MSCI

Innovation Investing and Equity Allocations

Mehdi Alighanbari, Ketaki Garg, Ashish Lodh, Saurabh Katiyar

October 2022

msci.com

Contents

Introduction

Innovation investing, which refers to a focus on companies that offer innovative solutions while creating new markets, increasing market share or enlarging an existing market, has gained momentum over the past few years. Innovation is not limited to products and services, as companies can be innovative in their business model, marketing approach or financing.

This growing investor appetite for innovation has led to the creation of investment vehicles that focus on both innovation-driven[1] themes and innovative companies. Innovation investing can encompass a variety of investment approaches. In this paper we focus on systematically investing in companies that seek to capitalize on opportunities created by megatrends and innovation-driven themes. Themes that are structural, transformative and often disruptive in nature, rather than short-term shifts or fads. Thus, we use the terms innovation investing and thematic investing almost interchangeably in this report.

Innovation investing is gradually becoming part of the institutional investor toolkit after primarily being popular among retail investors. As the potential for innovation in shaping the future equity market becomes clearer and more accepted, some asset owners are considering innovation investing in earlier stages of asset allocation. Taking a page out of the Yale Model by David Swensen and Dean Takahashi,[2] asset owners can allocate to innovation across their core and satellite allocations.

But limitations and challenges exist, such as the number of companies that have meaningful economic linkage to any single theme is often small. This restricts the thematic-investment universe and can result in both a restrained investment capacity and high tracking error, which may potentially be undesirable for large allocations. In this paper, we aim to address these challenges by answering the following questions:

- Where does innovation investing fit in the asset allocation process?
- How can portfolios be constructed to capture innovation-driven themes while providing a suitable level of capacity and liquidity?
- How might a traditional allocation framework, such as sector, country and style factor, be adjusted to incorporate an innovation allocation?

[1] For our definition of innovation-driven themes and the list of MSCI innovation-driven themes please see Appendix 2.

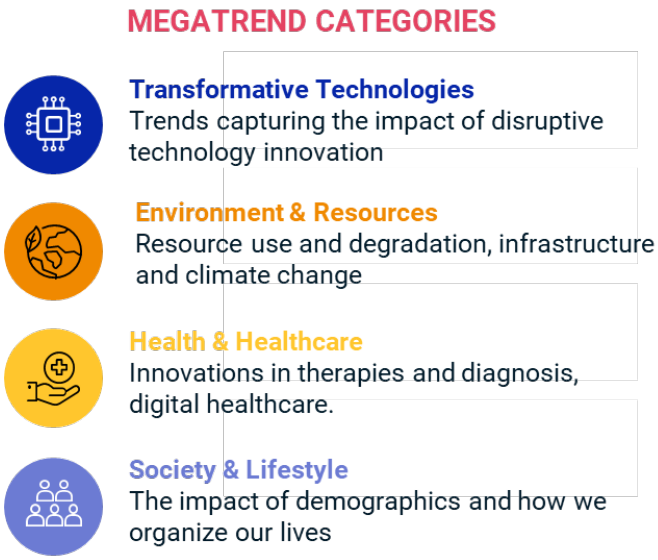
[2] The Yale Model broadly consists of dividing a portfolio into five or six roughly equal parts and investing each in a different asset class.

Capturing innovation through themes

What defines an innovative company, and how can we identify these companies? We initially identify key innovative themes and measure companies' exposure to these themes. This mirrors our approach when calculating stock exposure to style factors, where we first identify factors and then measure the exposure of individual stocks to these factors.

Themes are typically derived from megatrends, which we define as long-term structural trends that are transforming global economies and daily life, as well as impacting businesses. We have identified four broad megatrends, which are also the basis for MSCI's thematic indexes.

Exhibit 1: MSCI megatrend categories



The themes underlying these megatrends tend to be long-term in nature, and they typically span across sectors and may evolve quickly as the underlying trends have economic impact. Once we identify megatrend categories and their underlying themes, the next step is to find companies that have exposure to these themes.

Assessing thematic exposure

Challenges

While factor investing can draw on a long history of academic research, data and theory, thematic investing is predicated on the emergence of new business models, technological advancements and changing consumer behavior. Such information is not comprehensively reflected in companies' financial data. Key evidence may need to be found in a company's discussion of early-stage corporate activities, capital expenditure

or growth plans. It may also be difficult to identify companies that are buried deep in the value chain of a theme, and those that may have less of a direct linkage to the theme.

Economic linkage between a company and a theme

Thematic exposure gauges the economic linkage between a company and a theme. We call this metric a company's "relevance score" for a theme, which ranges from 0% to 100%. These scores are encapsulated through the MSCI Thematic Exposure Standard (TES) and can be used to systematically measure, monitor and report on the thematic exposure of indexes, portfolios and funds, as well as provide company-level thematic exposures for a broad universe of equities.

The relevance score is designed to help assess the importance of a theme to the company's business activities and may reflect both "upstream" activities such as capital expenditure and merger and acquisition plans, product development and competitive agenda, as well as established revenue or earnings streams disclosed at the business-line level.

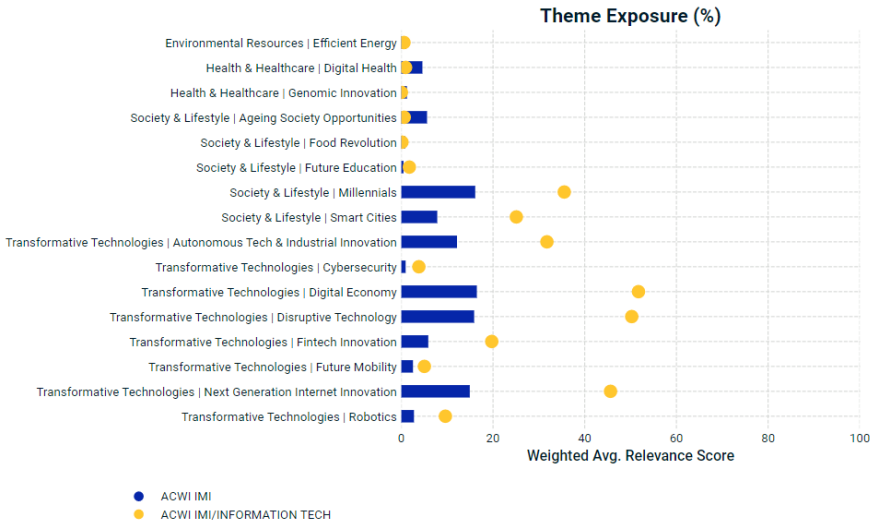
The first step in calculating the relevance score is to break down the theme's scope into high-level concepts such as products, services and technologies in the value chain. We then use natural language processing (NLP) techniques to gather synonyms and other related concepts to expand the high-level ideas into a more granular pool of words and phrases. The use of NLP techniques accelerates the research phase of theme development and allows themes to be modelled in a scalable and cost-effective manner.

