

Assessment of Waste Management Performance of Companies

by

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Executive Summary

According to the 2030 Agenda for Sustainable Development Goals (SDGs), a need for improved waste management was highlighted in SDGs 6, 11 and 12. In this context, the EU commission defines the circular economy targets of the member nations as 65% recycling and 35% waste-to-energy. The concept, therefore, is to “move away from landfills”¹.

Monitoring the progress of companies that are major contributors to the environment and the waste that is generated is key to achieve sustainability. In the past few decades, many indicators have been developed to analyze waste management performance of different companies. In addition, in 2003, Bloomberg introduced the Environmental, Social and Governance (ESG) indicators, that consider other factors than the financial indicators in the decision-making process. However, the ESG indicators do not consider waste management that is an important pillar in the nexus of sustainability.

The Sustainability Accounting Standards Board (SASB) was founded in 2011, with a goal to provide industry-specific metrics with emphasis on the waste management performance. In our analysis, eight industries were selected and assessed from the SASB Materiality Map. The SASB navigator was used to evaluate and rate the waste management performance of several companies in the selected industries were found in the SASB Navigator. The financial performance of the companies was considered, such as revenues and growth rate. Data were obtained from the Bloomberg Terminal. The results are presented as matrices of Revenue VS. Waste Management score and Growth Rate VS. Waste Management score, with the upper right quadrant representing companies with relatively high financial indicators and relatively high waste management performance.

Most leaders in all eight industries are making efforts on moving away from landfills for improving their waste management performance. For example, they initiated projects on higher recycling and reuse rate, on donating unsold food to those in need, and on

developing advanced technologies for the recovery of energy from wastes.

Additionally, since waste to energy is essential for sustainable waste management, SASB should consider including landfilling and waste-to-energy as one of the metrics of waste management performance.

Key Words: Waste Management, SASB, Industry-Based Indicator, Waste-to-Energy

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1. Background

1.1 Evolution and Definition of ESG indicator

Back in the 1500s, the idea of Ethical Investing was implemented as a primary filter by investors to regulate companies and corporations². Later in the 1960s, investors began to realize that socially responsible investing (SRI) would potentially help them make higher returns, and corporations with higher socially responsible ratings tended to develop more steadily in the long run.

Then, the idea of developing an indicator to address Environmental, Social and Governance issues on the corporate level emerged around 2003.

Azapagic, A. (2003)³ proposed a general framework for a Corporate Sustainability Management System (CSMS), to translate the general sustainable development principles into corporate practice with a systematic, step-by-step guidance.

Bockstaller, C., & Girardin, P. (2003)⁴ argued that the environmental indicators would only be helpful if they have been validated through their method of “design, output, end use” validation for different indicators.

Figge, F., & Hahn, T. (2004)⁵ proposed Sustainable Value-Added way of measuring corporate contributions among economic, environmental and social aspects. And Kempf, A., & Osthoff, P. (2007)⁶ gained 8.7% higher returns per year by applying the strategy of buying stocks with high socially responsible ratings (SRI) and selling stocks with low SRI, providing evidence that indicators like SRI would potentially help us gain higher return in our investment.

Herva, M., Franco, A., Carrasco, E. F., & Roca, E. (2011)⁷ reviewed four main groups of corporate level environmental indicators developed and used in the past few years, described and highlighted the situations most suitable for different kinds of indicators.

Meanwhile, organizations like MSCI and Bloomberg started to build their own system to disclose Environmental, Social and Governance information from annual Corporate Sustainable Responsibility (CSR) reports, generating an integrated ESG indicator which they hope could be widely applied for all companies as well as being useful for ESG issue analysis.

The integrated ESG indicators changed the way people understand and analyze the ESG issues and engaged more companies in ESG information disclosure.

In 2010, Lydenberg, S. D., Rogers, J., & Wood, D. (2010)⁸ co-authored a white paper From Transparency to Performance: Industry-Based Sustainability Reporting on Key Issues, describing the importance of creating metrics for every industry. They believe that the ESG indicator should be more industry-specific to help us focus on what really mattered for that industry.

Their work received support from many corporations and investors including Michael Bloomberg in their sustainability reporting. Finally, Jean Rogers founded the Sustainability Accounting Standards Board (SASB) in 2011, aimed to push the ESG information disclosure and analysis a step further.

1.2 Introduction to MSCI & Bloomberg ESG indicators and SASB

It's not easy but increasingly important to include waste management data, even in the most widely used ESG indicators developed by MSCI and Bloomberg. First, the need for improved waste management was highlighted in SDGs and many other Environmental Protection organizations, as well as for many investors and the public who embrace a sustainable future. However, companies that didn't perform well in waste management issues would be reluctant to disclose their detailed information. Because it could negatively influence their stock price and public trust.

As we've discussed in the previous part, MSCI and Bloomberg provided integrated ESG indicators. And their goal is to bring transparency in Environmental, Social and Governance disclosure as well as consistency in the disclosure standardization. Therefore, we may take a look at their efforts.

As is shown in Fig. 1, picture on the left is the MSCI ESG score card, with an ESG rating on the top right, ranging from CCC to AAA, and detailed factors under Environment, Social, and Governance issues on the left, such as product carbon footprint and labor management. And the picture on the right is the Bloomberg ESG score card, with an ESG Score on the top right chart, the company's ESG performance compared with its own history and peers on the top left chart, and the different metrics under Environment, Social, and Governance issues at the bottom, such as GHG/Revenue and women employment percentage. For example, Toyota Motor got a BBB ESG rating in MSCI and a 43.8 ESG Disclosure score in Bloomberg Terminal, showing that Toyota is performing average among its peers.

Though MSCI and Bloomberg tried to make their ESG indicators easy to use by incorporating different aspects of E, S and G information into one result, most investors found the MSCI and Bloomberg analysis too general to make any beneficial impact on their investment decision-making process. For example, companies A and B in XYZ industry could perform the same in ESG rating and score, but A performs much better than B in Environment issues, while B outperforms A in Social issues. This means their ESG indicator didn't behave well in specific problems. Additionally, we could tell that the two organizations are analyzing ESG issue in quite different metrics, which might need further standardization.

In Bloomberg Terminal, it also missed information of some flows which are of great importance for measuring this sector's environmental impact, such as plastic recycling rate, hazardous waste control.

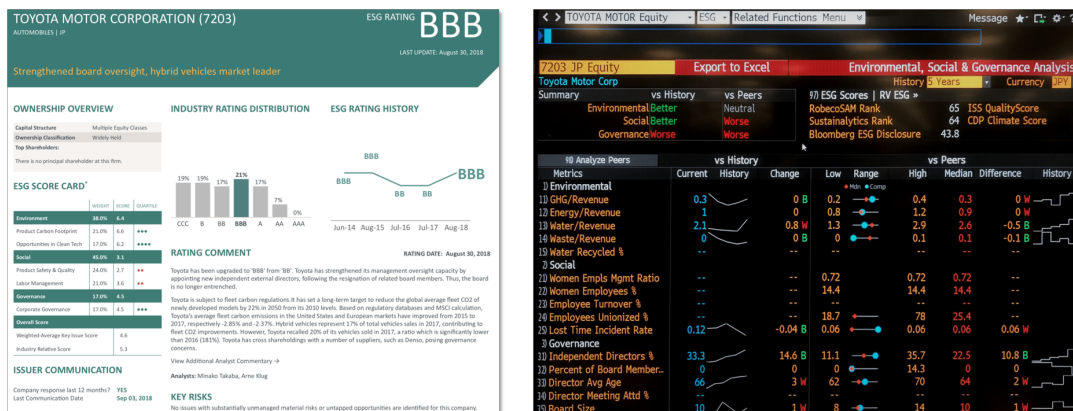


Fig. 1 MSCI and Bloomberg ESG indicators

After the release of the white paper From Transparency to Performance: Industry-Based Sustainability Reporting on Key Issues, describing the importance of creating metrics for every industry, people tend to figure out that different industries are faced with their unique issue, and thus need more specific metrics that focus on them. Also, the organization which integrates the ESG information should work closely with all the companies to give them proper guidance on data disclosure. That was what SASB has started doing since 2011.

1.3 Introduction to SASB Industry Standards & Materiality Map

1.3.1 SASB Industry Standards and Universe of Sustainability Issues

From SASB's Industry Standards preface, they committed to bringing consistency and transparency to sustainability performance disclosure, and providing standards that enable measurable, comparable, and decision-useful environmental, social, and governance (ESG) information for investors to assess risk and make more informed investment choices.⁹

In order to realize this commitment, they spent years working on providing detailed Industry Standards and Universe of Sustainability Issues.

For the Industry Standards, they brought a comprehensive and detailed categorization for all the companies, which has 10 sectors, including Health Care, Financials, Technology & Communications, Non-Renewable Resources, Transportation, Services, Resource Transformation, Consumption, Renewable Resources & Alternative Energy, and Infrastructure. And these sectors are further categorized into 77 industries.

For the Universe of Sustainability Issues, they set 5 broad issues which cover the issues they considered important in the ESG data disclosure, including Environment, Social Capital, Human Capital, Business Model & Innovation, and Leadership & Governance. Also, these broad issues are further expanded into 26 detailed identified issues.

1.3.2 Materiality Map

Frankly speaking, a material metric¹⁰ is the metric that SASB had engaged its stakeholders to gather insight on the relative importance of specific ESG issues.

After in-depth cooperation with companies in 77 industries, they established the Materiality Map¹¹ as shown in Fig. 2, with their Universe of Sustainability Issues¹² on the vertical direction, and 10 sectors, including all 77 industries based on their standardization in Industry Standards¹³, on the horizontal direction.

In Fig.2, the darkest squares represent issues that are likely to be material for more than 50% of industries in sector. The lighter squares represent issues that are likely to be less material for fewer than 50% of industries in sector. And the white squares represent issues that are not likely to be material for any of the industries in that sector.

Therefore, we could tell the topics that are mostly discussed for a specific sector or industry from this Map, saving our time for evaluating more important factors

As is shown in Fig. 3, if we click a specific sector, it would expand into different industries within this sector.

And we could have more detailed results on the exact industries that are likely to have material issues for a specific topic.

		Consumer Goods	Extractives & Minerals Processing	Financials	Food & Beverage	Health Care	Infrastructure	Renewable Resources & Alternative Energy	Resource Transformation	Services	Technology & Communications	Transportation
Dimension	General Issue Category ⁽¹⁾	Click to expand	Click to expand	Click to expand	Click to expand	Click to expand	Click to expand	Click to expand	Click to expand	Click to expand	Click to expand	Click to expand
Environment	GHG Emissions											
	Air Quality											
	Energy Management											
	Water & Wastewater Management											
	Waste & Hazardous Materials Management											
Social Capital	Ecological Impacts											
	Human Rights & Community Relations											
	Customer Privacy											
	Data Security											
	Access & Affordability											
Human Capital	Product Quality & Safety											
	Customer Welfare											
	Selling Practices & Product Labeling											
	Labor Practices											
	Employee Health & Safety											
Business Model & Innovation	Employee Engagement, Diversity & Inclusion											
	Product Design & Lifecycle Management											
	Business Model Resilience											
	Supply Chain Management											
	Materials Sourcing & Efficiency											
Leadership & Governance	Physical Impacts of Climate Change											
	Business Ethics											
	Competitive Behavior											
	Management of the Legal & Regulatory Environment											
	Critical Incident Risk Management											
	Systemic Risk Management											

Fig. 2 SASB Materiality Map

		Infrastructure							Renewable Resources & Alternative Energy	Resource Transformation	Services	Technology & Communications	
Dimension	General Issue Category ⁽¹⁾	Electric Utilities & Power Generators	Engineering & Construction Services	Gas Utilities & Distributors	Home Builders	Real Estate	Real Estate Services	Waste Management	Water Utilities & Services	Click to expand	Click to expand	Click to expand	Click to expand
Environment	GHG Emissions												
	Air Quality												
	Energy Management												
	Water & Wastewater Management												
	Waste & Hazardous Materials Management												
Social Capital	Ecological Impacts												
	Human Rights & Community Relations												
	Customer Privacy												
	Data Security												
	Access & Affordability												
Human Capital	Product Quality & Safety												
	Customer Welfare												
	Selling Practices & Product Labeling												
	Labor Practices												
	Employee Health & Safety												
Business Model & Innovation	Employee Engagement, Diversity & Inclusion												
	Product Design & Lifecycle Management												
	Business Model Resilience												
	Supply Chain Management												
	Materials Sourcing & Efficiency												
Leadership & Governance	Physical Impacts of Climate Change												
	Business Ethics												
	Competitive Behavior												
	Management of the Legal & Regulatory Environment												

Fig. 3 SASB Materiality Map Expansion

1.3.3 SASB's Navigator

SASB Navigator is a toolkit developed by SASB where we could find key evidence, analysis of corporate disclosure, as well as industry performance ranges for the company disclosure analyzed on SASB topics. It aims to help us discern sustainability risk and opportunities.

