

Data intensity as a measure of development

China is an unusually homogeneous country. A country with a population twice that of Europe has one written language, one literature and one set of heroes. When China is organised, it is highly productive. When it is in decline, the people go through decades of internal strife and hardship.

China's script is not alphabetic but ideographic. Chinese characters retain their meaning even though pronunciations change across time and space. This gives the written script a digital quality. Every character has a fixed value. Primary school children are able to read and recite verses from the Analects by Confucius written over two thousand years ago.

China also invented paper over two thousand years ago and was able to maintain the technology of its mass production until the defeat in Central Asia I referred to earlier. From Chinese prisoners of war, the Islamic world learned how to make paper and was transformed by it.

Alan Turing, whose ancestry was part Scottish, taught us that with an unlimited amount of paper, one could do an unlimited number of algorithmic calculations. Paper and ideographic writing enabled Chinese civilization to organise more human beings than anywhere else on earth by a large margin. During the Covid pandemic, the head of Chinese medicine pronounced that China had complete records of all epidemics that erupted in China over two thousand years. The collection and processing of data made possible a fine division of labour and therefore a highly productive economy when the country was at peace. It also facilitated the development of continental-scale infrastructural networks for irrigation, flood control, grain and salt distribution, water transportation, taxation and, of course, domestic political control. China has always been a data-intensive society. In sharp contrast to Europeans, Chinese people are less concerned with data privacy.

The scholars were the data specialists. For over a thousand years, they were selected by examinations and populated a civil service organised into ministries reporting through senior mandarins to the Emperor. It was only in relatively recent times that the rest of the world developed comparable civil services often through competitive examinations. Scholar-officials spent most of their time doing close work. Myopia became a competitive advantage. They also had many wives and children. It is not an accident that the Chinese have the higher incidence of myopia in the world. In today's world, one has to worry what mobile phones and endless scrolling will do for the eyesight of our children.

For the purpose of data recording and processing, brush ink and paper was orders of magnitude faster than nib ink and parchment. One can see the difference in the time needed to execute a painting using brush ink and paper compared to one using paint brush and canvas. They are different art forms, of course.

One way to gauge the level of advancement of a society is data intensity. Data intensity is a measure of education level, administrative efficiency and market dynamism. Good administration and efficient markets, in turn, draw talent into the social network. The healthy development of a community depends on its political, social and economic development. Markets cannot work well if the political system is dysfunctional and participants lack integrity and a sense of solidarity. Adam Smith's enduring legacy is not only the Wealth of Nations which explained how the market works its magic, but also in his Theory of Moral Sentiments which showed the importance of society having a healthy political and social framework within which an efficient market operates. Smith was first a moral philosopher; then an economist.

Codification and energy

Each human being in society can be likened to a computer chip networked to other human beings by an operating system which is composed of politics, law, values and culture. Part of the network is well defined like the electoral system and the legal system. They change relatively



slowly. A large part of the network is market-driven and can change at high speed. The more advanced a society is, the more highly coded it is.

Coding needs energy. Darwin's natural selection is driven by the competition for energy. Without energy, no organism can defend itself or attack others, or to find a mate and replicate. Within an organism, there is ceaseless competition for energy by different cells and organs. Cancers gobble up energy and can be overcome by depriving them of energy. All life is coding. The same four nucleotide bases A, C, G, T are the building block of all life on earth. In groups of three, they make up the 20 or 21 amino acids from which all proteins are made. Without the input of energy, order eventually breaks down, what in thermodynamics we call entropy. The struggle for life is therefore the struggle for energy and its efficient use.

Human civilization is equally driven by energy availability and efficiency. The agricultural revolution was an energy revolution. Civilization began in the great deltas after swamps were cleared for the cultivation of food crops. Seeds had to be selected, irrigation systems established, grain storage introduced and distribution systems organised. The surplus enabled armies to fan out and conquer. Empires grew until the cost of expansion outweighed the benefit. At that point, the energy equation turns negative.

In China, the agricultural system was largely unbroken over four thousand years. Control of water has always been key. The country continues to embark on huge water works today. The growing of rice which requires a high degree of organisation produces the most calories or energy per hectare of any crop. A complex internal network of canals facilitated efficient distribution over a vast area. China's agricultural system produced the energy which enabled a complex codification of its society. The steam engine invented by James Watt, a contemporary of Adam Smith, ushered in a new energy revolution, which led eventually to western domination of the world. Coal fired steam ships and trains. Later oil fueled cars and aeroplanes. The conversion of heat to mechanical power required an understanding of metallurgy especially of iron and thermodynamics. Singapore had three large markets built with Scottish cast iron. One still stands in Lau Pa Sat and is often frequented by tourists. Unfortunately, that energy revolution unleashed in Scotland also led eventually to slaughter on an industrial scale in the 20th century.

Energy and AI

The technology for producing energy and its efficient use has always underpinned political and military power in human history. So it remains today in the new age of AI.

British coal powered British manufacturing. The sea reduced friction of transportation, making energy use more efficient. Coal today is a fuel of the past, but I still have vivid memories of 1973 as a nineteen-year-old going up to Cambridge to study engineering. There was a miners' strike led by Joe Gormley and Arthur Scargill. Prime Minister Edward Heath's response was a three-day working week. On the other days, the shops in Picadilly

Circus and Leicester Square were lit by hurricane lamps.

