

CITIES OF TOMORROW

RESEARCHING THE OPPORTUNITIES

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Cities is a topic that fascinates me. This paper builds on previous work I have done on the subject and serves to illustrate how curious we are about the world. It provides an example of external research providers which we access to broaden our horizons and shows just how excited we are about cities as a driver of growth and development. MIT is a fascinating set-up and it was a privilege to interact with some of the world's best academics, who provided me with many of the ideas for this paper.



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CITIES OF TOMORROW – RESEARCHING THE OPPORTUNITIES

BY JOE FARADAY

Cities are growth engines. They are the centre of productivity advancements and are of paramount importance for the development of us all as humans, for the growth opportunities they present, and as home to the exciting businesses in which we might invest. Our thinking on this subject is shaped by discussions we hold, both internally and with various external parties, as we continue to educate ourselves and improve our understanding of such a vast and fascinating topic. We are always on the look-out for alternative

sources of information. We have used a wide range of sources such as the London School of Economics (LSE) and the Santa Fe Institute in the past and continue to do so. More recently we joined the Massachusetts Institute of Technology (MIT) industrial liaison programme. This gives us access to world leading academics and a broad range of research. In particular, three of MIT's academics – Anthony Vanky, Carlo Ratti and Ryan Chin – have helped us develop our views on cities and the opportunities they present.



RESEARCH INPUT FROM INDUSTRY EXPERTS

Asking the question ‘Why do cities matter?’ is perhaps a good starting point for our analysis. Asking it of different people elicits a range of answers. Anthony Vanky, a researcher and partner strategist at the MIT Senseable City Laboratory, thinks the answer is simple. Today, he points out, “they are only 2% of the earth’s crust but they are 50% of the population and consume 75% of the energy.” Vanky and his colleagues are intrigued by how cities grow and develop over time. One can attribute this curiosity to the broader research mantra at MIT which has parallels with our willingness to challenge conventional thinking. The researchers focus particularly on which factors will drive growth, and try to highlight potential investment opportunities, thus ensuring their work has business implications.

Carlo Ratti, one of Anthony’s colleagues and director of the department, concentrates on investigating areas such as how digital technologies are changing urban architecture, planning and design.

Like many of the staff and students at MIT, he is professionally trained, in this case as an architect (he runs an architecture firm in Turin, Italy on the side) and an engineer. His work, books, and patents all aim to “fundamentally challenge the status quo of architecture, urbanism, and design.” With his books he aims to “present new ingredients and recipes for future transformations in urban life and society” which can serve as food for thought for us in our idea generation and broader thinking around growth opportunities.

Ryan Chin is the managing director of the City Science Initiative at the MIT Media Lab, a different department, but one that also concentrates its efforts on cities. He conducts research on disruptive urban systems, with a particular focus on urban mobility, the use of the space around us and building-integrated agriculture. His laboratory comprises lots of fancy Lego models which the researchers use to analyse the

reaction of cities to factors such as weather, wind, heat, lighting and traffic. The models are useful when it comes to public engagement, but also help in conducting experiments they might not do otherwise. With the model “you can make a US\$10 million chess move by knocking out a building, see the effect it has, and then reinstate it at no cost”, he explains. This has helped with research in cities including Hamburg, where significant expansion is underway, on the doorstep in Cambridge (Boston) for obvious reasons, and in many others such as Singapore, Riyadh, Barcelona and those in Scandinavia. His work helps illustrate and remind us of the importance of embracing disruption, as well as reinforcing just how powerful it can be. It also chimes with our ‘left of the decimal point’ thinking when it comes to assessing a company’s longer-term prospects and our willingness to explore a wide range of outcomes in our research process.



Lego models enable effective research into city infrastructure.
© Ariel Noyman, MIT Media Lab.

GROWTH DRIVERS

There are three simple components that capture the drivers of productivity improvements for cities

THEIR ABILITY TO GROW

By 2025, 13% of the world's population will live in 'megacities' (populations of over 10 million), up from just one city in 1950 (New York City) and 25 today, and half the world will live in smaller cities. Three-quarters of the US population already live in metropolitan areas. These proportions will continue to increase. Cities have continued to grow and develop over time and have shown an ability to overcome barriers. Infrastructure, connectivity, the creation of hubs and the rise and fall of suburbs have all played a role. Research on monitoring and tracking the movement of people and goods, however controversial it may be, continues to evolve and will continue to do so. It will lead to considerable improvements in efficiency and productivity over time. Most observers believe tremendous gains will come from us living in a 'shared economy'

THEIR CONNECTIVITY ON MULTIPLE LEVELS

The rise of the smartphone changes everything in MIT's view, and location-based services are really coming to the fore. Lots of companies are working on

areas from lighting (how community lighting can influence an area's affluence) to transport (autonomous vehicles from cars to driverless delivery vehicles). Other areas include banking (mapping spending patterns) and dining (finding areas in developed cities where there is nowhere to buy food). These are all wide ranging, but are examples of many areas that can lead to an increase in productivity, perhaps under the guise of marginal gains.