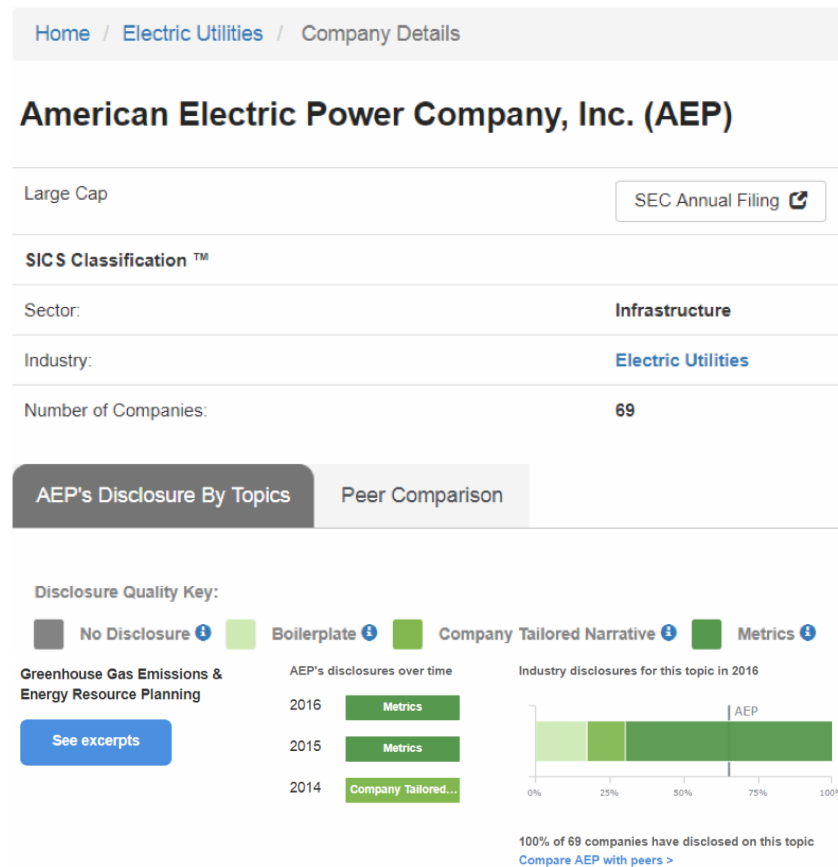


Fig. 4 SASB Navigator

Fig. 4 is the example SASB provided on its Navigator page. In this example, we could tell the basic information of AEP, a large cap in the Infrastructure sector and Electric Utilities industry, with 69 peers being evaluated. Additionally, SASB categorized the disclosure quality of companies into four types, No disclosure, Boilerplate, Company Tailored Narrative, and Metrics, as shown in the Disclosure Quality Key at the bottom. And it shows how SASB evaluates a specific company. From left to top, we could see the specific issue, the company's behavior of this issue from 2014 to 2016, and the company's general performance among its peers.

1.4 Aim of the research

Our research goal is to assess the waste management performance of companies in different industries with corporate-level industry-specific information provided by SASB. Additionally, we hope to find new insights of SASB's results by adding financial information in our analysis.

However, the current ESG indicators are either too general to use such as what MSCI and Bloomberg developed, or are not comprehensive enough for our waste management analysis in different industries. Therefore, we hope to figure out the best waste management practices in the real business world with SASB's results.

2. Methodology

2.1 Industries examined

According to the discussion above, we determined 8 industries that have material Waste Management data from SASB Materiality Map, including (1) Food Retailers & Distributors in Consumption sector, (2) Waste Management in Infrastructure Sector, (3) Iron & Steel Producers and (4) Metals & Mining in Non-Renewable Resources sector, (5) Solar Energy in Renewable Resources & Alternative Energy sector, (6) Containers & Packaging and (7) Electrical & Electronic Equipment in Resource Transformation sector, and (8) Automobiles in Transportation sector.

These 8 industries all have representative aspects in Waste Management, such as food waste management, recycling, material efficiency and leachate and hazardous waste management.

2.2 Incorporating financial data

In this paper, instead of doing simple research only on the ESG side, we will take a step further by incorporating key financial data such as Revenue and Growth Rate with the results from SASB, to generate more valuable results.

Our idea of evaluation came from the Growth-Share Matrix, which was brought by Bruce D. Henderson for the Boston Consulting Group in 1970¹⁴.

As is shown in Fig. 6, the Growth-Share Matrix has an x-axis of Relative Market Share, from right to left 0 to 1, and a y-axis of Market Growth Rate, from bottom to top -20% to 20%. The two axes cut the two-dimensional plane into four parts. Each quadrant represents one type of companies' business performance, Stars, Cows, Dogs, and Questions Marks, respectively. And it's obvious that companies lying in the Star quadrant, with both high Relative Market Share and Market Growth Rate, would be the best choices for investment in such analysis.

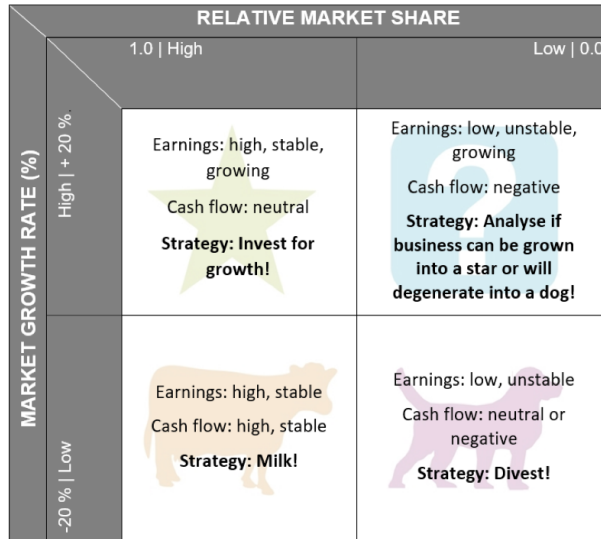


Fig. 6 Growth-Share Matrix

Back into our evaluation, we could put waste management score from SASB on x-axis and Revenue or Growth Rate from Bloomberg on y-axis. Then we could get figures as shown in Fig. 7 and generating our own Stars, Cows, Dogs, and Questions Marks in Waste Management performance for each industry. Table. 1 and Table. 2 below further explained detailed information on what each quadrant stands for in two types of figures.

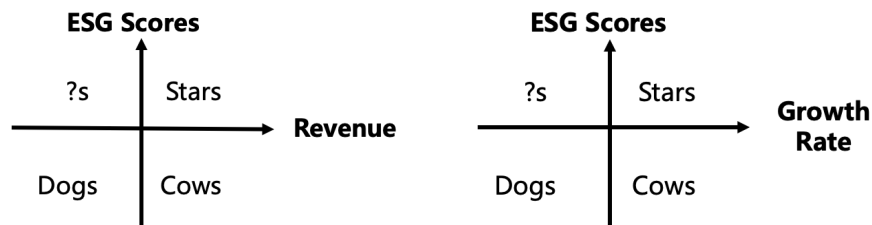


Fig. 7 waste management score VS. Revenue/Growth Rate

The results are presented in figures of quadrants. The upper right quadrant (Quadrant 1) contains companies that indicate high revenue/growth rate and high score. The upper left quadrant (Quadrant 2) contains companies that indicate high revenue/growth rate and low score. The lower left quadrant (Quadrant 3) contains companies that indicate low revenue/growth rate and low score. The lower right quadrant (Quadrant 4) contains companies that indicate low revenue/growth rate and high score.

Table. 1 Company Distribution in Revenue VS. Score Quadrants

Quadrant 2	Quadrant 1
Basic Info: High Revenue & Low Score Extended Info: Big Company with little efforts in waste management (revenue might be generated from the cost of environment)	Basic Info: High Revenue & High Score Extended Info: Stars wanted

Quadrant 3	Quadrant 4
Basic Info: Low Revenue & Low Score Extended Info: Companies that might need to reconsider their development strategy (no idea whether they could survive in the future)	Basic Info: Low Revenue & High Score Extended Info: Might have high potential in future development

Table. 2 Company distribution in Growth Rate VS. Score Quadrants

Quadrant 2	Quadrant 1
Basic Info: High Growth Rate & Low Score Extended Info: Fast growing company with little efforts in waste management	Basic Info: High Growth Rate & High Score
Quadrant 3	Quadrant 4
Basic Info: Low Growth Rate & Low Score Extended Info: Small start-ups that might need more guidance (no idea whether they could survive in the future)	Basic Info: Low Growth Rate & High Score Extended Info: Might have high potential in future development

2.3 Steps followed

First, we figured out the industries that are mostly influenced by Waste Management issues from SASB Materiality Map. As is shown in previous discussions, we selected 8 industries that worth analyzing. Second, we could rank the Waste Management performance of companies in each industry with the companies' waste management data disclosure performance in SASB Navigator. As is shown in Table. 3, we assigned scores from 0 to 3 for the four types of data disclosure qualities in SASB Navigator to quantify our evaluation of waste management. Then we add up the scores from 2014 to 2016, as provided in SASB Navigator, we could have the total score charts for different industries shown in Appendixes and the ranks needed.

Table. 3 Score assignment for different data disclosure quality

Data disclosure quality from SASB	No disclosure	Boilerplate	Company Tailored Narrative	Metrics
Score	0	1	2	3

Third, we could rank the financial performance of companies based on their revenues and growth rate from Bloomberg Terminal and 10-K form for each industry.

Fourth, we could draw the waste management scores VS. Revenue/Growth Rate figures. We put the scores from SASB on x-axis, with a range from 0 to 9, and the Revenue / Growth Rate information on y-axis, with a range from the least Revenue / Growth Rate to the highest.

Finally, we could find initiatives that could improve the waste management performance for each industry by looking into the CSR reports from leaders, in quadrant 1 as discussed in 2.2.

3. Results and Discussions

As discussed above, we would generate two types of figures, the waste management Scores VS. Revenue figure and waste management Scores VS. Growth Rate figure. And we would put the industry-specific as well as general results and discussions below. The leaders are dotted in red color.

For the waste management Scores VS. Revenue figure, we would use the blue dots to represent different companies and put their Stock sticker alongside. The leaders are dotted in red color.

For the waste management Scores VS. Growth Rate figure, we would use the yellow dots to represent different companies and put their Stock sticker alongside.

3.1 Food Retailers & Distributors Industry

The key metrics provided in SASB for Food Retailers & Distributors Industry is Food Waste Management.

3.1.1 Score VS. Revenue



Fig. 8 Score VS. Revenue - Food Retailers & Distributors

From Fig. 8, we could tell that this industry behaves poor in SASB's data disclosure, most companies have no Food Waste Management data disclosure from 2014 to 2016. Meanwhile, most companies' Revenue performance are worse than those having a higher data disclosure quality in this industry.

In the figure, Whole Foods Market's (WFM) SASB data disclosure ranks 1 while its revenue ranks 6

among its peers in 2016, and Cia Brasileira de Distribuicao's (CBD) SASB data disclosure ranks 2 while its revenue ranks 3.

Therefore, there are opportunities for Food Retailers & Distributors to improve their financial performance by paying more attention to Food Waste Management.

One exception is The Kroger Co. (KR), which has the highest revenue performance while having no data disclosure in its Food Waste Management. Maybe Food Waste Management could be one of the toughest parts for KR to incorporate with SASB's methodology due to its large volume. But since KR has pretty nice disclosure in other SASB factors, we believe that it's only a matter of time before it starts to disclose more Food Waste Management data.

3.1.2 Score VS. Growth Rate

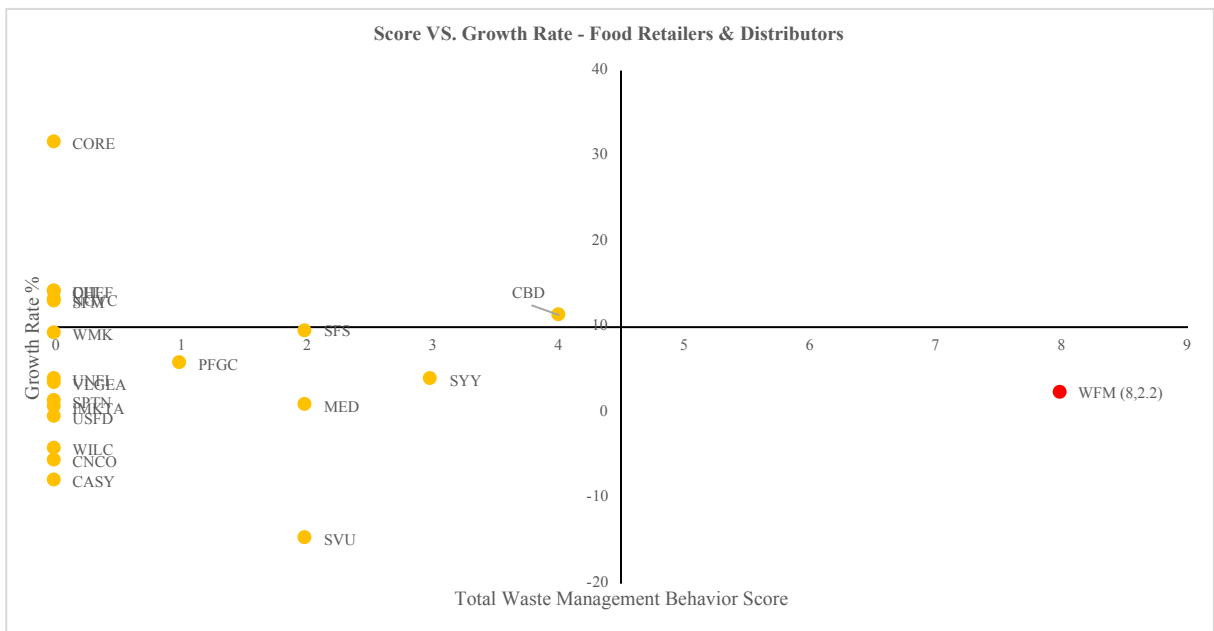


Fig. 9 Score VS. Growth Rate - Food Retailers & Distributors

As is shown in Fig. 9, the growth rate in this industry are quite stable. And most companies with high SASB data disclosure quality meet a positive growth rate, while those didn't provide any data in Food Waste Management generally experience a negative growth rate. This shows that Food Waste Management is a material factor to consider the sustainable development of a company within the Food Retailers & Distributors industry.

