

# Manager insights: Lawrence Burns

July 2024

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**Lawrence Burns:** In investing what really matters is finding, owning, and holding on to a small number of outliers. These are the companies that can deliver a very large multiple of your initial investment and thereby drive returns.

To deliver that large multiple return at scale companies usually need to either be tapping into or driving a significant structural change in the economy. For Amazon that was powering a revolution in retail going from high street stores to online. For Tesla, it has been helping the world transition from the internal combustion engine to electric cars.

Now over the last year, the structural change that has received the most attention has been the rise of artificial intelligence. The most eye-opening conversation on this topic for me took place back in the summer of 2018 talking with Professor Brian Arthur, one of the world's most influential thinkers on technology and the economy. He told me he thought artificial intelligence could be the most significant invention since the Gutenberg printing press.

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It was quite a statement, given that the printing press was invented over half a millennia ago. Before its invention, scribes painstakingly copied books by hand. Most were kept in monasteries, chained to desks to prevent theft. Gutenberg's invention made knowledge accessible, allowing ideas to spread like never before. It powered the Scientific Revolution, the Reformation, and countless political revolutions. Its impact was profound and immeasurable.

AI has the potential to impact the world in a similar fashion, but instead of externalising information, it is externalising intelligence. Making it available at rapidly decreasing cost anywhere in the world, instantly and on demand. Now, that could be to write a high school student's essay on the reign of Queen Victoria or it could be to help a radiologist identify a cancerous tumour. The applications here are truly vast.

When considering investment opportunities within artificial intelligence, it can be helpful to divide them into three layers: hardware, infrastructure, and applications. Scottish Mortgage is invested in companies involved in each of these layers.

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### **The Hardware Layer**

The hardware layer is about making the physical computational devices that enable AI. In this layer, since 2016, we have owned NVIDIA, the leading designer of AI chips. The company has a dominant position, with 90 per cent of all generative AI models trained on its chips. It is the critical and broad enabler of AI in the world today.

However, NVIDIA only designs its chips. It needs others to make them. For this, it uses TSMC, the world's largest integrated circuit manufacturer and a recent addition to the Scottish Mortgage portfolio. It has a dominant position in an industry where scale matters with the latest foundries, such as the three it is building in Arizona, costing over \$65bn. These chip foundries are so critical to supply chains and the modern economy that they hold geopolitical significance. As a result, the US government is providing over \$10bn in federal grants and loans to ensure they are built in the United States.

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To help make chips, TSMC requires a particularly crucial piece of equipment: lithography machines. For these, it relies on another of our longstanding holdings, ASML, which has a monopoly position in advanced lithography machines.

These rely on the world's flattest mirrors and one of the most powerful commercial lasers in existence to create an explosion 40 times hotter than the surface of the sun to pattern tiny shapes on silicon that measure just a few nanometres. This precision is what allows chips to be made containing tens of billions of transistors.

All three companies benefit from the rise of AI while possessing dominant and near-impregnable competitive positions.

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### **The Infrastructure Layer**

The second layer is the infrastructure layer. Here, we have the cloud service providers that buy NVIDIA's chips and offer scalable, on-demand access allowing companies to train and deploy AI models without the overhead of building their own infrastructure or having to go and buy their own chips. In essence, the cloud service providers democratise access to both computing and AI. There are three dominant cloud service providers. We own Amazon, which operates Amazon Web Services, the largest cloud service provider in the world.

We also own database companies like Snowflake and Databricks that benefit from allowing companies to store, manage and use their data to power AI models.

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## The Application Layer

The final layer is the application layer. This is about making productive use of AI in the real world. A significant number of Scottish Mortgage's holdings are making use of it to expand addressable markets, reduce costs and dig deeper competitive moats.

Tesla is using AI to make its cars self-driving and even hopes to leverage those advances to produce humanoid robots. After all, what is a self-driving car if not a robot operating in the physical world? Demonstrative of its progress is that Tesla cars have now driven 1.3bn miles autonomously, and the company is already in conversation with another major carmaker about licensing its self-driving technology.

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Recursion Pharmaceuticals is leveraging AI to improve drug discovery by creating a map of human biology that could dramatically cut the cost of developing new drugs. Tempus, which is one of our private holdings which has just gone public, has built a vast database of over 7 million cancer patients' clinical records and is applying machine learning to that dataset to enable physicians to make better treatment decisions.