THEIR DIVERSITY AND THE MIX OF THEIR SOCIAL FABRIC

The quality of life and the virtuous cycle a city can provide are of great importance. Singapore, as we all know, is very advanced, and arguably one of the best places for infrastructure, and possibly for living. It is a city state, not just a country. Its eclectic mix of suburbs and nationalities acts as a microcosm of the whole of Asia. It is amazing to see such diversity in such a small, organised country. The MIT team has been doing more research there, trying to help the country become even more advanced, and developing an open platform for real time data. Despite there being such diversity in

Singapore, everyone is willing to work together. The government is on side and most companies are on side. The populace embrace development and want Singapore to maintain its lead and play an important engagement role in the research. Lastly, perhaps just as importantly, the authorities have encouraged what one might call facilitators, including MIT. Data monitoring and analysis overlap with this and the open access is vast and makes experimentation easy. They get data on cell phone usage, smart grids, managed fleets, sensor systems, parking spaces, transport networks, ATMs, and cargo movements, to name but a few. One example has been the huge exhibition at the Singapore Art Museum, which displayed 'the living city' – a piece of work that is leading to improvements in energy usage, building cooling, locations of special events, GPS tags and a more efficient taxi service. They have also done some weird and wonderful things with maps, laying them out by time as opposed to distance, a good example of MIT and other academic institutions which, like us, try to challenge conventional thinking and remain open minded about what the future may bring.



As cities grow, the complexity of infrastructure and connectivity becomes more apparent.

By 2025, 13% of the world's population will live in 'megacities' (populations of over 10 million)

Shanghai at sunset.
© The Image Bank/Getty Images.



Cities continue to be 'ripe for disruption' and this will create significant opportunities, including the following:

URBAN MOBILITY

Media coverage and our own investment research tell us that growth in automated vehicles, such as driverless cars, is a huge area of research and development. There are also many other initiatives under this banner, such as vehicle pooling and passenger bikes adapted to help protect the user from the elements, to the concept of drones and driverless delivery vehicles. The world's automobile fleet is estimated at 800 million vehicles and is set to rise over time, given that seven out of ten people in the developed world currently own a car, compared to two in ten in the developing world. This growth has wide-ranging impacts spanning energy inefficiency, the

environmental consequences of fossil-fuel usage, potential disruptions to fuel supplies, the urban sprawl created by automobile reliance, and congestion caused by inadequate alternative modes of transport. The solution needs to be radical. It is hard to envision what the vehicle of choice will be – size, shape, range, speed, fuel type. It probably won't have a combustion engine, it is likely to be pooled, and there will be debate over how it should be integrated with public transport. In addition, a huge number of companies have vested interests in this – from the conventional auto companies, to consumer goods and services organisations, to technology and internet businesses. Between them, they have the opportunity to massively enhance our mobility and that of the goods and services we use. Efficiency is another factor at play here, with cars utilised less than 90% of the time, and there is

a 'redistribution problem' or the clustering of vehicles. Ryan Chin believes that "to make the car of the future, we need to make the city of the future." This could encompass facets such as no parking lots, quieter traffic, and even no traffic jams! In many ways it will all be about the digital infrastructure as opposed to the physical infrastructure which is often rightly dubbed the infrastructure dinosaur.

THE USE OF THE SPACE AROUND US

"Architecture aims at Eternity" is a saying from Sir Christopher Wren (1632-1723), the highly acclaimed British architect. The problem in this day and age though is that housing isn't really built like that, and most cities do not adopt such an approach. Most activity is about building it fast or stacking it high, with less focus on the actual quality of the buildings.



We don't need every building to be as long-lasting as Stonehenge (still standing since around 2600 BC), but there is a need for space and the use of it to become ever more flexible, while resisting the temptation just to build concrete jungles – something that is seen in many less developed economies.