3.1.3 Industry Leader Performance

From the results above, the leader in Food Retailers & Distributors Industry is Whole Food Market Inc. (WFM).

One of the greatest issues relevant to waste management for this industry is food waste. According to Trillium Asset Management, 40% of food produced in the U.S. goes uneaten, costing the American

economy \$218 billion per year, roughly 1.3% of GDP¹⁵.

To deal with this problem, Whole Foods Market has a tradition to donate unsold food to local soup kitchens and food banks. And their collaboration with Food Donation Connection (FDC) further helped reduce food waste. With FDC’s help, many Whole Foods Market stores have developed a process for packaging, refrigerating and donating a wider range of foods—including food from the salad bar and hot bar.

Additionally, for food that could no longer be consumed, Whole Foods Market would turn these food scraps into fertilizer. According to their CSR Reports, WFM composted over 2,240 tons in just seven months in 2012.

3.2 Waste Management Industry

3.2.1 Score VS. Revenue

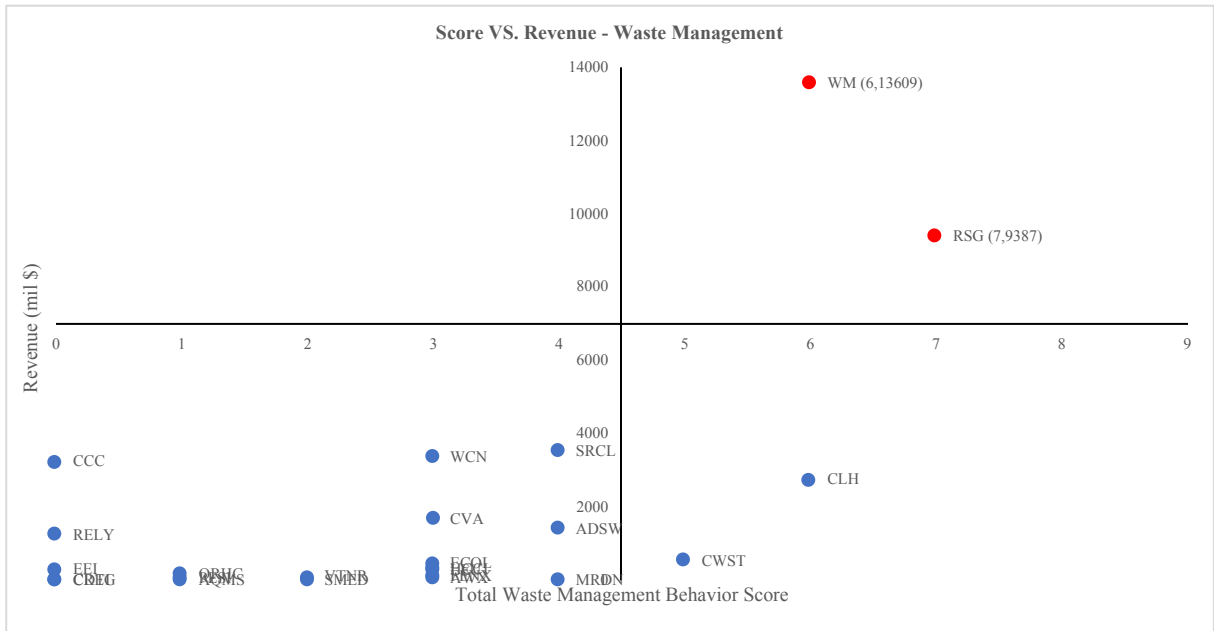


Fig. 10 Score VS. Revenue - Waste Management

The Waste Management industry performs much better than the previous industry in SASB data disclosure. However, their Revenue performance is much poorer.

In Fig. 10, we found Waste Management’s (WM) SASB data disclosure ranks 2 and its revenue ranks 1, while Republic Services’s (RSG) SASB data disclosure ranks 1 and its revenue ranks 2.

For this industry, it’s obvious that companies with higher SASB data disclosure generally have higher revenue in 2016.

However, Calgon Carbon Corporation (CCC) had no SASB data disclosure from 2014 to 2016 while its revenue ranks 5.

3.2.2 Score VS. Growth Rate

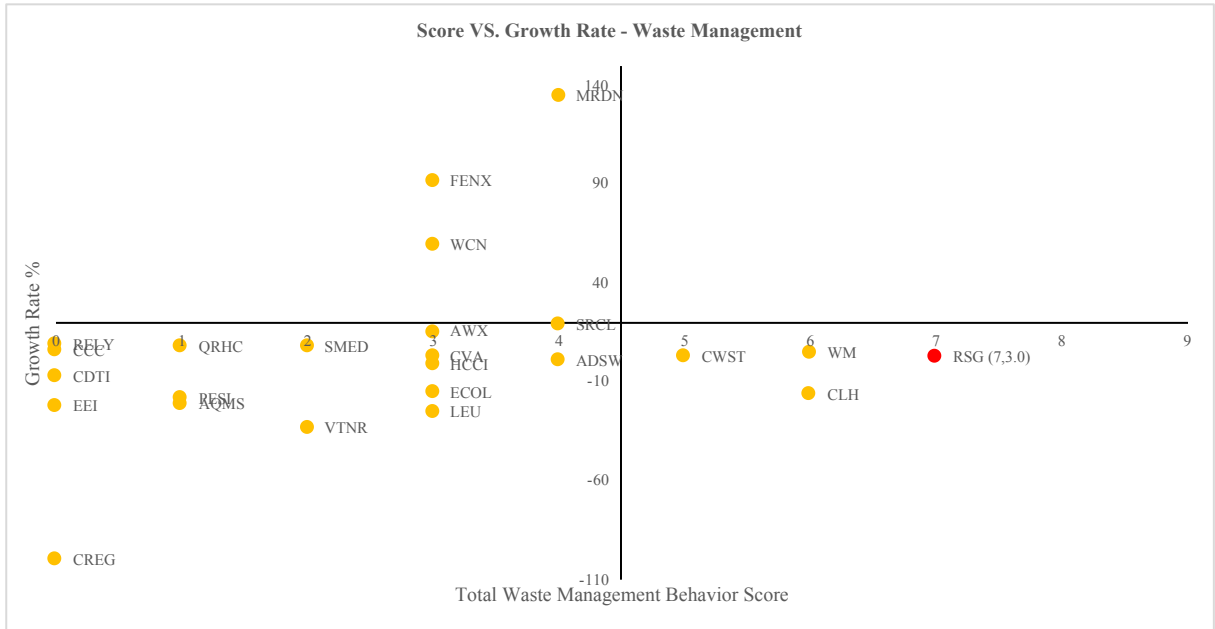


Fig. 11 Score VS. Growth Rate - Waste Management

As is shown in Fig. 11, most companies with higher SASB data disclosure had positive growth rate in 2016.

3.2.3 Industry Leader Performance

The industry leader for the Waste Management Industry is Waste Management, Inc. (WM) and Republic Services Inc. (RSG) According to their CSR Reports, they have been continuously working on Waste Reduction, Recycling, as well as other types of innovations. For example, WM provided over 35,000 environmental training opportunities across all employee in 2009¹⁶ RSG collect nearly 5 million tons of recyclable material annually¹⁷.

However, there has been intense public debate on landfill issues, the last step of dealing with waste for both WM and RSG. One of WM’s well-known effort is the Milam Process. In this initiative, they fuel up their trucks for another round of waste collection with Natural Gas produced from their landfills and generate electricity. Though they are recovering energy from landfills, according to the UN and other major organizations, this is still not sustainable.

Another way of dealing with waste in the last step has been developed in the past two decades, Waste to Energy (WTE). Companies like Covanta are making big progress in it. And there are academic supports for the WTE progress. For example, Cucchiella, F., D’Adamo, I., & Gastaldi, M. (2017)¹⁸ argued that WTE could be used as an alternative for landfill. However, this method requires public acceptance because the plants normally would locate near citizens, who are worried about possible waste emissions.

In general, the metrics used in SASB for the waste management industry are relevant to toxic release, recycling and incidents with large environmental impacts. In this way, WM and RSG are doing pretty

well.

3.3 Iron & Steel Producers Industry

3.3.1 Score VS. Revenue

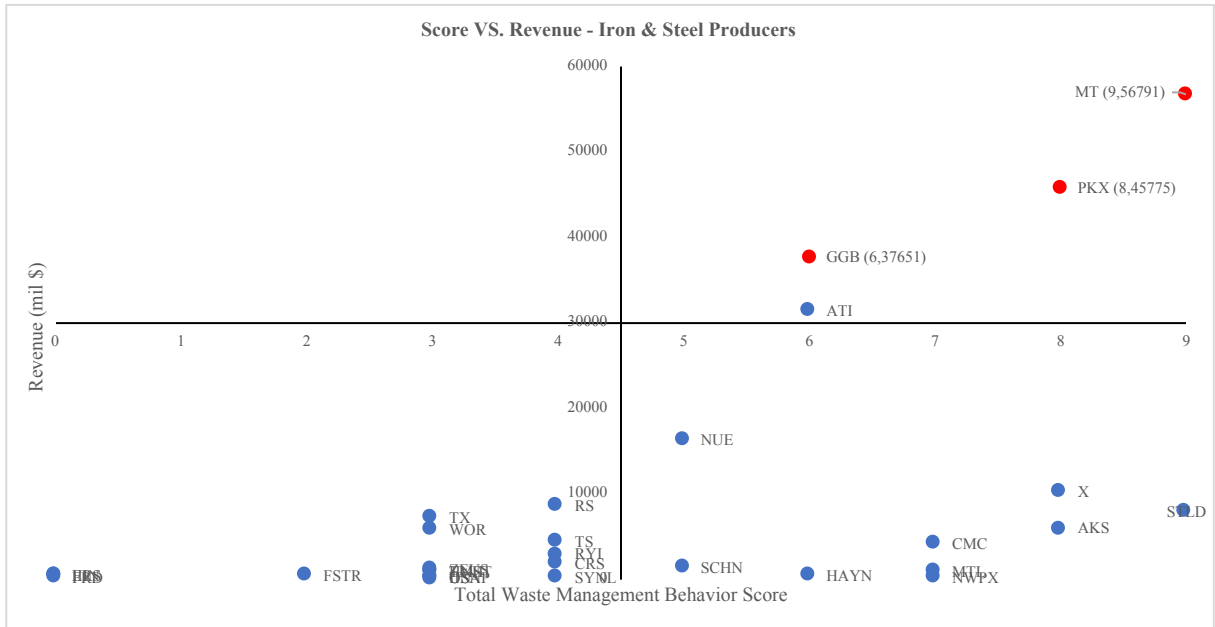


Fig. 12 Score VS. Revenue - Iron & Steel Producers

The Iron & Steel Producers industry performs well in both SASB data disclosure and Revenue generation. From Fig. 12, we could tell that ArcelorMittal's (MT) SASB data disclosure ranks 1 and its revenue ranks 1. Posco's (PKX) SASB data disclosure ranks 3 and its revenue ranks 2. Gerdau SA's (GGB) SASB data disclosure ranks 9 and its revenue ranks 3.

For this industry, it's obvious that companies with higher SASB data disclosure generally have higher revenue in 2016.

3.3.2 Score VS. Growth Rate

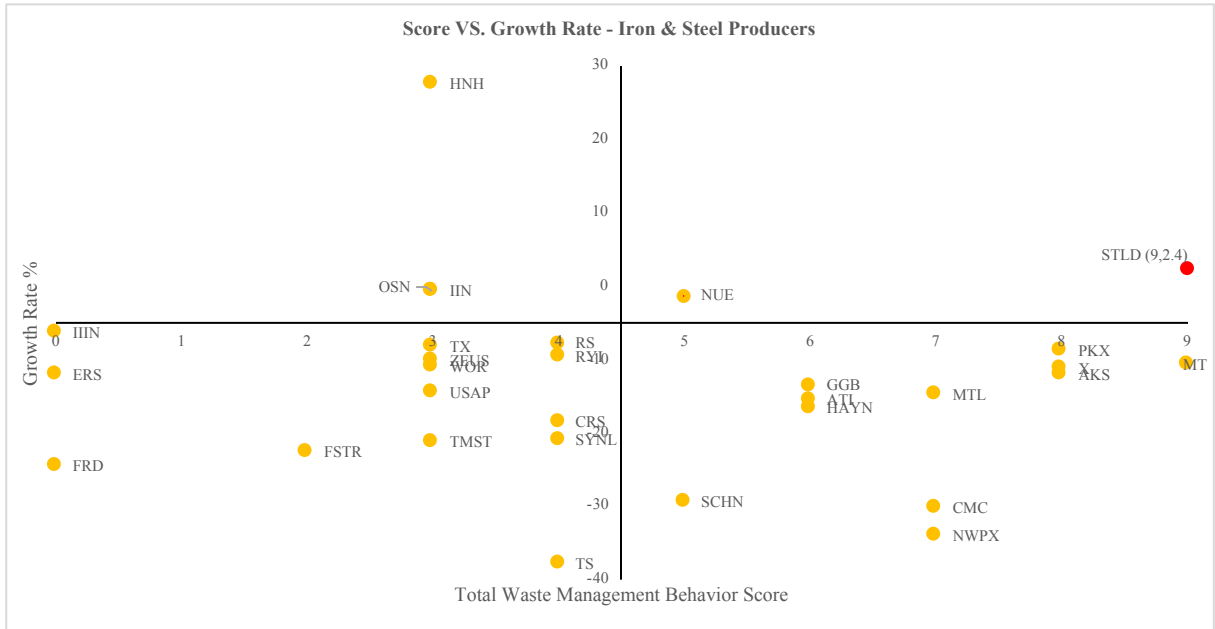


Fig. 13 Score VS. Growth Rate - Iron & Steel Producers

As is shown in Fig. 13, most companies in the Iron & Steel Producers industry experienced negative growth rate in 2016, showing the whole industry needs to consider new development strategies. However, we could still find that companies with higher SASB data disclosure had smaller negative result.