The next step is to compare companies' self-declared business-line information and publicly-sourced business description information with this resulting large pool of words and phrases. We do this to find evidence of the company's association with those products, services or technologies that are pertinent to the theme. This association is quantified in the relevance score by estimating revenue attributable to the theme as a proportion of the total revenue of the company.

In addition to being used as a screening metric to construct thematic indexes, the relevance score may also enable investors to better understand how themes impact their portfolio's profile, complementing more traditional country, industry and style factor lenses for analysis.

Exhibit 2 shows the thematic exposure profile of the MSCI ACWI Investable Market Index (IMI) and MSCI ACWI IMI Information Technology Index. Low thematic exposures of these indexes to certain themes, such as Efficient Energy, Digital Health, Genomic Innovation, highlights that simple sector or market allocations may not adequately provide exposure to themes.

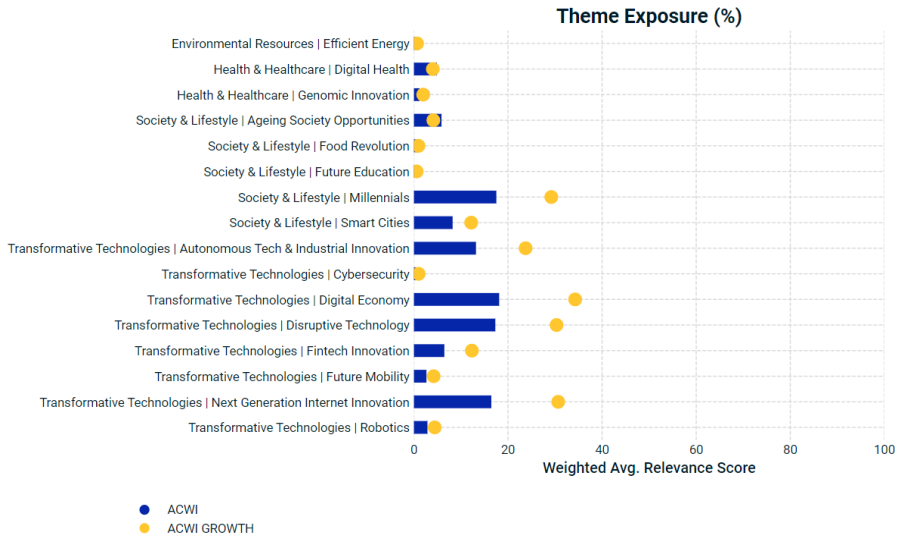
Exhibit 2: Market or sector allocations do not capture exposure to themes well enough



Data as of April 29, 2022.

Exhibit 3 details the thematic exposure profile of the MSCI ACWI Growth Index, which has significantly greater exposure to the Transformative Technology category than themes focused on healthcare or the environment. This also illustrates that thematic investing can provide exposure to themes that are complementary to those of traditional growth investing.

Exhibit 3: Traditional growth allocation is different from the 'growth exposure captured by thematic investing



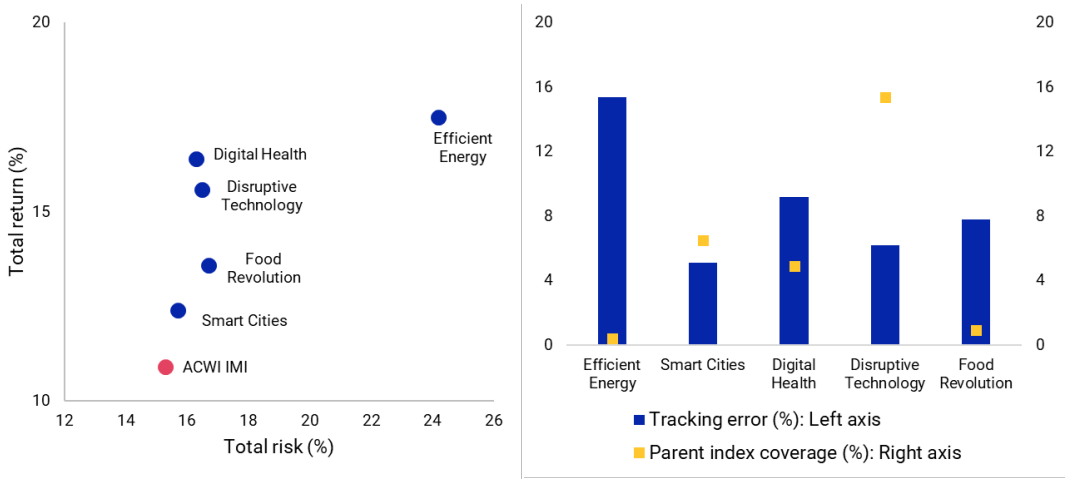
Latest available data as of April 29, 2022.

Putting themes to work

Many active funds, index-tracking funds and an increasing number of ETFs are aligned with a growing demand for financial products that target innovation-driven themes.

Exhibit 4 displays some important characteristics of selected MSCI indexes on which some of these financial products may be built. These indexes are designed to provide high exposure to a specific theme, and could be concentrated with constituents ranging from less than a hundred to several hundred. The more concentrated indexes could generate greater-than-market volatility with high relative tracking error (> 10%).

Exhibit 4: Characteristics of selected MSCI thematic indexes



Gross returns annualized in USD. Nov. 30, 2016, to May 31, 2022.

As some asset owners consider larger allocations to innovation, investment strategies need to offer higher-capacity and low tracking-error. It is important to keep in mind that most indexes capturing a single theme might be too concentrated and narrow to be the basis for large allocations.

As an example, the dot-com bubble included unrealistic growth expectations that got ahead of underlying business models viability and scalability. Speculative, fad-based investing without focusing on company's financial health was among the primary causes of this equity-market bubble. Additionally, large flows of capital into a small subset of internet-related companies (with limited capacity and free float) exacerbated the problem.

A portfolio designed for a large-scale allocation to innovation would need to actively reflect controls on its capacity and concentration characteristics during portfolio construction. To capture innovation more holistically, a diversification of the themes is also natural and often necessary. We believe these two objectives go hand in hand. We also see multi-theme diversification reducing the need for active decision-making and this could support its widespread adoption.