Meta, the company that owns Facebook, is using AI to improve advertising targeting across its platforms such as Facebook, Instagram and WhatsApp to powerful effect. Spotify is using it to enhance its personalised song recommendations and has released new features such as its AI-powered DJ. AI also enables podcasts on Spotify to be translated into other languages using the actual voice of the original podcaster.

The impact of AI across the portfolio is vast because all companies can benefit from the application of intelligence. In this sense, AI can be thought of as a powerful new set of tools for companies to apply to their business that will, crucially, only get significantly better with time.

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The companies that will be best placed to use this toolkit will be those with large amounts of proprietary data, software expertise and a culture of innovation. In each of these dimensions, our portfolio companies should be well-placed.

The opportunities of the application layer in new technology paradigms naturally lag behind those in hardware and infrastructure. So those initial two layers need to scale first in order to support the development of applications. But it can also take time and human ingenuity to find ways to leverage and apply powerful new technologies, to make use of that hardware.

We can draw an analogy with the smartphone. When the iPhone was released, it was clearly an impactful piece of hardware. Still, it took time for companies and aspiring founders to build applications to utilise the new device's potential fully. It didn't all happen at its release in 2007, because then it would have been hard to immediately

predict the new business models it was going to enable, such as ride-hailing, food delivery, mobile payments and short-form video apps such as ByteDance's TikTok.

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It even took time to appreciate just how meaningful it would be for the existing digital activities such as ecommerce, streaming, and social media, which all saw their market opportunities greatly enlarged by this technological change.

## **Analysis**

The developments of AI have already produced a clear outlier in the form of NVIDIA. And it's a powerful example of how impactful an outlier can be with the shares having risen over 80x since our initial investment in 2016.

However, it is also important to remember that progress is rarely a straight line. We cannot rule out that there could be a period of digestion following heavy investments in the hardware and infrastructure layer as companies take longer than expected to work out how to use these new capabilities.

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Alternatively, we could encounter unexpected limitations to AI models requiring new algorithmic breakthroughs to be made. We are cognisant that the hardware companies in particular, though currently propelled by insatiable demand, can be viciously cyclical businesses should they hit air pockets of demand.

We continue to expect them to perform well but, in recognition of this cyclicity, have been making some mild reductions to NVIDIA, which is our largest holding and it's also the holding that's seized the title of the world's most valuable company just recently.

Yet, if the promise of AI is to be truly fulfilled then we are today still early in experiencing the impact of AI. That impact has been most strongly felt in that hardware and infrastructure layer, but it should gradually expand to the application layer, and in doing so, benefit a number of holdings as well as creating new opportunities for Scottish Mortgage to invest in.

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## **Conclusion**

The role of Scottish Mortgage will continue to be to invest in companies driving large structural changes where, if successful, the payoffs are extraordinary. We will make mistakes along the way but if we are able to own just a small number of outliers then we believe we will deliver worthwhile returns for our shareholders.

Looking at the portfolio today we believe we own a range of companies that are driving the big structural changes of the future. Not just in AI but in diverse yet profoundly important areas.

SpaceX is lowering the cost of accessing space. In the first instance, this has allowed it to put in place a growing network of over 6,000 satellites that are providing high-speed internet to homes, remote areas, planes, and ships around the world. Its launch capabilities also open up a range of possibilities including transporting people and cargo around the world faster than ever before, going from London to Hong Kong not in 12 hours but in under 35 minutes.

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Moderna's technology platform is allowing a single company to tackle a broad array of diseases from flu all the way through to cancer. MercadoLibre is leveraging technology not just to change retail in Latin America but also to provide many millions access to credit, investments and insurance for the first time as it seeks to become the largest financial institution on the continent.

It is this broad opportunity to invest in transformational change and companies that have the potential for truly extraordinary payoffs that fills us with long-term optimism. Thank you for listening.

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### **Annual Past Performance To 31 March each year (net%)**

	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>	<b>2024</b>
Scottish Mortgage Investment Trust	12.7	99.0	-9.5	-33.6	32.5

Source: Morningstar, share price, total return, sterling.  
Past performance is not a guide to future returns.

### **Risk factors**

The trust invests in overseas securities. Changes in the rates of exchange may also cause the value of your investment (and any income it may pay) to go down or up.

The trust invests in emerging markets, which includes China, where difficulties in dealing, settlement and custody could arise, resulting in a negative impact on the value of your investment.

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