Housing is a segment MIT and other academic institutions have been working on. Ryan Chin and his colleagues have been researching adaptable living spaces, and broadening the remit to include workspaces. They have been working on what they consider to be an optimal design for a compact 200 square feet apartment – beds and furniture that are automated, can even be hidden away, and make the user space much more versatile. Some of his colleagues are planning an automated furniture start-up, a good example of the commercial

side to their work. Discussing this with him evokes an image of a desk, bed, and other such furniture all moving around the room, getting out of the way or making the living and workspace much more flexible. Some of the ideas may appear excessive, but they are evidence of a willingness to push boundaries and challenge convention. Would you really want or need an automated helper or a desk that can bring your printing or even a coffee or snack? Who knows. Whatever happens it will be exciting to see what new ideas come through in this field.

AGRICULTURE

Agriculture and food is a much newer area of research, certainly for the cities lab at MIT where the work currently involves propagating plants in water with added nutrients in controlled environments. How this can be done industrially in

confined spaces and in cities is a question now being addressed. The arguments for this include the ability to produce plants with higher nutrient content, faster growing cycles in controlled conditions, and facilities to optimise production. The idea of high rises growing broccoli seems a little far-fetched, but it serves to show just how novel some of the research is in this area. This could have huge implications. Might it lead to the democratising of growing and the ability to pull back some control from the large agriculture companies around the world? Or the opportunity to enhance yields and limit diseases? Could it also impact supply chains? Is there a possibility of it helping improve diets globally by making access to varied foods more readily available? Could it also have an impact on the green urban environment?

TAKING THE RESEARCH FURTHER

These three areas are enormous in scope. They underline the broader challenge and opportunities for cities – the ability to offer us ever more productive places to live and work. There are also other significant areas worth thinking about when researching such a topic.

THE POWER OF DATA

Data are what Anthony and his colleagues thrive on. The challenge is harnessing it all. The fact that each day we now produce more than 5 exabytes of data – a figure that was the sum of all data until 2003 – is mind boggling. Anthony envisages a world where everything has a sensor and provides data, even the bricks in a wall. Data mapping can show real life city dynamics such as where people are but generally not who they are. The power for those who do know is, arguably, phenomenal.

In addition to being tech geeks, what is impressive is how the MIT team is happy to roll up their sleeves and conduct real life projects as well as

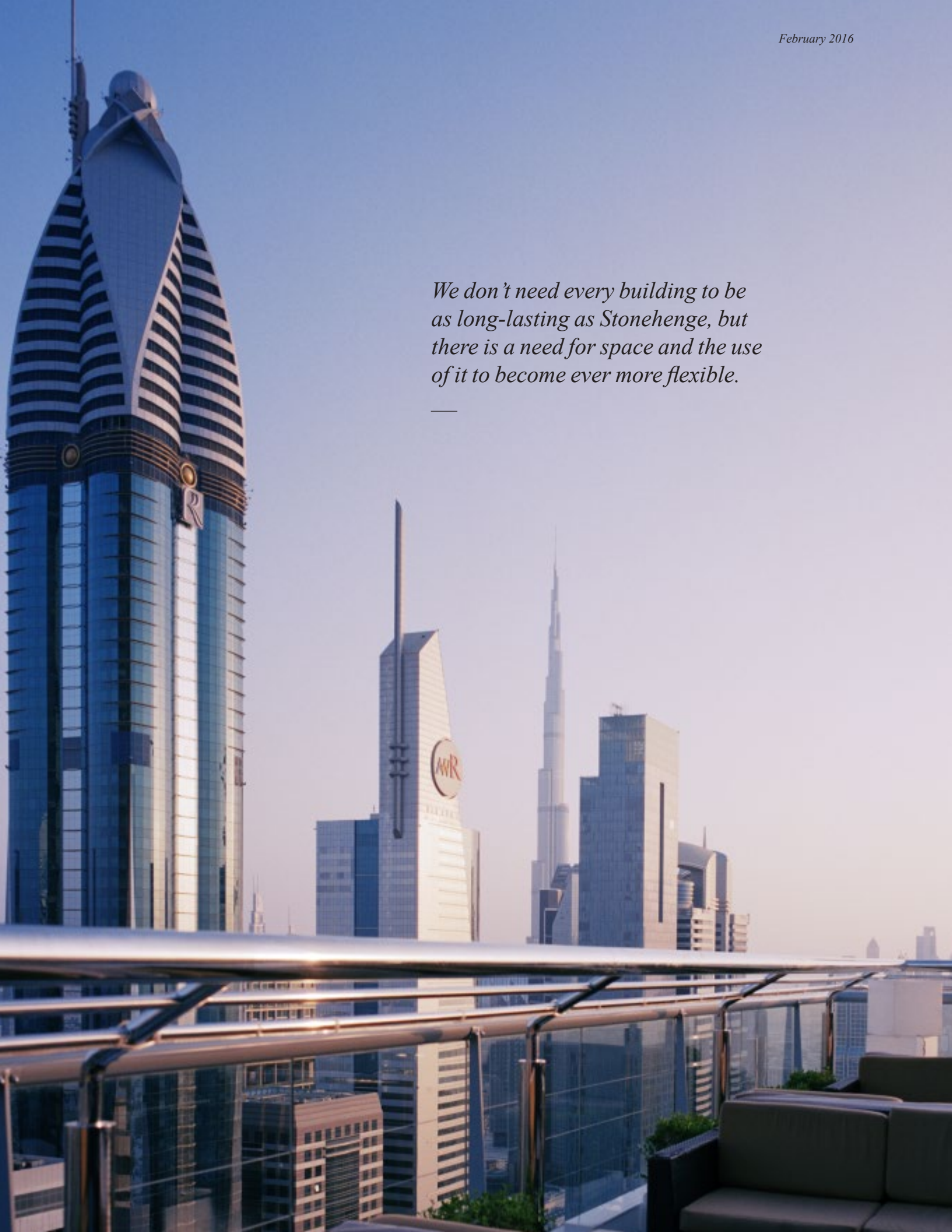
data crunching. A great example is the project in Seattle, which tracked 3,000 trash objects and analysed how effective or not the recycling of certain products actually was. Another project involved analysing sewage waste. Unpleasant perhaps, but it may help to identify disease outbreaks on a larger scale. Analysing diabetes and flu at a neighbourhood level might also have a big impact on the treatment of disease and illness.