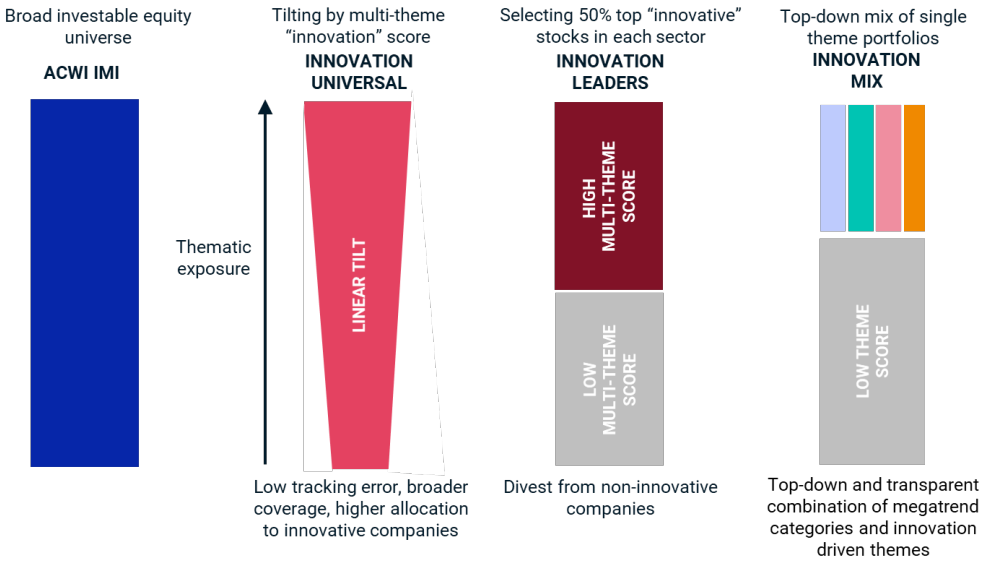
Designing innovation portfolios

There are different approaches to broadly invest in innovation that may fit the capacity and investability requirements for the basis of a significant (core) allocation by institutional asset owners. These broad approaches could also be relevant for investors who want to target innovation but do not have a preference for one theme over another.

In advance of all these approaches, we first measure innovation holistically and define an "innovation score" that not only captures a broad range of innovation-driven themes but also represents the aforementioned megatrends. We identified 14 innovation-driven themes across the four megatrends (Appendix 1), tallying a company's innovation score by aggregating the four megatrend category scores.[3]

Exhibit 5 details three ways to construct broad innovation portfolios. The approaches aim to be broad and diversified, both in terms of the number of innovation-driven themes they cover and the number of portfolio constituents. The differences in the approaches to combine innovation-driven themes results in some variance in how broad these portfolios are, how much they deviate from the benchmark market-cap index (MSCI ACWI IMI) and other characteristics.

Exhibit 5: Approaches to construct broad innovation portfolios



[3] The megatrend category score (ranging 0-1) is the highest theme relevance score the company exhibits across all the themes mapped to that megatrend category. The innovation score (ranging 0-4) could be used to aid security selection or weighting when constructing broad innovation targeting portfolios. Please see Appendix 1 for more details.

The names of the portfolios represent concepts and do not correspond to MSCI indexes or real portfolios.

1. The **Innovation Universal** approach allows to create the broadest and most diversified portfolio among the three approaches. This approach intends to include all of the constituents of the broad market-cap index to inherit the high-capacity characteristics and shifts allocations from less-innovative companies to the most innovative. This gives the resulting portfolio a tilt towards innovation, as measured by aggregate exposure to the targeted themes.[4]

2. The **Innovation Leaders** approach aims to achieve exposure to innovation by selecting the most innovative companies within each sector in the benchmark, as sectors are important aspects of current asset allocation models for some investors. To avoid large and unintended sectorial biases, the approach targets companies with the highest innovation score within each sector (represents 50% of sector market capitalization). Compared to Innovation Universal, the Innovation Leaders approach tended to achieve higher exposure to innovation (as reflected in the higher MSCI TES scores related to specific themes) and resulted in lower market coverage (about 50% of index). [5]

3. The **Innovation Mix** approach is a top-down approach that combines single-theme portfolios to create a broad multi-theme portfolio[6]. Like the other two approaches, the use of multiple themes provides a level of diversification, both in terms of themes and number of stocks in the portfolio. The top-down nature of this methodology creates an additional level of transparency and flexibility. It enables investors to dynamically implement their views as the themes and their macroeconomic views evolve, and it also provides a simple performance-attribution breakdown across individual themes. [7]

Characteristics of broad multi-thematic approaches

To better understand the trade-offs between the three approaches, we compare their historical behavior using simulated backtesting, from Nov. 30, 2016, to May 31, 2022. Exhibit 6 demonstrates the trade-off between the exposure to innovation and active risk relative to the broad market-cap index. Innovation exposure is defined as the average of

[4] The Innovation Universal approach reweights all the constituents of ACWI IMI in the proportion of their free float adjusted market cap and a tilt factor. The tilt factor is determined by stock's innovation score, and it ranges from 1 (for innovation scores 0.00 – 0.25) to 5 (for innovation scores 3.00 – 4.00). Please see Appendix 1 for more details on portfolio construction.

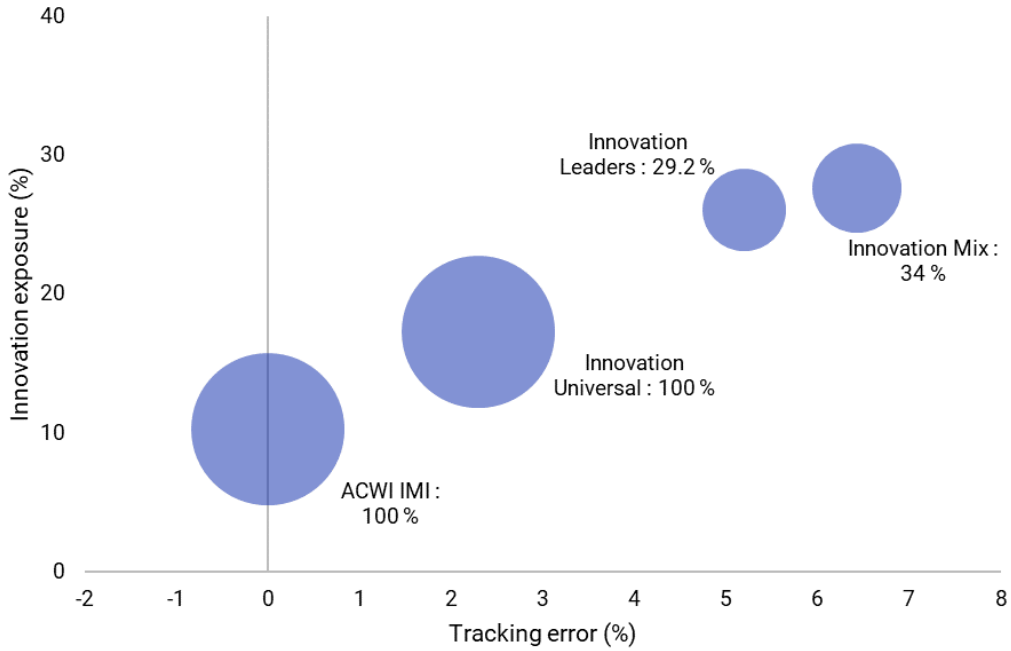
[5] The Innovation Leaders approach selects, within each sector, stocks with the highest innovation score until 50% of sector market cap is reached. Stocks with innovation score of < 0.25 are ineligible. Please see Appendix 1 for more details on portfolio construction.