3.3.3 Industry Leader Performance

The leader in the Iron & Steel Producers industry is ArcelorMittal. According to their CSR reports, they achieved utilizing 2.2 million tons of materials that are recyclable and used, out of 24.6 million tons of total consumption, to produce steel.

3.4 Metals and Mining Industry

3.4.1 Score VS. Revenue

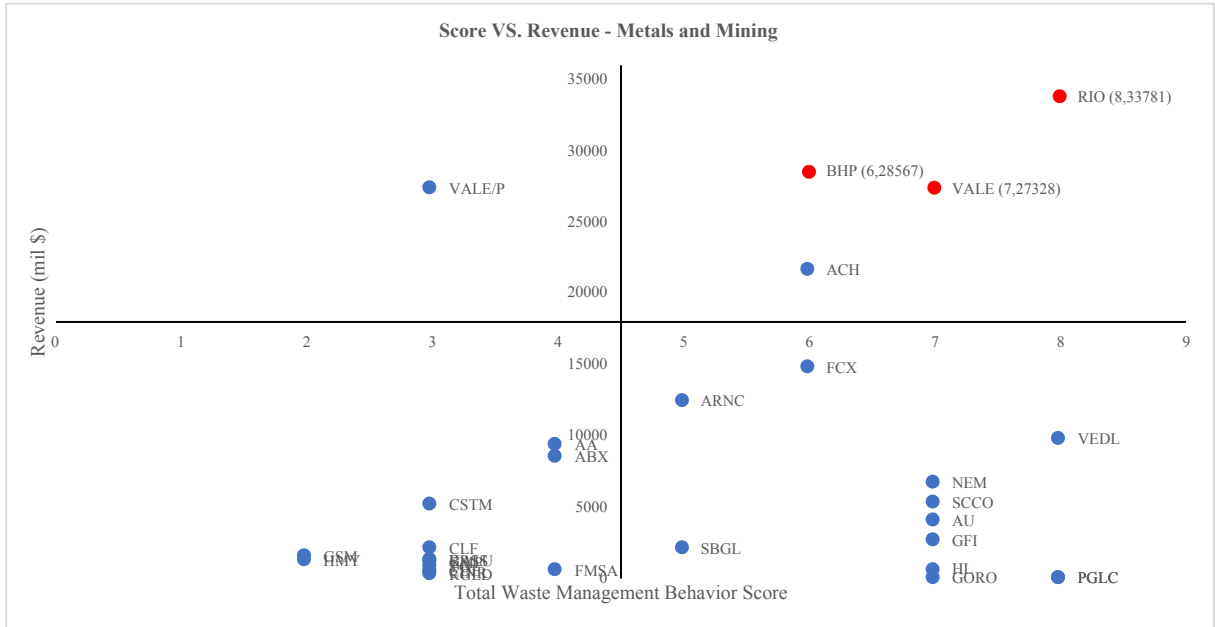


Fig. 14 Score VS. Revenue - Metals and Mining

From Fig. 14, the Metals and Mining industry performs well in both SASB data disclosure and Revenue generation. Rio Tinto PLC's (RIO) SASB data disclosure ranks 1 and its revenue ranks 1. Vale SA's (VALE) SASB data disclosure ranks 4 and its revenue ranks 3. BHP Billiton Ltd's (BHP) SASB data disclosure ranks 11 and its revenue ranks 2.

For this industry, it's obvious that companies with higher SASB data disclosure generally have higher revenue in 2016.

However, AA's SASB data disclosure ranks 16, while its revenue ranks 9. But its revenue has large difference from the industry leaders.

3.4.2 Score VS. Growth Rate

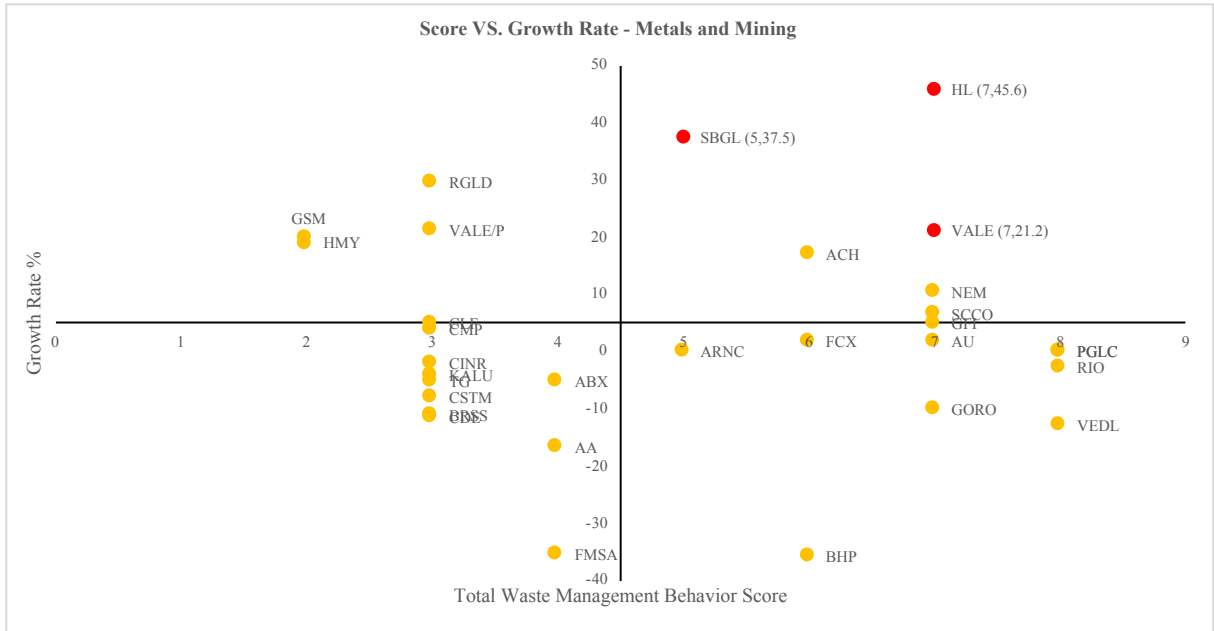


Fig. 15 Score VS. Growth Rate - Metals and Mining

As is shown in Fig. 15, most companies with higher SASB data disclosure had positive and even high growth rate in 2016.

3.4.3 Industry Leader Performance

The Metals and Mining industry leader at the moment is Rio Tinto PLC. RIO put great effort in utilizing renewable energy and reducing greenhouse gas (GHG) emission in their mining process.

From their CSR reports, we could see that their primary sources of energy used are coal, hydro, natural gas and diesel, while the primary sources of electricity used are hydro, coal and nuclear. And hydro played very important roles in both kinds of usages, which seemed to be one of the most advanced and plausible way of reducing GHG.

According to McKinsey's report in June 2018 for the Metals and Mining Industry, they figured out a slow but pretty stable increase in mining productivity since 2014, which they argued is mainly because of the improvement in technology-based transformation¹⁹.

3.5 Solar Energy Industry

3.5.1 Score VS. Revenue

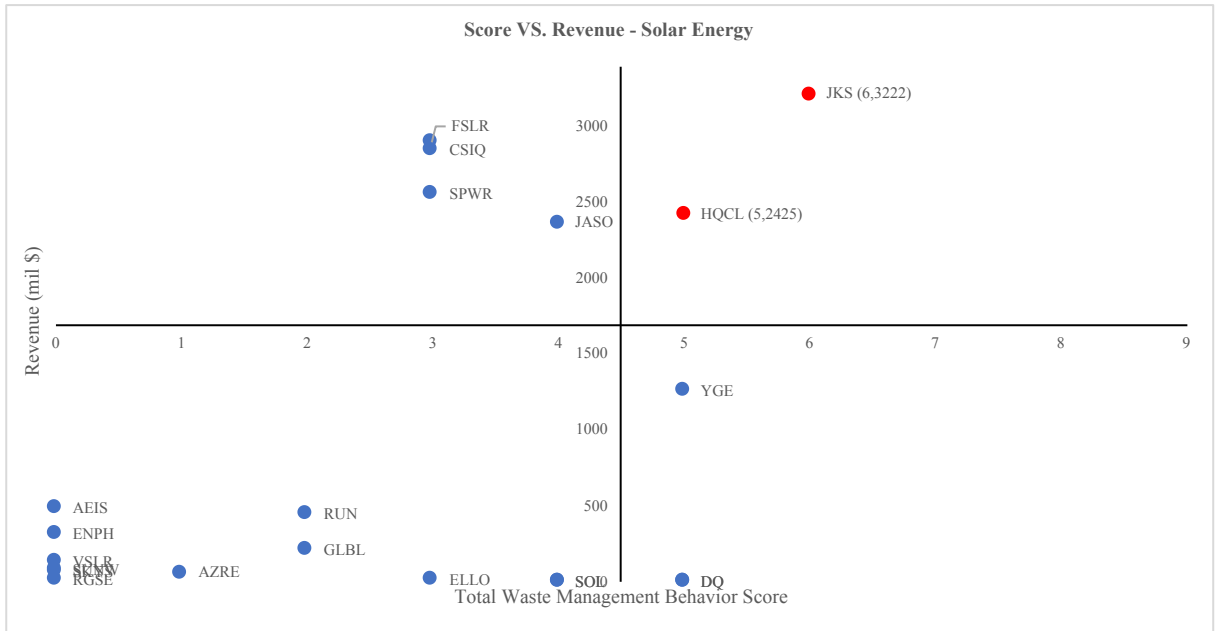


Fig. 16 Score VS. Revenue - Solar Energy

From Fig. 16, we could see the Solar Energy industry performs relatively poor in both SASB data disclosure and Revenue generation. Jinko solar Holding Co. Ltd's (JKS) SASB data disclosure ranks 1 and its revenue ranks 1. Hanwha Q Cells Korea Corp's (HQCL) SASB data disclosure ranks 2 and its revenue ranks 5.

For this industry, it's obvious that companies with higher SASB data disclosure generally have higher revenue in 2016.

3.5.2 Score VS. Growth Rate

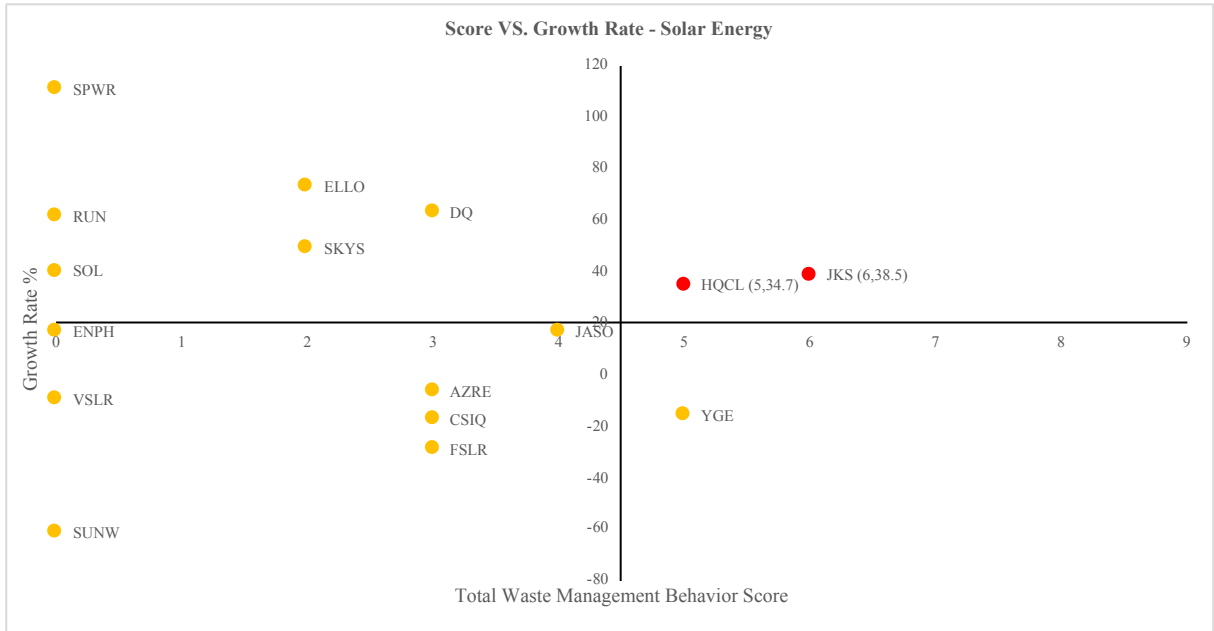


Fig. 17 Score VS. Growth Rate - Solar Energy

From Fig. 17, there is no obvious connection between Growth Rate and Score in this industry. Maybe mainly because most companies are start-ups.