EXPERIMENTING HELPS

A city, in essence, should be a ‘living laboratory’. MIT’s approach to modelling ranges from high tech simulations, in which many computer science academics assist, through to physical modelling, using the likes of Lego. It has helped them form what Ryan Chin terms an “urban observatory” – combining Lego and live imaging that can be mapped on to the models so a host of factors can be analysed, for example traffic information, weather patterns, lighting, internet, walkability, household sizes, population numbers, and mobile data

*Dubai is a good example
of a modern city.*
© Moment RM/ Getty Images.

We don't need every building to be as long-lasting as Stonehenge, but there is a need for space and the use of it to become ever more flexible.





How people interact in a city determines the city's success.
© Ernst Haas/Getty Images.

Research on monitoring and tracking the movement of people and goods, however controversial it may be, continues to evolve and will continue to do so.

usage. This has enabled Ryan to get a much better “sense of how people live and work in the city” and provides “a finely grained geospatial view of where things are happening in cities”. The lack of refinement makes the malleability, interactivity, and three-dimensional properties of the Lego model far more useful than traditional photorealistic rendering of editing, which are often “photoshopped to death.”

CREATIVE PEOPLE PROVIDE BREAKTHROUGH IDEAS

Naturally, MIT as a research university aspires to be better than others in what it does. What the team sees as its secret recipe, according to Anthony, is that it is all about the mix of people. Breaking down the faculty and students, the mix is roughly split three ways, and fairly evenly – one-third from spatial disciplines such

as architects, urban planners etc., one-third from technical orientated disciplines including IT, engineers, computer scientists, physicists and the like, and one-third human sciences such as sociology, the arts etc. Exciting, even wacky, projects underway at MIT include localised heating, where infra red beams shine on individuals and track them to provide heating as opposed to having huge energy systems heating a whole building in largely the same way. Another involves making a road frustration index to measure the stresses of driving and how that can feed into planning and finding solutions. Another area of research is the use of sensors to evaluate real estate values, e.g. how valuable a store front is dependent on its footfall and the type of passer by. Perhaps we can take away from this that the line between what machines and humans can do is being blurred.

CONCLUSION

Cities are powerful engines and matter to us as humans. As the homes of companies with attractive long-term prospects, they are also important to us as investors. They are a significant driver of growth and a focal point for productivity improvements. They are unique in their ability to expand and grow, the connectivity they offer and in their diversity, and the mix of the social fabric. The opportunities cities present are broad and diverse, but some notable areas ripe for disruption include urban mobility, the use of the space around us, and agriculture. Our research continues in these areas but being able to draw on the insights of MIT academics such as Anthony Vanky, Carlo Ratti and Ryan Chin, is just one of many examples of us trying to ensure we remain curious about the world and inquisitive and differentiated in our research and thinking around stocks. We want to look in the right places, find the right opportunities and research the real drivers of growth.

CURIOUS ABOUT THE WORLD

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