[6] Here single-theme portfolios are based on MSCI thematic indexes.

[7] The Innovation Mix approach combines, in equal weight and at a quarterly frequency, 10 single theme MSCI thematic indexes targeting the following innovation themes (spanning across the four categories): Efficient Energy, Smart Cities, Digital Health, Disruptive Technology, Genomic Innovation, Food Revolution, Next Gen Internet Innovation, Fintech Innovation, Autonomous Technology Innovation, and Future Mobility. The 10 themes represent a parsimonious subset of all innovation-driven themes, to minimizes overlap in scope and constituents. Please see Appendix 1 for more details on portfolio construction.

the four category scores (ranging 0-1), and it allows us to quantify the aggregate exposure to the innovation-driven themes across the four megatrend categories.

Exhibit 6: Trade-off between tracking error, innovation exposure and market coverage



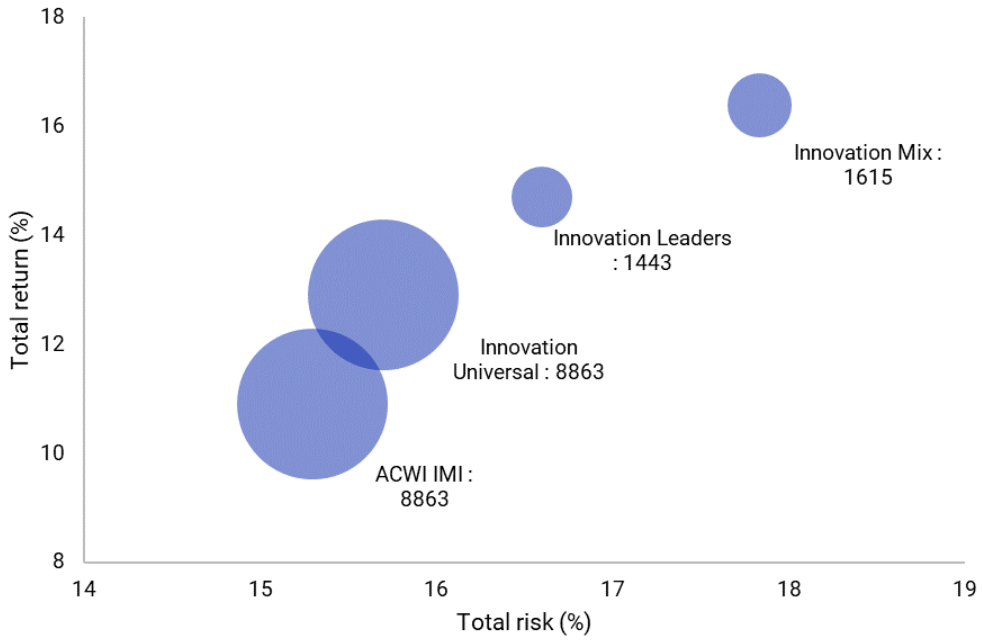
Gross returns annualized in USD. Nov. 30, 2016, to May 31, 2022. Bubble size represents the ACWI IMI coverage.

Compared to the market-cap index, all three portfolios show higher exposure to innovation. The Innovation Universal resulted in a 7% increase in innovation exposure compared to the MSCI ACWI IMI (from 10.3% to 17.3%). This improvement was achieved while holding all of the constituents of the ACWI IMI index and producing a tracking error of only 2.3%. The Innovation Leaders and Innovation Mix achieved higher innovation exposure by allowing the portfolio to select the subset of the MSCI ACWI IMI, which resulted in higher tracking error of 5.2% and 6.4% respectively.[8]

The Innovation Universal and Innovation Leaders approaches resulted in an improvement in performance over the MSCI ACWI IMI by 2.0% and 3.8%, respectively (Exhibit 7). Although both approaches exhibited marginally higher volatilities, they provided enhanced risk-adjusted returns relative to the MSCI ACWI IMI. The Innovation Mix had the highest return and volatility.

[8] Optimized portfolios targeting innovation could also be constructed if the objective is the optimal trade-off between tracking error and innovation score. While the optimization approach could provide better control on tracking error, it might also be more complex than the ones we have considered in this paper.

Exhibit 7: Risk-adjusted returns of the approaches



Gross returns annualized in USD. Number of stocks as of May 2022. Nov 30, 2016, to May 31, 2022. Bubble size represents the number of stocks

Exhibit 8 shows the active sector allocations for these approaches relative to MSCI ACWI IMI. The Innovation Universal approach's tilt-based weighting resulted in modest active sector allocations. And while the Innovation Leaders approach was designed to include the most innovative companies within each sector, some sectors like information technology and health care had higher innovation exposure and were overweighted in this approach. The Innovation Mix approach does not apply any control on sectors and active exposure to sectors can be significant.

Exhibit 8: Active sector exposures relative to the MSCI ACWI IMI

	Innovation Universal	Innovation Leaders	Innovation Mix
Energy	-1.5	-2.8	-3.6
Materials	-1.2	-2.4	2.2
Industrials	-0.6	1.1	0.3
Consumer discretionary	-0.4	1.4	-2.6
Consumer staples	-2.7	-6.1	-5.7
Health care	2.7	9.0	13.2
Financials	-5.7	-13.0	-14.1
IT	9.8	12.1	17.4
Comm. serv.	1.6	4.5	-2.9
Utilities	-0.5	-0.2	-0.2
Real estate	-1.5	-3.5	-3.8