3.5.3 Industry Leader Performance

Jinkosolar Holding Co. Ltd (JKS) and First Solar, Inc (FSLR) from the Solar Energy Industry all focus a lot on their amount of hazardous waste and material efficiency. For example, Jinkosolar Holding Co. Ltd (JKS) reduced its GHG emission by over 60% and water usage by 42% in 2017 compared with 2013²⁰. And they improved p-type monocrystalline cell efficiency at 23.95%, breaking their own world leading record in 2017²¹. And FSLR reduced their GHG emissions intensity by 35% by 2016 from the base year of 2008²².

Also, since this industry is still growing compared with other industries mentioned above, there's lack of regulation. For example, JKS dumped toxic waste and received a fine in 2011²³. That is why they have another goal of conducting and improving the current policy requirements in aspects including environment, social and governance as shown in SASB's metrics and their CSR reports.

3.6 Containers and Packaging Industry

3.6.1 Score VS. Revenue

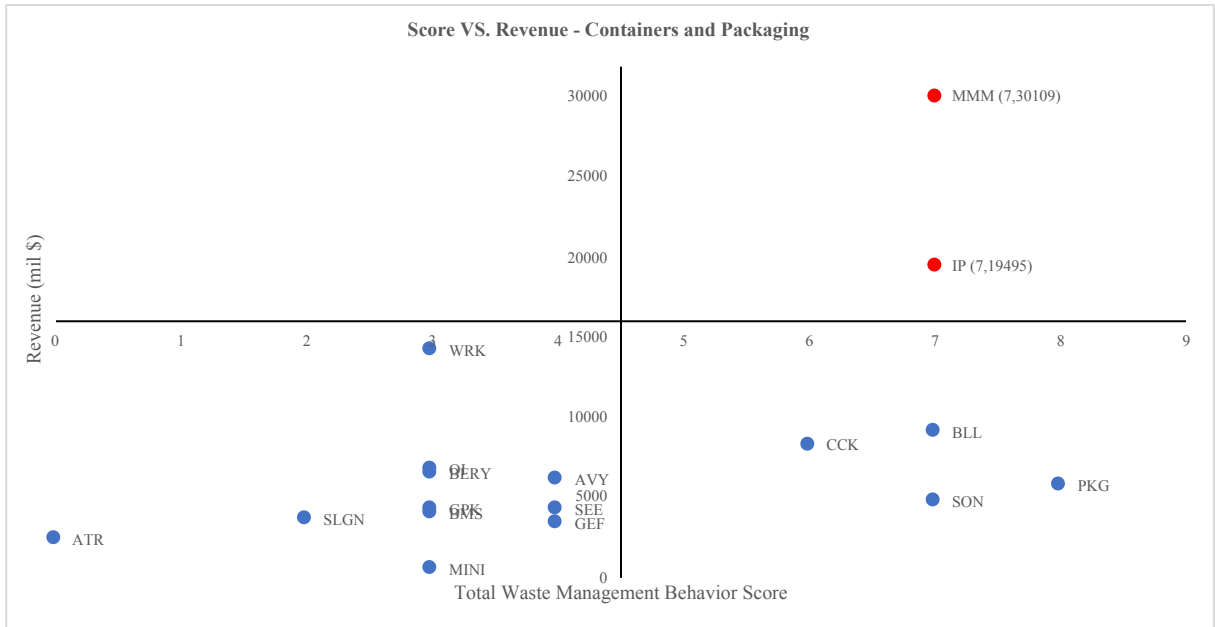


Fig. 18 Score VS. Revenue - Containers and Packaging

From Fig. 18, the Containers and Packaging industry performs relatively good in both SASB data disclosure and Revenue generation. 3M Company’s (MMM) SASB data disclosure ranks 2 and its revenue ranks 1. International Paper Company’s (IP) SASB data disclosure ranks 2 and its revenue ranks 2. Also, there are small companies such as Sonoco Products Company (SON) and Packaging Corporation of America (PKG) that performs really well in SASB data disclosure.

For this industry, it's obvious that companies with higher SASB data disclosure generally have higher revenue in 2016. However, Westrock Company’s (WRK) SASB data disclosure ranks 10, while their revenue ranks third.

3.6.2 Score VS. Growth Rate

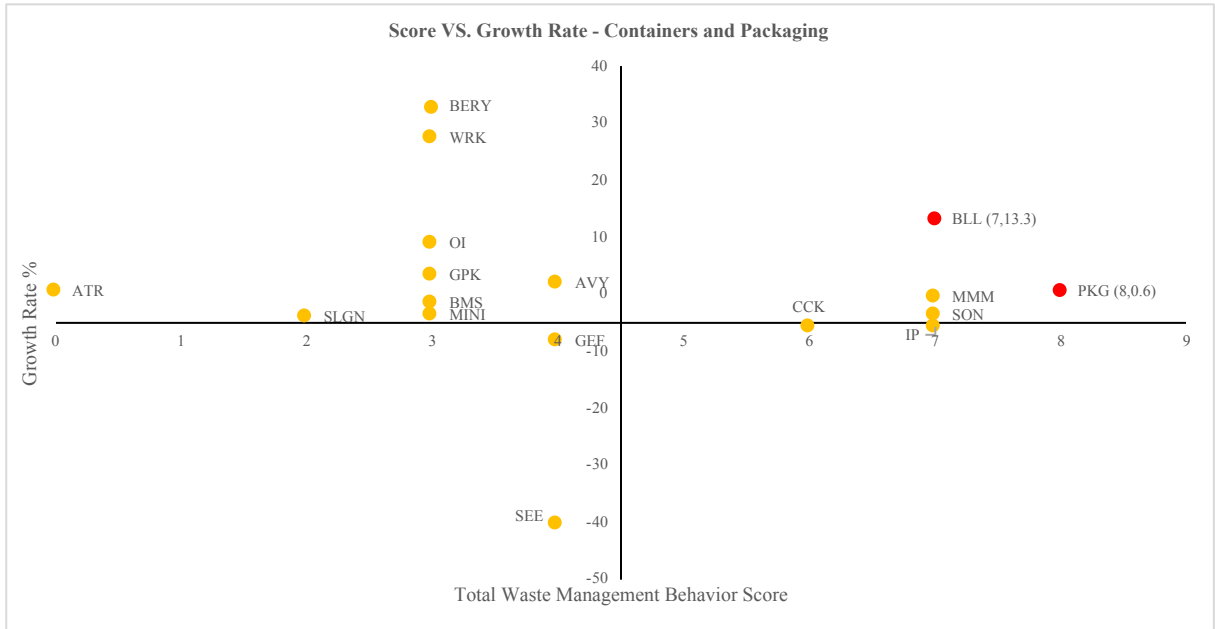


Fig. 19 Score VS. Growth Rate - Containers and Packaging

As is shown in Fig. 19, most companies with higher SASB data disclosure had positive and even high growth rate in 2016.

3.6.3 Industry Leader Performance

According to the sustainability reports, the Containers and Packaging industry leader 3M company (MMM) focus a lot on maximizing their raw material usage and optimizing efficiencies in operational waste and recycling.

For example, in 2015 alone, they prevented more than 1.5 million tons of total waste pollution, as is shown in Fig. 20. It seems this industry started to generate revenues and protect the environment at the same time.

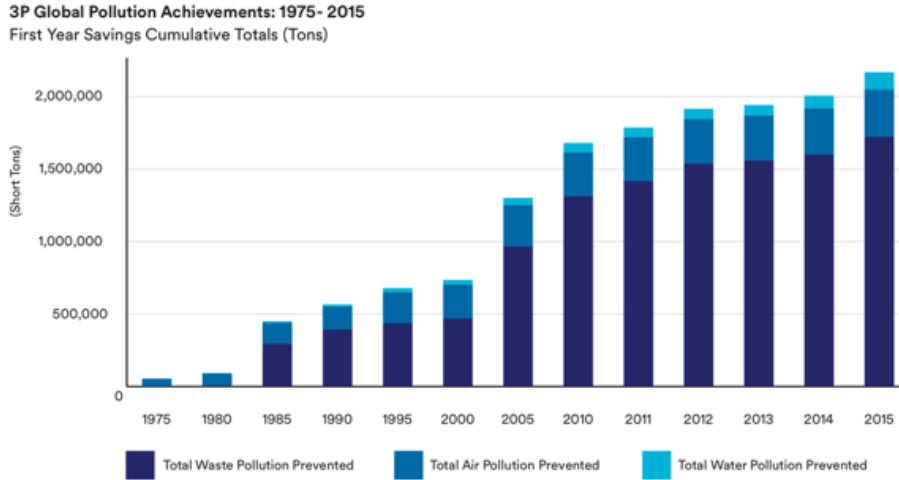


Fig. 20 3M Company waste prevention results since 1975

3.7 Electrical and Electronic Equipment Industry

3.7.1 Score VS. Revenue

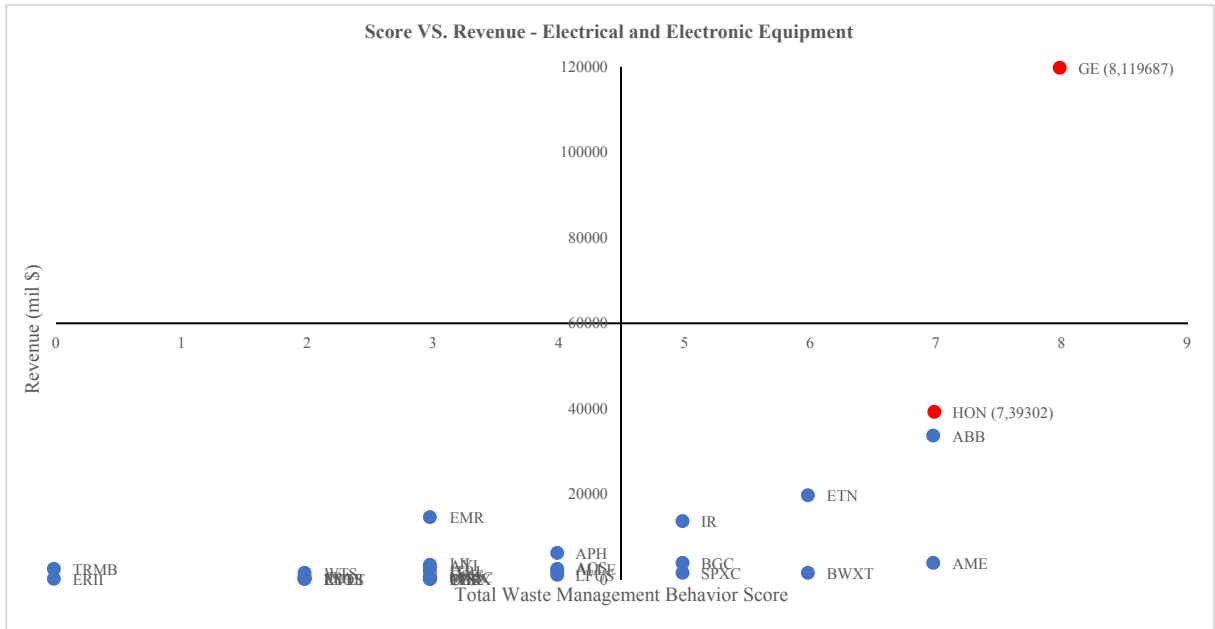


Fig. 21 Score VS. Revenue - Electrical and Electronic Equipment

From Fig. 21, we found that the Containers and Packaging industry performs relatively good in both SASB data disclosure and Revenue generation. General Electric Company's (GE) SASB data disclosure ranks 1 and its revenue ranks 1. Honeywell International Inc's (HON) SASB data disclosure ranks 2 and its revenue ranks 2.

Also, there are mid-size companies such as Bwx Technologies, Inc's (BWXT) that performs really well

in SASB data disclosure.

For this industry, there's some truth that companies with higher SASB data disclosure would have higher revenue in 2016.

3.7.2 Score VS. Growth Rate

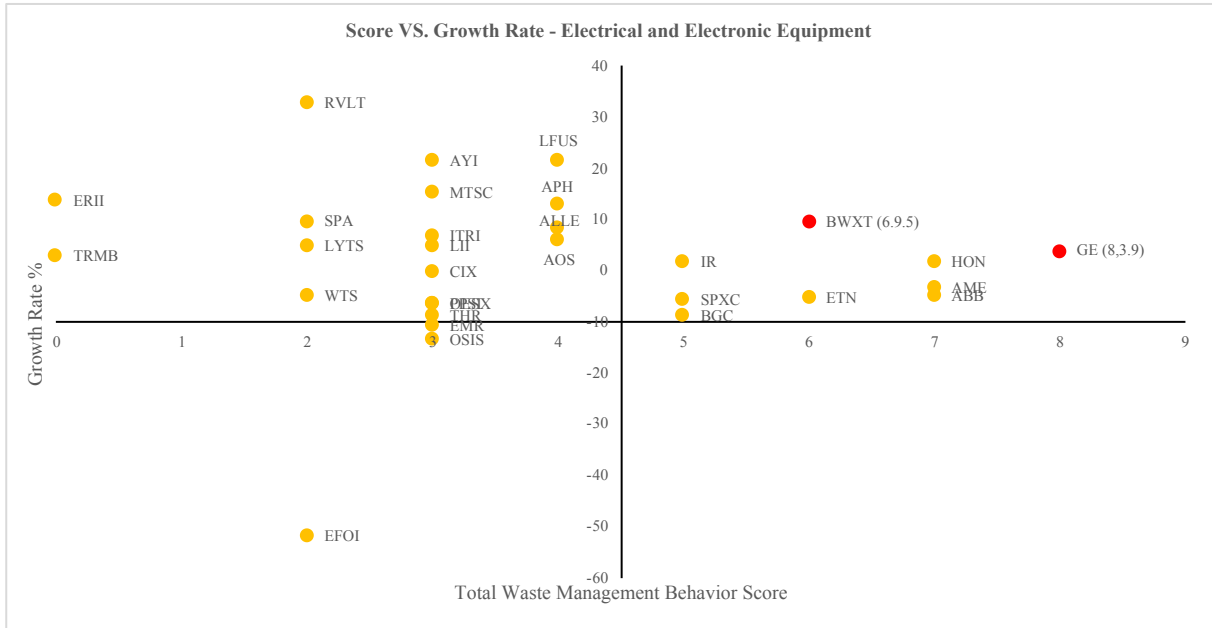


Fig. 22 Score VS. Growth Rate - Electrical and Electronic Equipment

As is shown in Fig. 22, the whole industry shows high Growth Rate. Company like RVLT experienced really high growth rate. However, it didn't disclose SASB data well.