America had not only coal but also abundant oil. Japan was forced into the Second World War because the US imposed an oil embargo in response to its invasion of China. In February 1945, after the Yalta Summit, President Roosevelt on board the USS Quincy stopped five days in the Suez Canal to confer with King Abdelaziz of Saudi Arabia. Out of that meeting, a historic agreement was made that in return for US protection of the kingdom, Saudi oil would be priced in US dollars. For decades, the US dominated energy markets in the world. The current standoff in Iran with double blockades of the Straits of Hormuz has altered an old dispensation. Energy markets continue to operate efficiently, but US dominance has been significantly weakened. King Abdelaziz's grandson, Mohamad bin Salman, is moving slowly to diversify away from the US dollar. China, in the meantime, has made rapid strides in developing alternative energy sources, particularly solar and wind. China has also steadily brought down the cost of battery storage. With sun and wind everywhere, political power will no longer be concentrated in the hands of major energy producers.

Energy will however always be scarce because the demand will keep growing with the development of AI. Energy is the ultimate constraint on the amount of computation that AI can do. The constraint is not in technology because the technology is readily available, but in politics. Elon Musk has repeated complained about how difficult it is to get approvals and public support for the construction of energy infrastructure in the US.

It is China that has made the most progress in energy production and distribution. Household electricity costs continue to fall and is among the lowest in the world. Just a few months ago, I was in Shantou near where my paternal grandfather and my mother grew up. There huge turbines capture energy from strong winds in the



The Painting, titled "Activities of Minister of War," depicts the career of an ancient Chinese civil servant. The career path starts with passing the civil service examinations (left side) and progresses to a high position in the government (right side).

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The concentration of power in the hands of a few cannot be good because it will inevitably lead to the degradation of humanity. From this perspective, multipolarity in AI is a good phenomenon. It will create healthy competition and curb abuse. By breaking the US monopoly, China's AI development is a blessing to all of humanity and will encourage the growth of other AI centers in the world. As Kai-Fu Lee pointed out a few years ago, AI systems are inevitably values-based. The Islamic world, for example, will allocate weights differently in their models.



A reporter films at a data centre supported by Huawei in Yulin city, Shaanxi province, China, on April 25, 2023.

TINGSHU WANG/REUTERS



Taiwan Strait which is a veritable wind tunnel. I was told the electricity energy cost in Shantou is half that of China's average. The city is now considering two uses of that energy, for the generation of hydrogen and for data processing. China now generates more electricity than the US and Europe combined.

For a time, it seemed that the US' lead in AI would secure its superpower status into an indefinite future. By pushing its AI stack to all parts of the world, US intelligence and security agencies will potentially know everything about everyone at any time through the Magnificent Seven. When DeepSeek released its first AI LLM, it was surprisingly good and open source. Probably directed by the Central Government, all Chinese LLMs are now open source and keeping pace with US LLMs. This has enabled the use of AI to diffuse into all parts of the Chinese economy and beyond. Chinese LLMs are no more than six to nine months at most behind US LLMs. Nvidia CEO Jensen Huang has repeatedly warned that Chinese AI is catching up with US AI.

In chip technology, despite intense efforts by the US to stymie China, China has redoubled efforts to achieve self-sufficiency. Ironically, it is the US which is now pushing China to buy lower-end Nvidia GPUs. In physical AI, meaning the incorporation of AI into manufacturing systems and products, such as cars, drones and robots, China is advancing rapidly. China is ahead not because it has a monopoly of the technologies but because it has a huge domestic market which enables a division of labour no other country can match. By promoting free trade with its neighbours along the belt and road, China is extending this division of labour over a much wider region and a much larger population.

How much a country can benefit from open source AI and ubiquitous energy will increasingly depend on the political and social system it has in order to educate its people and engender cooperative effort and healthy competition.

Moral challenge of AI

Pope Leo XIV in one of his recent encyclical on AI, Magnifica Humanitas, talks about the moral challenge of AI. He described AI as a fruit of human intelligence. He likened the development of AI more as "cultivation" than as production upon a preconceived design. The fruit can be sweet; it can be bitter. It can be good or it can be bad.

The concentration of power in the hands of a few cannot be good because it will inevitably lead to the degradation of humanity. From this perspective, multipolarity in AI is a good phenomenon. It will create healthy competition and curb abuse. By breaking the US monopoly, China's AI development is a blessing to all of humanity and will encourage the growth of other AI centers in the world. As Kai-Fu Lee pointed out a few years ago, AI systems are inevitably values-based. The Islamic world, for example, will allocate weights differently in their models.

The key is always the availability of energy and its efficient use. Europe with its high energy cost is severely handicapped. The wound is partly self-inflicted. To overcome this crippling weakness, Europe will have to review its policy towards Russia, the Middle East and North Africa, and China.

India is not naturally endowed with plentiful energy but is determined to source oil and gas cheaply and to develop alternative energy. It has every ambition to be an AI power and will eventually become one too. Brazil has the potential as well and will not be left behind. Africa has energy in abundance but many parts are unfortunately held back by underdeveloped political and social structures. China is now building much needed physical infrastructure in this vast continent. It is in Europe's interest to work with China in helping Africa to grow sustainably.

AI can enhance our intelligence and creativity, or it can dumb us down and make us lazy. It can make us more human or less human. What is clear is that humanity is on the threshold of a new age.

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