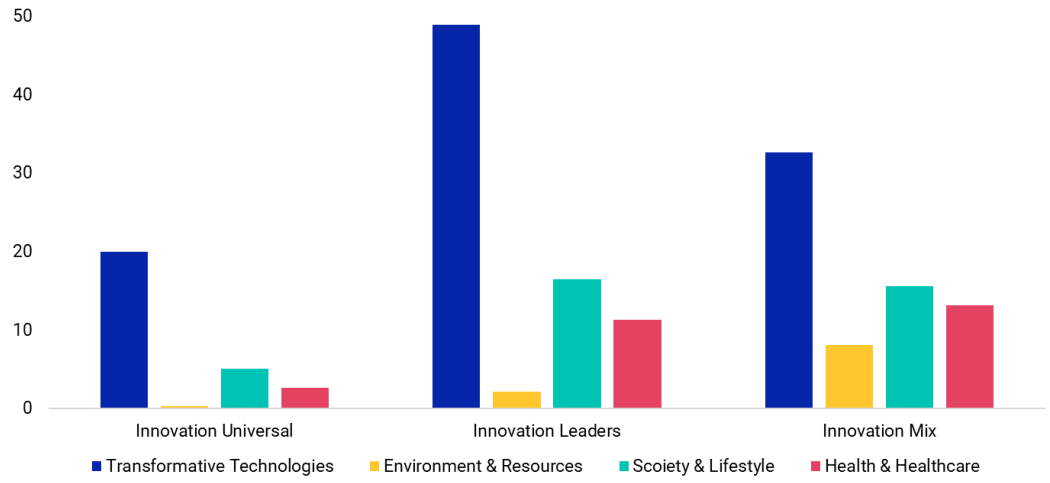
Monthly averages. Nov. 30, 2016, to May 31, 2022.

While all three approaches showed higher innovation exposure to targeted innovation-driven themes, it is important to see how different themes contributed to overall innovation exposure. Exhibits 9 and 10 present the active exposure of each portfolio to the four megatrend categories and the 14 underlying innovation-driven themes.

All three approaches showed positive active exposures to the megatrends and their underlying innovation-driven themes, with the Innovation Leaders and Innovation Mix providing higher exposures than Innovation Universal. These exposures stand in contrast to those of the MSCI ACWI Growth and MSCI Information Technology Indexes (Exhibits 2 and 3), which are characterized by a bias towards certain themes and a lack of exposure to others.

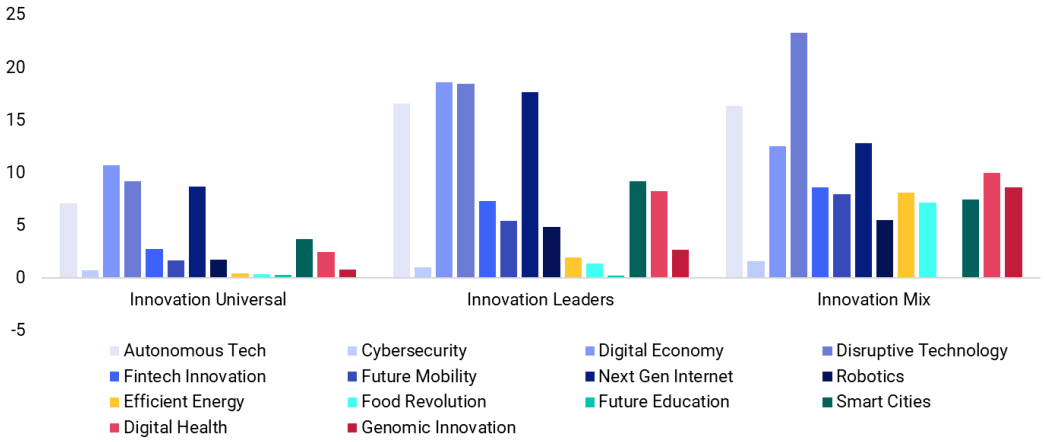
The level of exposure to megatrends and individual themes broadly depended on the magnitude of the portfolio's active share stemming from its design, as higher active share could lead to higher exposure. Though, the underlying themes also had an impact. For themes that have large number of companies operating in their value chain, such as the digital economy or a disruptive technology, it may be easier to achieve higher exposure compared to narrower themes without a deep value chain.

Exhibit 9: Active thematic category exposures (%) with respect to MSCI ACWI IMI index



As of May 31, 2022.

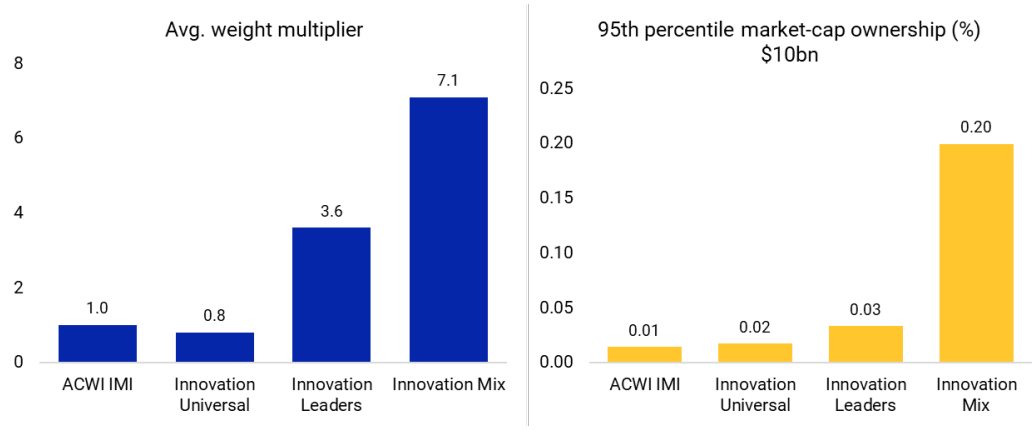
Exhibit 10: Active thematic exposures (%) with respect to MSCI ACWI IMI index



As of May 31, 2022.

Capacity is an important portfolio characteristic, especially when considered for large allocations. Exhibit 11 shows two proxies often used to demonstrate the level of portfolio capacity, namely the average-weight multiplier[9] and 95th percentile of market-cap ownership.[10] The graphic shows a comparison of the three portfolios with the MSCI ACWI IMI, presented as a baseline with high capacity.

Exhibit 3: Capacity proxies in detail



Monthly averages. Top market-cap ownership is the maximum ownership of free-float-adjusted market cap of a security for a $10bn portfolio.

The Innovation Universal approach had a capacity in line with the MSCI ACWI IMI, based on an average and maximum weight multiplier. The Innovation Leaders had lower

[9] The weight multiplier for each stock is the ratio of its weight in the portfolio over its weight in the benchmark. The average weight multiplier is the average of this multipliers over all the constituents of the portfolio.
[10] Given a specific portfolio size, the ownership % for each stock shows what % of its market cap the portfolio holds. The 95th percentile is across all the constituents of portfolio.

capacity than the Innovation Universal, but the average weight multiplier was a relatively modest 3.6x. The capacity of the Innovation Mix was lower than the other two approaches, which is due to its top-down approach and the direct impact of the capacity of underlying single-theme indexes.