3.7.3 Industry Leader Performance

According to the discussion above, we found that the leader in the Electrical and Electronic Equipment industry is HON. They mentioned in their sustainability report in 2016 that 50% of their revenue comes from their energy efficiency solutions. For example, they delivered more than \$5 billion in energy and operational savings in their building solutions.



Fig. 23 Daisy by Apple²⁴

From SASB’s industry metrics, we found the product lifecycle management and material efficiency is also of great importance. And some big corporations such as Apple and Samsung are not in the SASB list. If we take a glimpse at what techniques they have brought in product lifecycle management and material efficiency, we would find that Apple invented Daisy, a robot arm, to help disassemble nine different iPhone models and thus recover materials that traditional recyclers cannot.

3.8 Automobile Industry

3.8.1 Score VS. Revenue

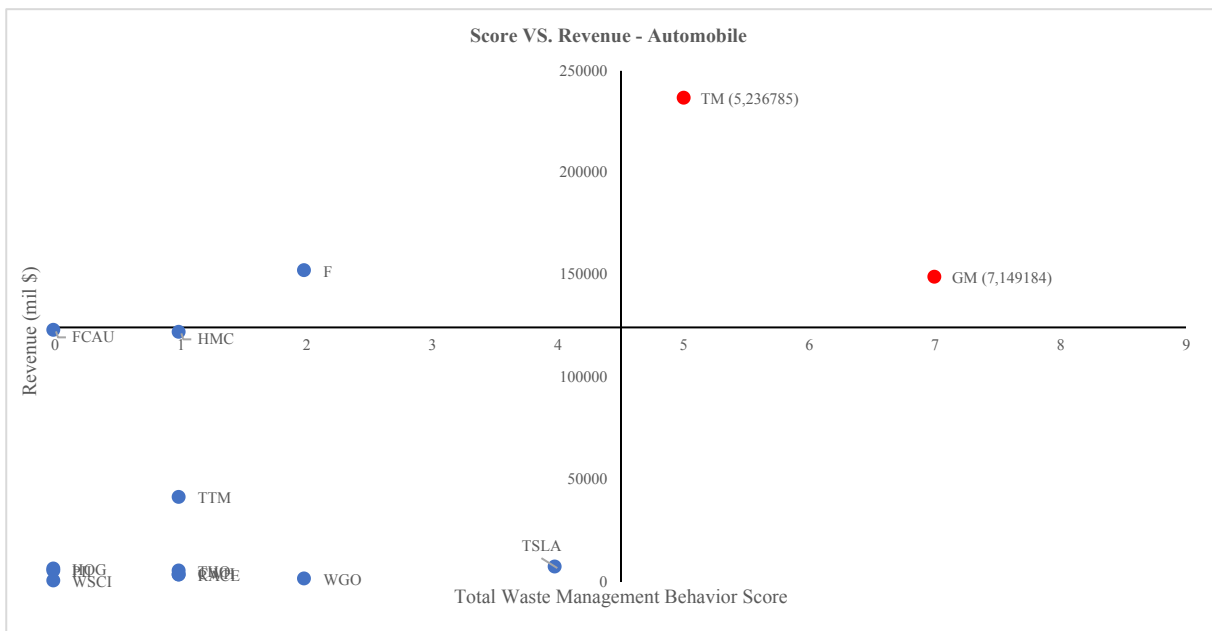


Fig. 24 Score VS. Revenue – Automobile

From Fig. 24, we found that the Automobile industry performs relatively poor in SASB data disclosure but has high Revenue generation. Toyota Motor Corp’s (TM) SASB data disclosure ranks 2 and its revenue ranks 1. General Motors Company’s (GM) SASB data disclosure ranks 1 and its revenue ranks 3.

For this industry, there is some connection that companies with higher SASB data disclosure tend to have higher revenue in 2016.

However, Fiat Chrysler Automobiles’ (FCAU) SASB data disclosure ranks 11, while their revenue ranks 4.

3.8.2 Score VS. Growth Rate

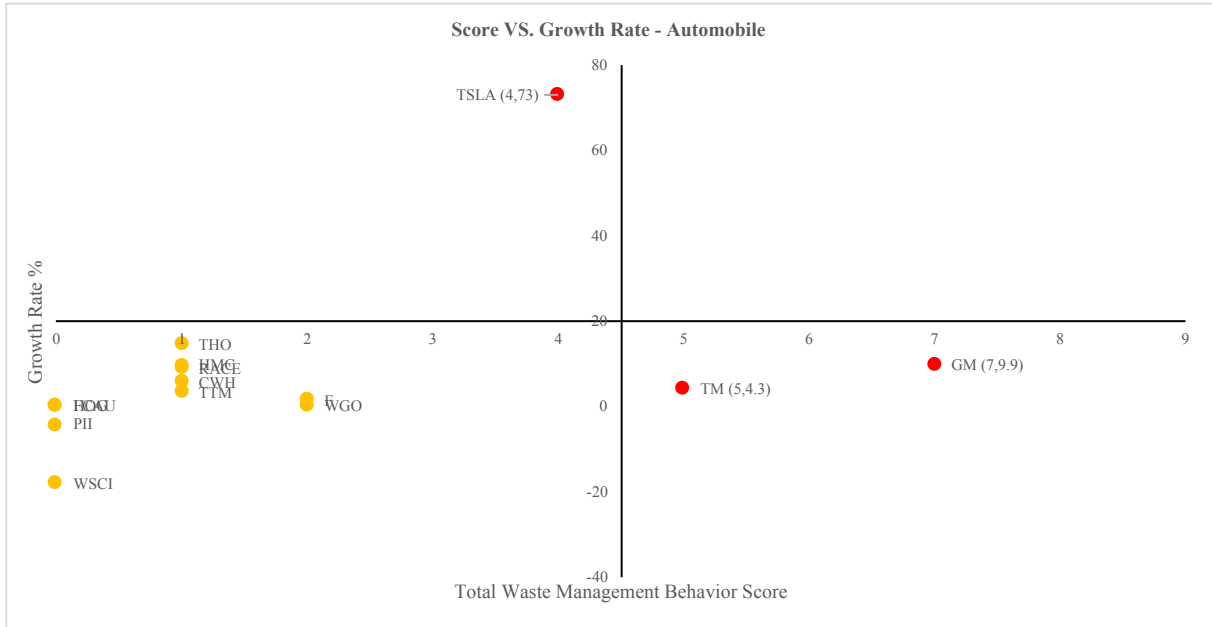


Fig. 25 Score VS. Growth Rate – Automobile

As is shown in Fig. 25, the whole industry shows relatively stable Growth Rate.

3.8.3 Industry Leader Performance

According to our analysis, the industry leaders in the Automobile industry are General Motors Company (GM) and Toyota Motor Corp (TM). Their main materials efficiency and recycling strategy is working on new technologies. For example, they applied stop-start technology and advanced transmissions to improve fuel efficiency. Additionally, they successfully improved fuel efficiency by about 5% by reducing mass by 10% in some of their models, using lightweight and recyclable materials. And almost all the corporations in this industry is currently investing money in research on Electric Vehicles (EV) as well as bio-fuels implementation.

4. Conclusions

According to the 2030 Agenda for Sustainable Development Goals (SDGs), a need for improved waste management was highlighted in SDGs 6, 11 and 12. In this context, the EU commission defines the circular economy targets of the member nations as 65% recycling and 35% waste-to-energy. The concept, therefore, is to “move away from landfills”²⁵.

Monitoring the progress of companies that are major contributors to the environment and the waste that is generated is key to achieve sustainability. In the past few decades, many indicators have been developed to

analyze waste management performance of different companies. In addition, in 2003, Bloomberg introduced the Environmental, Social and Governance (ESG) indicators, that consider other factors than the financial indicators in the decision-making process. However, the ESG indicators do not consider waste management that is an important pillar in the nexus of sustainability.

The Sustainability Accounting Standards Board (SASB) was founded in 2011, with a goal to provide industry-specific metrics with emphasis on the waste management performance.

In our analysis, eight industries were selected and assessed from the SASB Materiality Map. The SASB navigator was used to evaluate and rate the waste management performance of several companies in the selected industries were found in the SASB Navigator. The financial performance of the companies was considered, such as revenues and growth rate. Data were obtained from the Bloomberg Terminal. The results are presented as matrices of Revenue VS. Waste Management score and Growth Rate VS. Waste Management score, with the upper right quadrant representing companies with relatively high financial indicators and relatively high waste management performance.

Most leaders in all eight industries are making efforts on moving away from landfills for improving their waste management performance. For example, they initiated projects on higher recycling and reuse rate, on donating unsold food to those in need, and on developing advanced technologies for the recovery of energy from wastes.

Additionally, since waste to energy is essential for sustainable waste management, SASB should consider including landfilling and waste-to-energy as one of the metrics of waste management performance. Also,

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 - ¹¹ SASB Materiality Definition <https://materiality.sasb.org>
 - ¹² SASB Materiality Map <https://www.sasb.org/standards-overview/materiality-map/>
 - ¹³ SASB Navigator <https://www.sasb.org>
 - ¹⁴ Growth Share Matrix <https://www.economist.com/news/2009/09/11/growth-share-matrix>

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- ²³ Jinkosolar news <https://www.sustainablebusiness.com/jinko-solar-dump-toxic-waste-apologizes-49635/>
- ²⁴ APPLE Inc. 2017 annual report http://www.annualreports.com/HostedData/AnnualReports/PDF/NASDAQ_AAPL_2017.pdf

Appendix

Appendix 1 Food Retailers & Distributers SASB Scores and Rank

Company Name	Ticker	Cap Size	2014	2015	2016	Total Score	Rank
Whole Foods Market, Inc.	WFM	Large Cap	2	3	3	8	1
Cia Brasileira de Distribuicao	CBD	Mid Cap	0	1	3	4	2
Supervalu Inc.	SVU	Small Cap	0	1	1	2	4
Core-Mark Holding Company, Inc.	CORE	Small Cap	0	0	0	0	8
Natural Grocers By Vitamin Cottage, Inc.	NGVC	Small Cap	0	0	0	0	8
Performance Food Group Company	PFGC	Mid Cap	0	0	1	1	7
The Chefs' Warehouse Inc	CHEF	Small Cap	0	0	0	0	8
Sysco Corporation	SYU	Large Cap	1	1	1	3	3
US Foods Holding Corp.	USFD	Mid Cap	0	0	0	0	8
Spartannash Company	SPTN	Small Cap	0	0	0	0	8
United Natural Foods, Inc.	UNFI	Mid Cap	0	0	0	0	8
The Kroger Co	KR	Large Cap	0	0	0	0	8
Smart & Final Stores, Inc.	SFS	Small Cap	0	1	1	2	4
Cencosud SA	CNCO	Mid Cap	0	0	0	0	8
Medifast, Inc.	MED	Small Cap	1	0	1	2	4
Amcon Distributing Company Inc	DIT	Small Cap	0	0	0	0	8
G. Willifood International Ltd.	WILC	Small Cap	0	0	0	0	8
Casey's General Stores, Inc.	CASY	Mid Cap	0	0	0	0	8

Village Super Market, Inc.	VLGEA	Small Cap	0	0	0	0	8
Sprouts Farmers Market Texas, LP	SFM	Mid Cap	0	0	0	0	8
Weis Markets, Inc.	WMK	Small Cap	0	0	0	0	8
Ingles Markets, Incorporated	IMKTA	Small Cap	0	0	0	0	8

