27,653.0	27,653.0	27,653.0	27,653.0	27,653.0	27,653.0	
Unlevered Free Cash Flow	12,164.4	15,163.2	31,025.7	11,029.3	7,151.3	25,594.1	28,038.1	30,046.9	32,004.1	33,989.8	
					Average Growth	6%					1,612,780.59

APPENDIX 31

Multiples Valuation

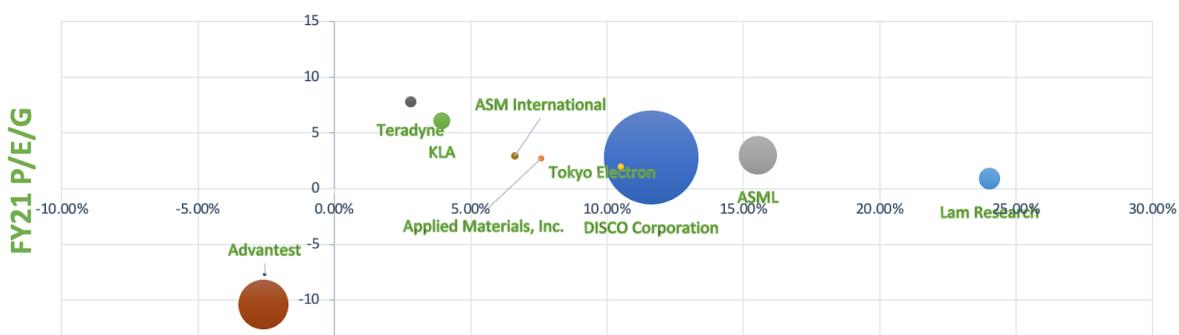
Multiples Valuation

	PE FY20E	Growth FY21	Market Cap (Bn)	P/E/G FY21	EV/EBITDA FY1
DISCO Corporation	32.5	11.62%	924.7	3	17.73563203
Applied Materials, Inc.	20.68	7.58%	4.27	3	14.64
ASML	46.51	15.53%	150.08	3	33.91
Tokyo Electron	20.68	10.50%	4.27	2	10.89
Lam Research	21.58	24.02%	47.47	1	15.03
KLA	23.96	3.94%	28.69	6	15.04
Advantest	19.66	-2.56%	1.03	(8)	10.73
SCREEN	27.13	-2.61%	253.41	(10)	10.57
Teradyne	21.79	2.79%	12.67	8	17.83
ASM International	19.5	6.61%	5.78	3	10.27
Peer Average	25.4	7.74%	143.237	1	15.6645632
Peer Median (w/o VAT)				2.76	
Value				1043459.652	

APPENDIX 32

Multiples analysis

Multiple analysis



Earning Growth FY21 (Circle size represents Market Cap)

APPENDIX 33

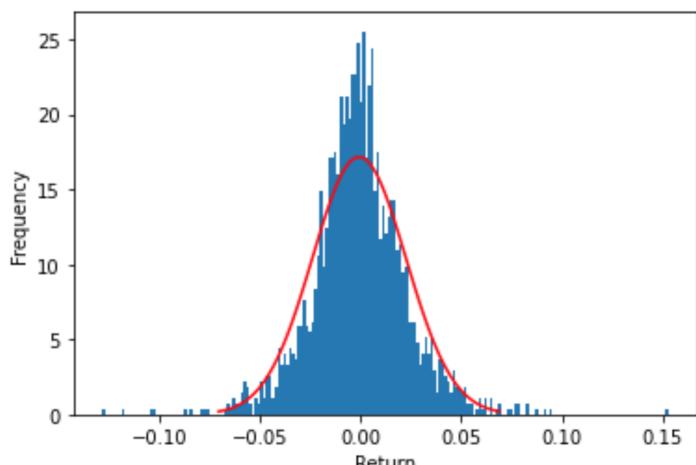
Sensitivity analysis

SENSITIVITY ANALYSIS

WACC	9.80%	9.90%	10.00%	10.10%	10.20%	10.30%	10.40%	10.50%	10.60%	
PERPETUAL GROWTH RATE	6.50%	54%	50%	45%	41%	38%	34%	31%	27%	24%
	6.40%	50%	46%	42%	38%	34%	31%	28%	25%	22%
	6.30%	46%	42%	38%	35%	31%	28%	25%	22%	19%
	6.20%	43%	39%	35%	32%	29%	26%	23%	20%	17%
	6.10%	39%	36%	32%	29%	26%	23%	20%	17%	15%
PERPETUAL GROWTH RATE	6.00%	36%	33%	29%	26%	23%	21%	18%	15%	13%
	5.90%	33%	30%	27%	24%	21%	18%	16%	13%	11%
	5.80%	30%	27%	24%	21%	19%	16%	13%	11%	9%
	5.70%	27%	24%	22%	19%	16%	14%	11%	9%	7%
	5.60%	25%	22%	19%	17%	14%	12%	9%	7%	5%
	5.50%	22%	20%	17%	14%	12%	10%	8%	6%	4%

APPENDIX 34

Value at Risk (VaR) and Expected Shortfall (CVaR)



$$\text{VaR}_\alpha(X) = - \inf \{x \in \mathbb{R} : F_X(x) > \alpha\} = F_Y^{-1}(1 - \alpha).$$

$$CVaR = \frac{1}{1 - c} \int_{-1}^{VaR} xp(x) dx$$

where:

$p(x)dx$ = the probability density of getting a return with value "x"

c = the cut-off point on the distribution where the analyst sets the VaR breakpoint

VaR = the agreed-upon VaR level

In Value at risk 99.99% Actual loss won't exceed: -12.64%

In Value at risk 99% Actual loss won't exceed: -5.96%

In Value at risk 95% Actual loss won't exceed: -3.80%

In Value at risk Losses expected to exceed -3.80% 18.25 out of 365 days

In Expected Shortfall (CVaR) 99.99% Actual loss won't exceed: -12.83%

In Expected Shortfall (CVaR) 99% Actual loss won't exceed: -7.76%

In Expected Shortfall (CVaR) 95% Actual loss won't exceed: -5.29%

In Expected Shortfall (CVaR) Losses expected to exceed -5.29% 18.25 out of 365 days