It should be noted that for simplicity, we combined the MSCI thematic indexes and gave them equal weights to construct the Innovation Mix. Some of the underlying themes are relatively narrow and the indexes are concentrated, which impacted the overall capacity of the Innovation Mix. To improve capacity, a high-capacity weighting approach can also be applied.

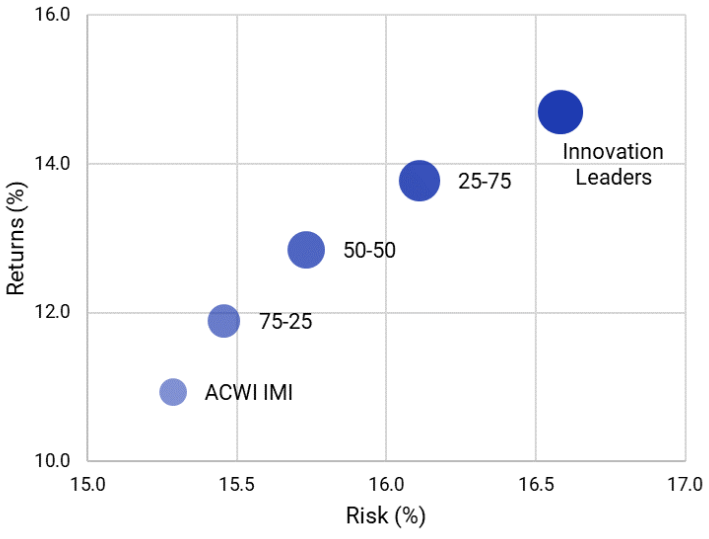
Innovation in investment allocations

Historically, many asset owners have tended to split their allocations into core and satellite buckets. Within equity, the core allocations have constituted diversified equity with the aim of capturing broader-market returns. Satellite allocations usually included investments that seek to earn excess returns within the allotted risk budget.

We explored three approaches to allocate to the innovative megatrends among these two buckets:

1. **Supplement core market allocations with an innovation allocation.** In the previous section, we showed that a combination of innovation-driven themes exhibited low tracking error and high capacity. Exhibit 12 shows how funding a broad innovation allocation from a traditional market allocation changed the risk-return profile of the core allocation.

Exhibit 4: Efficient frontier using market and multi-theme allocations



Bubble size = Innovation Exposure. Nov 30, 2016, to May 31, 2022.

Different combinations of market and broad-innovation allocations[11] provided a wide range of risk levels and innovation-exposure. Predictably, a higher allocation to Innovation Leaders would have provided a higher innovation exposure, risk and return. Interestingly, diversification benefits were in play through the higher exposure to innovative firms which meant a 50-50 combination of the MSCI ACWI IMI and the Innovation Leaders provided higher innovation exposure and higher historical risk-adjusted returns.

2. **Deploy innovation portfolios in satellite allocations**. We recognize that the innovation allocation comes with its own set of distinct characteristics. Single theme portfolios might be less diversified and have capacity challenges for large allocations, while producing high tracking error to market allocations. As such, they have historically been used in satellite allocations.[12] While single theme portfolios may provide flexibility for thematic rotation, broad innovation portfolios can also be used in the satellite allocation as they provide diversity among themes and may be attractive when investors don't have strong conviction on specific theme.

3. **Combine innovation allocations with low-volatility allocations**. We noted earlier that the outperformance of innovation investing has been generated with higher risk. In a previous MSCI blog, we explored how innovation could have been added to equity programs by combining it with low-volatility allocations. The research highlighted how this combination helped balance the trade-offs between higher levels of innovation and risk.

Value investing and innovation allocations

When it comes to value versus growth investing, innovative companies are often grouped into the growth bucket, since they might experience higher growth rates than average as they acquire market share from the incumbents. What about value investors and innovation investing? To answer this question, we look at the MSCI Value and MSCI Growth Indexes to detail their innovation exposure.

When combined, the MSCI Value and MSCI Growth Indexes cover the full investible equities universe. While there could be different approaches to consider innovation within value and growth investing, we apply the intuitive approach of overlaying the Innovation Universal approach to portfolios tracking the MSCI ACWI IMI Value and MSCI ACWI IMI Growth Indexes. The resulting portfolios include all existing constituents, albeit at a tilted allocation based on their innovation exposure score.

As shown in Exhibit 13, the Innovation Universal overlay helped improve historical risk-adjusted returns without sacrificing value or growth exposures. In fact, the overall

[11] The combination of the MSCI ACWI IMI and the Innovation Leaders portfolio approach is rebalanced quarterly.

[12] According to the report, "Morningstar Global Thematic Funds Landscape 2022." As of Dec. 2021, the Morningstar database consisted of 1952 thematic funds globally with a combined AUM of 806 billion $. The thematic funds represented 2.7% of all assets in equity funds, up from 0.8% 10 years ago.

innovation exposure was significantly higher for both value and growth indexes after overlaying the Innovation Universal approach.

Exhibit 5: Universal overlay for value and growth

	ACWI IMI Value Index	Value Innovation Universal	ACWI IMI Growth Index	Growth Innovation Universal
Total returns (%)	8.4	8.8	13.0	15.0
Total risk	15.7	15.4	16.3	17.2
Value exposure	0.40	0.36	-0.39	-0.42
Growth exposure	-0.33	-0.33	0.32	0.41
Innovation exposure	5.8	10.9	15.6	20.9

Gross returns annualized in USD. Nov. 30, 2016, to May 31, 2022.

Conclusion

Companies with new and disruptive technologies or products have often taken market share from incumbents, and this evolution has driven changes in equity indexes over time.

Allocations to innovation might have previously played a role in the investment process through fundamental stock selection. But due to challenges around identifying secular megatrends and portfolio capacity for large allocations, allocations to innovation have usually been restricted.

In this paper, we presented a framework for asset allocators to seek higher exposure to innovation in their core allocations. We showed that multi-theme portfolios provided an opportunity to capture innovation with high capacity and low tracking error.

While not a focus of this paper, it should be highlighted that for “pure plays” on themes, the more focused and narrow thematic indexes remain important tools. These indexes, where stocks with significant exposure to the targeted themes are selected from the broad equity universe, can help investors create financial products they can use to implement their higher conviction views on specific themes. Some of these indexes may not offer the capacity required for large allocations (due to high concentration and extensive use of small cap universe), but they may provide the pure small-cap play that investor seek.

References

Damodaran, Aswath. *Investment Valuation: Tools and Techniques for Determining the Value of Any Asset*: Wiley, 2002.