Appendix 2 Waste Management SASB Scores and Rank

Company Name	Ticker	Cap Size	2014	2015	2016	Total Score	Rank
Republic Services, Inc.	RSG	Large Cap	2	2	3	7	1
Casella Waste Systems, Inc.	CWST	Small Cap	0	2	3	5	4
Waste Management, Inc.	WM	Large Cap	1	2	3	6	2
Advanced Disposal Services, Inc.	ADSW	Small Cap	2	1	1	4	5
WCI Acquisition Corp 2	WCN	Large Cap	0	0	3	3	8
Clean Harbors, Inc.	CLH	Mid Cap	1	2	3	6	2
Covanta Holding Corporation	CVA	Mid Cap	0	2	1	3	8
US Ecology, Inc.	ECOL	Small Cap	0	2	1	3	8
Heritage-Crystal Clean, Inc.	HCCI	Small Cap	1	1	1	3	8
Meridian Waste Solutions, Inc.	MRDN	Small Cap	1	1	2	4	5
Perma-Fix Environmental Services, Inc.	PESI	Small Cap	0	1	0	1	18
Real Industry, Inc.	RELY	Small Cap	0	0	0	0	22
Quest Resource Holding Corporation	QRHC	Small Cap	0	0	1	1	18
China Recycling Energy Corporation	CREG	Small Cap	0	0	0	0	22
Stericycle, Inc.	SRCL	Mid Cap	0	1	3	4	5
Centrus Energy Corp.	LEU	Small Cap	0	1	2	3	8
Calgon Carbon Corporation	CCC	Small Cap	0	0	0	0	22
Clean Diesel Technologies Inc	CDTI	Small Cap	0	0	0	0	22
Fenix Parts, Inc.	FENX	Small Cap	0	2	1	3	8
Avalon Holdings Corporation	AWX	Small Cap	1	1	1	3	8
Ecology and Environment Inc.	EEI	Small Cap	0	0	0	0	22
Sharps Compliance Corp.	SMED	Small Cap	0	1	1	2	15
Vertex Energy, Inc.	VTNR	Small Cap	0	1	1	2	15
Aqua Metals, Inc.	AQMS	Small Cap	0	1	1	2	15
Liqtech International A/S	LIQT	Small Cap	0	1	0	1	18
Industrial Services of America, Inc.	IDSA	Small Cap	1	0	0	1	18

Appendix 3 Iron & Steel Producers SASB Scores and Rank

Company Name	Ticker	Cap Size	2014	2015	2016	Total Score	Rank
ArcelorMittal	MT	Small Cap	3	3	3	9	1
United States Steel Corp	X	Mid Cap	2	3	3	8	3
AK Steel Holding Corporation	AKS	Mid Cap	2	3	3	8	3

Steel Dynamics, Inc.	STLD	Mid Cap	3	3	3	9	1
Gerdau SA	GGB	Mid Cap	3	1	2	6	9
Posco	PKX	Small Cap	2	3	3	8	3
Haynes International, Inc.	HAYN	Small Cap	2	2	2	6	9
Mechel PJSC	MTL	Small Cap	3	3	1	7	6
Nucor Corporation	NUE	Large Cap	1	2	2	5	12
Allegheny Technologies Incorporated	ATI	Small Cap	1	3	2	6	9
Ternium Sa	TX	Mid Cap	1	1	1	3	19
Worthington Industries, Inc.	WOR	Mid Cap	1	1	1	3	19
Empire Resources, Inc.	ERS	Small Cap	0	0	0	0	28
Commercial Metals Company	CMC	Mid Cap	2	3	2	7	6
Ryerson Holding Corporation	RYI	Small Cap	1	1	2	4	14
Timkensteel Corporation	TMST	Small Cap	1	1	1	3	19
Synalloy Corporation	SYNL	Small Cap	1	2	1	4	14
Insteel Industries, Inc.	IIIN	Small Cap	0	0	0	0	28
Reliance Steel & Aluminum Co.	RS	Mid Cap	1	2	1	4	14
Tenaris SA	TS	Large Cap	1	2	1	4	14
Northwest Pipe Company	NWPX	Small Cap	3	3	1	7	6
Universal Stainless & Alloy Products, Inc.	USAP	Small Cap	1	1	1	3	19
Handy & Harman Ltd.	HNH	Small Cap	1	1	1	3	19
Intricon Corporation	IIN	Small Cap	1	1	1	3	19
Schnitzer Steel Industries, Inc.	SCHN	Small Cap	2	3	0	5	12
Olympic Steel, Inc.	ZEUS	Small Cap	1	1	1	3	19
Carpenter Technology Corporation	CRS	Small Cap	1	3	0	4	14
Ossen Innovation Co Ltd	OSN	Small Cap	1	1	1	3	19
L. B. Foster Company	FSTR	Small Cap	1	1	0	2	27
Friedman Industries, Incorporated	FRD	Small Cap	0	0	0	0	28

Appendix 4 Metals and Mining SASB Scores and Rank

Company Name	Ticker	Cap Size	2014	2015	2016	Total Score	Rank
BHP Billiton Ltd	BHP	Large Cap	0	3	3	6	11
Rio Tinto PLC	RIO	Large Cap	2	3	3	8	1
Freeport-Mcmoran Inc.	FCX	Large Cap	1	3	2	6	11
Gold Fields Ltd	GFI	Mid Cap	1	3	3	7	4
Southern Copper Corporation	SCCO	Large Cap	1	3	3	7	4
Vedanta Ltd	VEDL	Large Cap	2	3	3	8	1
Fairmount Santrol Inc.	FMSA	Small Cap	1	0	3	4	16
Alcoa Corporation	AA	Mid Cap	0	3	1	4	16
Vale SA	VALE	Large Cap	1	3	3	7	4

Newmont Mining Corporation	NEM	Large Cap	2	3	2	7	4
Aluminum Corp of China Ltd	ACH	Mid Cap	1	3	2	6	11
Sibanye Gold Ltd	SBGL	Small Cap	1	2	2	5	14
AngloGold Ashanti Ltd	AU	Mid Cap	2	3	2	7	4
Arconic Inc.	ARNC	Large Cap	2	1	2	5	14
Compass Minerals International, Inc.	CMP	Mid Cap	1	1	1	3	19
Constellium N.V.	CSTM	Small Cap	1	1	1	3	19
Gold Resource Corporation	GORO	Small Cap	3	1	3	7	4
Cliffs Natural Resources Inc.	CLF	Mid Cap	1	1	1	3	19
Pershing Gold Corporation	PGLC	Small Cap	3	2	3	8	1
Barrick Gold Corp.	ABX	Small Cap	0	2	2	4	16
Harmony Gold Mining Co Ltd	HMY	Small Cap	0	0	2	2	29
Kaiser Aluminum Corporation	KALU	Small Cap	1	1	1	3	19
Tredegar Corporation	TG	Small Cap	1	1	1	3	19
Vale SA	VALE/P	Large Cap	1	0	2	3	19
Coeur Mining, Inc.	CDE	Small Cap	1	1	1	3	19
Ferroglobe PLC	GSM	Small Cap	0	1	1	2	29
Royal Gold, Inc.	RGLD	Mid Cap	1	1	1	3	19
Global Brass and Copper Holdings, Inc.	BRSS	Small Cap	1	1	1	3	19
Ciner Resources LP	CINR	Small Cap	1	1	1	3	19
Hecla Mining Company	HL	Mid Cap	3	3	1	7	4

Appendix 5 Solar Energy SASB Scores and Rank

Company Name	Ticker	Cap Size	2014	2015	2016	Total Score	Rank
Jinkosolar Holding Co. Ltd	JKS	Small Cap	2	2	2	6	1
Hanwha Q Cells Korea Corp.	HQCL	Small Cap	1	2	2	5	2
Yingli Green Energy Holding Company Limited	YGE	Small Cap	1	1	3	5	2
Canadian Solar Inc	CSIQ	Small Cap	1	1	1	3	7
JA Solar Holdings Company Ltd	JASO	Small Cap	1	1	2	4	5
First Solar, Inc.	FSLR	Mid Cap	1	1	1	3	7
Renesola Zhejiang Ltd.	SOL	Small Cap	1	1	2	4	5
Chongqing Daqo New Energy Co. Ltd.	DQ	Small Cap	2	2	1	5	2
Sky Solar Holdings Ltd	SKYS	Small Cap	0	0	0	0	14
Sunpower Corporation	SPWR	Small Cap	1	1	1	3	7
Sunrun Inc.	RUN	Small Cap	0	1	1	2	11
Azure Power India Private Limited	AZRE	Small Cap	0	0	1	1	13
Vivint Solar, Inc.	VSLR	Small Cap	0	0	0	0	14
Sunworks, Inc.	SUNW	Small Cap	0	0	0	0	14
Ellomay Capital Ltd	ELLO	Small Cap	1	1	1	3	7

Enphase Energy, Inc.	ENPH	Small Cap	0	0	0	0	14
Real Goods Solar, Inc.	RGSE	Small Cap	0	0	0	0	14
Terraform Global, Inc.	GLBL	Small Cap	0	1	1	2	11
Advanced Energy Industries, Inc.	AEIS	Mid Cap	0	0	0	0	14

Appendix 6 Containers and Packaging SASB Scores and Rank

Company Name	Ticker	Cap Size	2014	2015	2016	Total Score	Rank
Packaging Corporation of America	PKG	Mid Cap	2	3	3	8	1
International Paper Company	IP	Large Cap	2	3	2	7	2
3M Company	MMM	Large Cap	3	2	2	7	2
Ball Corporation	BLL	Large Cap	3	3	1	7	2
Sonoco Products Company	SON	Mid Cap	3	3	1	7	2
Westrock Company	WRK	Large Cap	0	2	1	3	10
Crown Holdings Inc.	CCK	Mid Cap	2	3	1	6	6
Owens-Illinois, Inc.	OI	Mid Cap	1	1	1	3	10
Graphic Packaging Holding Company	GPK	Mid Cap	1	1	1	3	10
Silgan Holdings Inc.	SLGN	Mid Cap	1	0	1	2	16
Greif, Inc.	GEF	Mid Cap	1	1	2	4	7
Berry Plastics Group, Inc.	BERY	Mid Cap	1	1	1	3	10
Bemis Company, Inc.	BMS	Mid Cap	1	0	2	3	10
Sealed Air Corporation	SEE	Mid Cap	2	1	1	4	7
Avery Dennison Corporation	AVY	Mid Cap	2	1	1	4	7
Aptargroup, Inc.	ATR	Mid Cap	0	0	0	0	17
Mobile Mini, Inc.	MINI	Small Cap	1	1	1	3	10

Appendix 7 Electrical and Electronics Equipment SASB Scores and Rank

Company Name	Ticker	Cap Size	2014	2015	2016	Total Score	Rank
ABB Ltd	ABB	Large Cap	1	3	3	7	2
General Electric Company	GE	Large Cap	3	3	2	8	1
Eaton Corporation Public Limited Company	ETN	Large Cap	1	3	2	6	5
Ingersoll-Rand Public Limited Company	IR	Large Cap	1	3	1	5	7
Honeywell International Inc.	HON	Large Cap	3	3	1	7	2
Emerson Electric Co.	EMR	Large Cap	1	1	1	3	14
Orion Energy Systems, Inc.	OESX	Small Cap	1	1	1	3	14
Amphenol Corporation	APH	Large Cap	1	1	2	4	10
SPX Corporation	SPXC	Small Cap	2	1	2	5	7
A. O. Smith Corporation	AOS	Mid Cap	2	1	1	4	10
General Cable Corporation	BGC	Small Cap	1	3	1	5	7
Bwx Technologies, Inc.	BWXT	Mid Cap	2	2	2	6	5

Acuity Brands, Inc.	AYI	Mid Cap	1	1	1	3	14
Itron, Inc.	ITRI	Mid Cap	1	1	1	3	14
Pioneer Power Solutions, Inc.	PPSI	Small Cap	1	1	1	3	14
Thermon Group Holdings, Inc.	THR	Small Cap	1	1	1	3	14
Watts Water Technologies, Inc.	WTS	Mid Cap	1	0	1	2	24
Allegion Public Limited Company	ALLE	Mid Cap	1	1	2	4	10
Ametek, Inc.	AME	Large Cap	2	3	2	7	2
CompX International Inc.	CIX	Small Cap	1	1	1	3	14
Energy Focus, Inc.	EFOI	Small Cap	1	0	1	2	24
Energy Recovery, Inc.	ERII	Small Cap	0	0	0	0	29
Littelfuse, Inc.	LFUS	Mid Cap	1	1	2	4	10
Lennox International Inc.	LII	Mid Cap	2	0	1	3	14
LSI Industries Inc.	LYTS	Small Cap	1	0	1	2	24
MTS Systems Corporation	MTSC	Small Cap	1	1	1	3	14
OSI Systems, Inc.	OSIS	Small Cap	1	0	2	3	14
Revolution Lighting Technologies, Inc.	RVLT	Small Cap	0	1	1	2	24
Sparton Corporation	SPA	Small Cap	0	0	2	2	24
Trimble Inc.	TRMB	Mid Cap	0	0	0	0	29

Appendix 8 Automobile SASB Scores and Rank

Company Name	Ticker	Cap Size	2014	2015	2016	Total Score	Rank
General Motors Company	GM	Large Cap	1	3	3	7	1
Toyota Motor Corp	TM	Small Cap	2	0	3	5	2
Tata Motors Ltd	TTM	Large Cap	0	0	1	1	6
Ford Motor Company	F	Large Cap	0	1	1	2	4
Honda Motor Co Ltd	HMC	Large Cap	0	0	1	1	6
Harley-Davidson, Inc.	HOG	Large Cap	0	0	0	0	11
Ferrari Nv	RACE	Large Cap	0	0	1	1	6
Tesla, Inc.	TSLA	Large Cap	2	1	1	4	3
Camping World Holdings, Inc.	CWH	Mid Cap	0	0	1	1	6
Thor Industries, Inc.	THO	Mid Cap	0	0	1	1	6
Winnebago Industries, Inc.	WGO	Small Cap	1	0	1	2	4
Polaris Industries Inc.	PII	Mid Cap	0	0	0	0	11
Wsi Industries, Inc.	WSCI	Small Cap	0	0	0	0	11
Fiat Chrysler Automobiles N.V.	FCAU	Large Cap	0	0	0	0	11