Schumpeter, Joseph A. *Capitalism, Socialism and Democracy*. Harper Perennial, 1942.

Aghion, Phillippe, Antonin, Céline, Bunel, Simon, and Cohen-Tanugi, Jodie. *The Power of Creative Destruction: Economic Upheaval and the Wealth of Nations*: Belknap Press, 2021.

Aghion, Phillippe, Akcigit, Ufak, and Howitt, Peter. 2015. "The Schumpeterian Growth Paradigm." Annual Review of Economics, 7:557–575.

Daepp, Madeleine I. G., Hamilton, Marcus J., West, Geoffrey B., and Bettencourt, Luís M. A. 2015. "The mortality of companies." The Royal Society.

Baslandze, Salomé 2021. "Barriers to Creative Destruction: Large Firms and Non-Productive Strategies." SSRN Electronic Journal.

Kumar N., Doole, S., Garg, K., Bhalodia, V. and Ghate, D (2019). Indexing Change: Understanding MSCI Thematic Indexes. MSCI Research Insights.

Doole, S., Neeraj, K., and Bhalodia, V (2020). A Thematic Lens for Portfolios. MSCI Blogs.

Doole, S., Rao, A (2021). The Pace of Fast Change: Growth vs. Thematic Investing. MSCI Blogs.

Rao, A and Subramanian, R (2021). Innovation Remix: Adding Thematics to Equity Programs. MSCI Blogs.

Foster et al (2021). Positioning thematic funds in portfolios. Blackrock.

Appendix 1

The table summarizes the categories and the underlying innovation-driven themes.

Megatrend categories	**Innovation-driven themes**
Transformative Technologies	Autonomous Technology Innovation, Cybersecurity, Digital Economy, Disruptive Technology, Fintech Innovation, Future Mobility, Next Gen. Internet Innovation, Robotics
Environment & Resources	Efficient Energy
Health & Healthcare	Digital Health, Genomic innovation
Society & Lifestyle	Smart Cities, Food Revolution, Future Education

Megatrend Category Score (CS_i) = max (theme relevance score)

Innovation Score = $CS_1 + CS_2 + CS_3 + CS_4$
Innovation Score is used in the construction of Universal and Leaders portfolios

Innovation Exposure = $(CS_1 + CS_2 + CS_3 + CS_4)/4$
Innovation Exposure is a proxy to measure the holistic exposure to innovation-driven themes

The table summarizes portfolio methodologies:

	Innovation Universal	**Innovation Leaders**	Innovation **Mix**
Eligible universe	ACWI IMI	Max (Category score) > 0.25	Relevance score > 0.25
Selection	All stocks	Stocks with the highest innovation score until 50% of sector market cap is reached	All eligible stocks
Weighting	Market cap x Tilt score	Market cap	Market cap x Relevance score
Capping	5%	5%	5%
Aggregation	-	-	10 MSCI indexes combined in equal proportion

Rebalancing	Semi-annual	Semi-annual	Semi-annual

The table maps, for the Universal approach, stock tilt scores to innovation scores.

Innovation score	Tilt score
0.00 – 0.25	1
0.25 – 1.00	2
1.00 – 2.00	3
2.00 – 3.00	4
3.00 – 4.00	5

Appendix 2

We have identified a subset of themes from our megatrend suite as innovation-driven themes for use in designing broad-innovation portfolios. This subset is based on our assessment and research and some investors may have a different assessment leading to a different subset. Here we explain the framework utilized for identifying this subset.

We first need to make the distinction between "innovative companies" and "innovation-driven themes," and while these are not mutually exclusive, they do represent different aspects. For instance, themes can be predominantly non-innovation-driven and still include some innovative companies. More importantly, a theme's drivers are less ambiguous and easier to identify (we have also relied on MSCI's external theme experts' views for this) unlike the definition of what makes a company innovative. Hence, we have leveraged the former approach. In this regard, we find the following definitions useful:

Innovation-driven themes. The structural, long-term drivers of these themes are predominantly technological (information technology/medical/other) advancements or innovations.

Non-innovation driven themes. The structural, long-term drivers of these themes are predominantly demographic, behavioral or regulatory.

The table maps each of the themes in our megatrend suite to one of these definitions.

Categories, themes and drivers

Megatrend Category	Theme	Theme Drivers
Society & Lifestyle	Ageing Society Opportunities	Demographic and Behavioral
	Millennials	Demographic and Behavioral
	Future Education	Behavioral, Technological innovation
	Food Revolution	Technological innovation, Sustainability Conscious Consumer
	Smart Cities	Urbanization, Technological innovation
Health & Healthcare	Genomic Innovation	Technological innovation
	Digital Health	Technological innovation
Transformative Technologies	Cybersecurity	Technological innovation
	Robotics	Technological innovation
	Digital Economy	Technological innovation
	Disruptive Technology	Technological innovation
	Future Mobility	Technological innovation
	Fintech Innovation	Technological innovation
	NextGen Internet Innovation	Technological innovation
	Autonomous Tech and Industrial Innovation	Technological innovation
	Space Exploration	Technological innovation
	Blockchain Economy	Technological innovation
Environment & Resources	Efficient Energy	Climate Change, Technological innovation

Contact us

clientservice@msci.com

AMERICAS

Americas	1 888 588 4567 *
Atlanta	+ 1 404 551 3212
Boston	+ 1 617 532 0920
Chicago	+ 1 312 675 0545
Monterrey	+ 52 81 1253 4020
New York	+ 1 212 804 3901
San Francisco	+ 1 415 836 8800
São Paulo	+ 55 11 3706 1360
Toronto	+ 1 416 628 1007

EUROPE, MIDDLE EAST & AFRICA

Cape Town	+ 27 21 673 0100
Frankfurt	+ 49 69 133 859 00
Geneva	+ 41 22 817 9777
London	+ 44 20 7618 2222
Milan	+ 39 02 5849 0415
Paris	0800 91 59 17 *

ASIA PACIFIC

China North	10800 852 1032 *
China South	10800 152 1032 *
Hong Kong	+ 852 2844 9333
Mumbai	+ 91 22 6784 9160
Seoul	00798 8521 3392 *
Singapore	800 852 3749 *
Sydney	+ 61 2 9033 9333
Taipei	008 0112 7513 *
Thailand	0018 0015 6207 7181 *
Tokyo	+ 81 3 5290 1555

* = toll free

About MSCI

MSCI is a leading provider of critical decision support tools and services for the global investment community. With over 50 years of expertise in research, data and technology, we power better investment decisions by enabling clients to understand and analyze key drivers of risk and return and confidently build more effective portfolios. We create industry-leading research-enhanced solutions that clients use to gain insight into and improve transparency across the investment process.