Appendix 9 Food Retailers & Distributors Revenue and Growth Rate Details

Company Name	Ticker	Total Waste Management Behavior Score	Revenue (mil \$)	Growth Rate %
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Whole Foods Market, Inc.	WFM	8	15724	2.2
Cia Brasileira de Distribuicao	CBD	4	41454	11.4
Supervalu Inc.	SVU	2	11283	-15
Core-Mark Holding Company, Inc.	CORE	0	14529	31.3
Natural Grocers By Vitamin Cottage, Inc.	NGVC	0	705	12.9
Performance Food Group Company	PFGC	1	16104	5.5
The Chefs' Warehouse Inc	CHEF	0	1192	13.9
Sysco Corporation	SYU	3	50366	3.5
US Foods Holding Corp.	USFD	0	22918	-0.9
Spartannash Company	SPTN	0	7734	1.1
United Natural Foods, Inc.	UNFI	0	8470	3.5
Smart & Final Stores, Inc.	SFS	2	4341	9.3
Cencosud SA	CNCO	0	15293	-6
Medifast, Inc.	MED	2	274.5	0.6
Amcon Distributing Company Inc	DIT	0	467.9	13.8
G. Willifood International Ltd.	WILC	0	76.5	-4.5
Casey's General Stores, Inc.	CASY	0	7122	-8.3
Village Super Market, Inc.	VLGEA	0	1634	3.2
Sprouts Farmers Market Texas, LP	SFM	0	4046	12.6
Weis Markets, Inc.	WMK	0	3136	9
Ingles Markets, Incorporated	IMKTA	0	3795	0.4
The Kroger Co	KR	0	109830	1.3

Appendix 10 Waste Management Revenue and Growth Rate Details

Company Name	Ticker	Total Waste Management Behavior Score	Revenue (mil \$)	Growth Rate %
Republic Services, Inc.	RSG	7	9387	3
Casella Waste Systems, Inc.	CWST	5	565	3.4
Waste Management, Inc.	WM	6	13609	5
Advanced Disposal Services, Inc.	ADSW	4	1404	0.6
WCI Acquisition Corp 2	WCN	3	3375	59.4
Clean Harbors, Inc.	CLH	6	2755	-15.9
Covanta Holding Corporation	CVA	3	1699	3.3
US Ecology, Inc.	ECOL	3	477	-15.2
Heritage-Crystal Clean, Inc.	HCCI	3	347	-0.7
Meridian Waste Solutions, Inc.	MRDN	4	31.7	134.9
Perma-Fix Environmental Services, Inc.	PESI	1	51.2	-17.9
Real Industry, Inc.	RELY	0	1249	9.1
Quest Resource Holding Corporation	QRHC	1	183.8	8

China Recycling Energy Corporation	CREG	0	0	-100
Stericycle, Inc.	SRCL	4	3562	19.3
Centrus Energy Corp.	LEU	3	311	-25.6
Calgon Carbon Corporation	CCC	0	3245	6.1
Clean Diesel Technologies Inc	CDTI	0	36.8	-7.3
Fenix Parts, Inc.	FENX	3	132.1	91.6
Avalon Holdings Corporation	AWX	3	61.4	15.6
Ecology and Environment Inc.	EEI	0	312	-21.8
Sharps Compliance Corp.	SMED	2	33.4	8
Vertex Energy, Inc.	VTNR	2	98.1	-33.3
Aqua Metals, Inc.	AQMS	2	-	-
Liqtech International A/S	LIQT	1	-	-
Industrial Services of America, Inc.	IDSA	1	36.5	-21

Appendix 11 Iron & Steel Revenue and Growth Rate Details

Company Name	Ticker	Total Waste Management Behavior Score	Revenue (mil \$)	Growth Rate %
ArcelorMittal	MT	9	56791	-10.7
United States Steel Corp	X	8	10261	-11.3
AK Steel Holding Corporation	AKS	8	5882	-12.1
Steel Dynamics, Inc.	STLD	9	7777	2.4
Gerda SA	GGB	6	37651	-13.6
Posco	PKX	8	45775	-8.8
Haynes International, Inc.	HAYN	6	406	-16.7
Mechel PJSC	MTL	7	781	-14.8
Nucor Corporation	NUE	5	16208	-1.4
Allegheny Technologies Incorporated	ATI	6	31314	-15.7
Ternium Sa	TX	3	7224	-8.3
Worthington Industries, Inc.	WOR	3	5664	-11.1
Empire Resources, Inc.	ERS	0	458	-12.1
Commercial Metals Company	CMC	7	4177	-30.2
Ryerson Holding Corporation	RYI	4	2859	-9.7
Timkensteel Corporation	TMST	3	869	-21.4
Synalloy Corporation	SYNL	4	138	-21
Insteel Industries, Inc.	IIIN	0	418	-6.5
Reliance Steel & Aluminum Co.	RS	4	8613	-7.9
Tenaris SA	TS	4	4293	-37.8
Northwest Pipe Company	NWPX	7	156	-34
Universal Stainless & Alloy Products, Inc.	USAP	3	154	-14.5

Handy & Harman Ltd.	HNH	3	828	27.5
Intricon Corporation	IIN	3	68	-0.8
Schnitzer Steel Industries, Inc.	SCHN	5	1352	-29.4
Olympic Steel, Inc.	ZEUS	3	1055	-10.2
Carpenter Technology Corporation	CRS	4	1813	-18.6
Ossen Innovation Co Ltd	OSN	3	117	-0.7
L. B. Foster Company	FSTR	2	483	-22.6
Friedman Industries, Incorporated	FRD	0	81.6	-24.6

Appendix 12 Metals and Mining Revenue and Growth Rate Details

Company Name	Ticker	Total Waste Management Behavior Score	Revenue (mil \$)	Growth Rate %
BHP Billiton Ltd	BHP	6	28567	-36
Rio Tinto PLC	RIO	8	33781	-3
Freeport-Mcmoran Inc.	FCX	6	14830	1.5
Gold Fields Ltd	GFI	7	2666	4.8
Southern Copper Corporation	SCCO	7	5379	6.6
Vedanta Ltd	VEDL	8	9773	-12.9
Fairmount Santrol Inc.	FMSA	4	535	-35.4
Alcoa Corporation	AA	4	9318	-16.8
Vale SA	VALE	7	27328	21.2
Newmont Mining Corporation	NEM	7	6711	10.3
Aluminum Corp of China Ltd	ACH	6	21719	16.8
Sibanye Gold Ltd	SBGL	5	2133	37.5
AngloGold Ashanti Ltd	AU	7	4085	1.7
Arconic Inc.	ARNC	5	12394	-0.2
Compass Minerals International, Inc.	CMP	3	1138	3.6
Constellium N.V.	CSTM	3	5249	-8
Gold Resource Corporation	GORO	7	83.2	-10.2
Cliffs Natural Resources Inc.	CLF	3	2109	4.8
Pershing Gold Corporation	PGLC	8	-	-
Barrick Gold Corp.	ABX	4	8558	-5.2
Harmony Gold Mining Co Ltd	HMY	2	1272	18.8
Kaiser Aluminum Corporation	KALU	3	1330	-4.4
Tredegar Corporation	TG	3	830	-5.2
Vale SA	VALE/P	3	27328	21.2
Coeur Mining, Inc.	CDE	3	571	-11.5
Ferroglobe PLC	GSM	2	1576	19.7
Royal Gold, Inc.	RGLD	3	359	29.4

Global Brass and Copper Holdings, Inc.	BRSS	3	1338	-11.1
Ciner Resources LP	CINR	3	475	-2.3
Hecla Mining Company	HL	7	646	45.6

Appendix 13 Solar Energy Revenue and Growth Rate Details

Company Name	Ticker	Total Waste Management Behavior Score	Revenue (mil \$)	Growth Rate %
Jinkosolar Holding Co. Ltd	JKS	6	3222	38.5
Hanwha Q Cells Korea Corp.	HQCL	5	2425	34.7
Yingli Green Energy Holding Company Limited	YGE	5	1261	-16
Canadian Solar Inc	CSIQ	3	2853	-17.7
JA Solar Holdings Company Ltd	JASO	4	2369	16.4
First Solar, Inc.	FSLR	3	2904	-29.4
Renesola Zhejiang Ltd.	SOL	4	-	-
Chongqing Daqo New Energy Co. Ltd.	DQ	5	-	-
Sky Solar Holdings Ltd	SKYS	0	65.9	39.8
Sunpower Corporation	SPWR	3	2559	62.4
Sunrun Inc.	RUN	2	453	49
Azure Power India Private Limited	AZRE	1	62.4	-
Vivint Solar, Inc.	VSLR	0	135	110.6
Sunworks, Inc.	SUNW	0	86.4	60.9
Ellomay Capital Ltd	ELLO	3	12	-6.8
Enphase Energy, Inc.	ENPH	0	322	-9.7
Real Goods Solar, Inc.	RGSE	0	17.5	-61.6
Terraform Global, Inc.	GLBL	2	214	72.7
Advanced Energy Industries, Inc.	AEIS	0	483	16.6

Appendix 14 Containers and Packaging Revenue and Growth Rate Details

Company Name	Ticker	Total Waste Management Behavior Score	Revenue (mil \$)	Growth Rate %
Packaging Corporation of America	PKG	8	5779	0.6
International Paper Company	IP	7	19495	-5.7
3M Company	MMM	7	30109	-0.5
Ball Corporation	BLL	7	9061	13.3
Sonoco Products Company	SON	7	4782	-3.7
Westrock Company	WRK	3	14171	27.4
Crown Holdings Inc.	CCK	6	8284	-5.5
Owens-Illinois, Inc.	OI	3	6702	8.9

Graphic Packaging Holding Company	GPK	3	4298	3.3
Silgan Holdings Inc.	SLGN	2	3612	-4
Greif, Inc.	GEF	4	3323	-8.1
Berry Plastics Group, Inc.	BERY	3	6489	32.9
Bemis Company, Inc.	BMS	3	4004	-1.6
Sealed Air Corporation	SEE	4	4211	-40.1
Avery Dennison Corporation	AVY	4	6086	2
Aptargroup, Inc.	ATR	0	2330	0.6
Mobile Mini, Inc.	MINI	3	508	-3.5

Appendix 15 Electrical and Electronics Equipment Revenue and Growth Rate Details

Company Name	Ticker	Total Waste Management Behavior Score	Revenue (mil \$)	Growth Rate %
ABB Ltd	ABB	7	33828	-4.7
General Electric Company	GE	8	119687	3.9
Eaton Corporation Public Limited Company	ETN	6	19747	-5.3
Ingersoll-Rand Public Limited Company	IR	5	13508	1.6
Honeywell International Inc.	HON	7	39302	1.9
Emerson Electric Co.	EMR	3	14522	-10.6
Orion Energy Systems, Inc.	OESX	3	67.6	-6.3
Amphenol Corporation	APH	4	6286	12.9
SPX Corporation	SPXC	5	1472	-5.6
A. O. Smith Corporation	AOS	4	2685	5.9
General Cable Corporation	BGC	5	3858	-8.7
Bwx Technologies, Inc.	BWXT	6	1550	9.5
Acuity Brands, Inc.	AYI	3	3191	21.6
Itron, Inc.	ITRI	3	2013	6.9
Pioneer Power Solutions, Inc.	PPSI	3	99	-6.5
Thermon Group Holdings, Inc.	THR	3	281	-8.6
Watts Water Technologies, Inc.	WTS	2	1398	-4.7
Allegion Public Limited Company	ALLE	4	2238	8.2
Ametek, Inc.	AME	7	3840	-3.4
Compex International Inc.	CIX	3	108	-0.1
Energy Focus, Inc.	EFOI	2	31	-51.9
Energy Recovery, Inc.	ERII	0	49	13.8
Littelfuse, Inc.	LFUS	4	1056	21.7
Lennox International Inc.	LII	3	3641	5
LSI Industries Inc.	LYTS	2	322	4.7

MTS Systems Corporation	MTSC	3	650	15.3
OSI Systems, Inc.	OSIS	3	829	-13.4
Revolution Lighting Technologies, Inc.	RVLT	2	172	32.8
Sparton Corporation	SPA	2	419	9.7
Trimble Inc.	TRMB	0	2362	3.1

Appendix 16 Automobile Revenue and Growth Rate Details

Company Name	Ticker	Total Waste Management Behavior Score	Revenue (mil \$)	Growth Rate %
General Motors Company	GM	7	149184	9.9
Toyota Motor Corp	TM	5	236785	4.3
Tata Motors Ltd	TTM	1	40873	3.4
Ford Motor Company	F	2	151800	1.5
Honda Motor Co Ltd	HMC	1	121724	9.6
Harley-Davidson, Inc.	HOG	0	5996	0
Ferrari Nv	RACE	1	3105	8.8
Tesla, Inc.	TSLA	4	7000	73
Camping World Holdings, Inc.	CWH	1	3519	5.6
Thor Industries, Inc.	THO	1	4582	14.4
Winnebago Industries, Inc.	WGO	2	975.2	-0.1
Polaris Industries Inc.	PII	0	4516	-4.3
Wsi Industries, Inc.	WSCI	0	35.2	-18.1
Fiat Chrysler Automobiles N.V.	FCAU	0	122877	0.3

²⁵ Sustainable Development Goals (SDGs) <https://sustainabledevelopment.un.org/sdgs>