To learn more, please visit www.msci.com.

The process for submitting a formal index complaint can be found on the index regulation page of MSCI's website at: https://www.msci.com/index-regulation.

Notice and disclaimer

This document and all of the information contained in it, including without limitation all text, data, graphs, charts (collectively, the "Information") is the property of MSCI Inc. or its subsidiaries (collectively, "MSCI"), or MSCI's licensors, direct or indirect suppliers or any third party involved in making or compiling any Information (collectively, with MSCI, the "Information Providers") and is provided for informational purposes only. The Information may not be modified, reverse-engineered, reproduced or redisseminated in whole or in part without prior written permission from MSCI. All rights in the Information are reserved by MSCI and/or its Information Providers.

The Information may not be used to create derivative works or to verify or correct other data or information. For example (but without limitation), the Information may not be used to create indexes, databases, risk models, analytics, software, or in connection with the issuing, offering, sponsoring, managing or marketing of any securities, portfolios, financial products or other investment vehicles utilizing or based on, linked to, tracking or otherwise derived from the Information or any other MSCI data, information, products or services.

The user of the Information assumes the entire risk of any use it may make or permit to be made of the Information. NONE OF THE INFORMATION PROVIDERS MAKES ANY EXPRESS OR IMPLIED WARRANTIES OR REPRESENTATIONS WITH RESPECT TO THE INFORMATION (OR THE RESULTS TO BE OBTAINED BY THE USE THEREOF), AND TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, EACH INFORMATION PROVIDER EXPRESSLY DISCLAIMS ALL IMPLIED WARRANTIES (INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTIES OF ORIGINALITY, ACCURACY, TIMELINESS, NON-INFRINGEMENT, COMPLETENESS, MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE) WITH RESPECT TO ANY OF THE INFORMATION.

Without limiting any of the foregoing and to the maximum extent permitted by applicable law, in no event shall any Information Provider have any liability regarding any of the Information for any direct, indirect, special, punitive, consequential (including lost profits) or any other damages even if notified of the possibility of such damages. The foregoing shall not exclude or limit any liability that may not by applicable law be excluded or limited, including without limitation (as applicable), any liability for death or personal injury to the extent that such injury results from the negligence or willful default of itself, its servants, agents or sub-contractors.

Information containing any historical information, data or analysis should not be taken as an indication or guarantee of any future performance, analysis, forecast or prediction. Past performance does not guarantee future results.

The Information should not be relied on and is not a substitute for the skill, judgment and experience of the user, its management, employees, advisors and/or clients when making investment and other business decisions. All Information is impersonal and not tailored to the needs of any person, entity or group of persons.

None of the Information constitutes an offer to sell (or a solicitation of an offer to buy), any security, financial product or other investment vehicle or any trading strategy.

It is not possible to invest directly in an index. Exposure to an asset class or trading strategy or other category represented by an index is only available through third party investable instruments (if any) based on that index. MSCI does not issue, sponsor, endorse, market, offer, review or otherwise express any opinion regarding any fund, ETF, derivative or other security, investment, financial product or trading strategy that is based on, linked to or seeks to provide an investment return related to the performance of any MSCI index (collectively, "Index Linked Investments"). MSCI makes no assurance that any Index Linked Investments will accurately track index performance or provide positive investment returns. MSCI Inc. is not an investment adviser or fiduciary and MSCI makes no representation regarding the advisability of investing in any Index Linked Investments.

Index returns do not represent the results of actual trading of investible assets/securities. MSCI maintains and calculates indexes, but does not manage actual assets. Index returns do not reflect payment of any sales charges or fees an investor may pay to purchase the securities underlying the index or Index Linked Investments. The imposition of these fees and charges would cause the performance of an Index Linked Investment to be different than the MSCI index performance.

The Information may contain back tested data. Back-tested performance is not actual performance, but is hypothetical. There are frequently material differences between back tested performance results and actual results subsequently achieved by any investment strategy.

Constituents of MSCI equity indexes are listed companies, which are included in or excluded from the indexes according to the application of the relevant index methodologies. Accordingly, constituents in MSCI equity indexes may include MSCI Inc., clients of MSCI or suppliers to MSCI. Inclusion of a security within an MSCI index is not a recommendation by MSCI to buy, sell, or hold such security, nor is it considered to be investment advice.

Data and information produced by various affiliates of MSCI Inc., including MSCI ESG Research LLC and Barra LLC, may be used in calculating certain MSCI indexes. More information can be found in the relevant index methodologies on www.msci.com.

MSCI receives compensation in connection with licensing its indexes to third parties. MSCI Inc.'s revenue includes fees based on assets in Index Linked Investments. Information can be found in MSCI Inc.'s company filings on the Investor Relations section of www.msci.com.

MSCI ESG Research LLC is a Registered Investment Adviser under the Investment Advisers Act of 1940 and a subsidiary of MSCI Inc. Except with respect to any applicable products or services from MSCI ESG Research, neither MSCI nor any of its products or services recommends, endorses, approves or otherwise expresses any opinion regarding any issuer, securities, financial products or instruments or trading strategies and MSCI's products or services are not intended to constitute investment advice or a recommendation to make (or refrain from making) any kind of investment decision and may not be relied on as such. Issuers mentioned or included in any MSCI ESG Research materials may include MSCI Inc., clients of MSCI or suppliers to MSCI, and may also purchase research or other products or services from MSCI ESG Research. MSCI ESG Research materials, including materials utilized in any MSCI ESG Indexes or other products, have not been submitted to, nor received approval from, the United States Securities and Exchange Commission or any other regulatory body.

Any use of or access to products, services or information of MSCI requires a license from MSCI. MSCI, Barra, RiskMetrics, IPD and other MSCI brands and product names are the trademarks, service marks, or registered trademarks of MSCI or its subsidiaries in the United States and other jurisdictions. The Global Industry Classification Standard (GICS) was developed by and is the exclusive property of MSCI and S&P Global Market Intelligence. "Global Industry Classification Standard (GICS)" is a service mark of MSCI and S&P Global Market Intelligence.

MIFID2/MIFIR notice: MSCI ESG Research LLC does not distribute or act as an intermediary for financial instruments or structured deposits, nor does it deal on its own account, provide execution services for others or manage client accounts. No MSCI ESG Research product or service supports, promotes or is intended to support or promote any such activity. MSCI ESG Research is an independent provider of ESG data, reports and ratings based on published methodologies and available to clients on a subscription basis. We do not provide custom or one-off ratings or recommendations of securities or other financial instruments upon request.

Privacy notice: For information about how MSCI collects and uses personal data, please refer to our Privacy Notice at https://www.msci.com/privacy-pledge.

.