

## The signals from this 'Made in China' smartphone story +

**H**uawei, the Chinese smartphone giant, has created ripples within the strategic and business community with its newly unveiled Mate 60 Pro which houses the Kirin 9000 processor. The chipset reportedly used Semiconductor Manufacturing International Corp (SMIC)'s second-generation 7nm fabrication technique, thereby demonstrating China's capability to manufacture a 7nm chip.

### Challenges before China's quest

Consequently, observers have claimed that the capability marks a major breakthrough in Beijing's drive to attain self-sufficiency in manufacturing advanced chips. The fact that China succeeded in achieving this feat despite American sanctions on key semiconductor technologies has led many to even question the efficacy of the sanctions. However, while China's technology demonstration deserves appreciation, the capability itself might not mean much as several challenges besiege its self-sufficiency drive.

To begin with, the fabrication technique used by Huawei-SMIC to manufacture the Kirin 9000 processor is highly inefficient. The wafer yield (a metric of efficiency) of the deployed technology is way less than 50%. In contrast, Taiwan's Taiwan Semiconductor Manufacturing Company Limited (TSMC)'s 7nm fabrication technique has a wafer yield in excess of 90%. This makes the SMIC's process extremely expensive – up to 10 times the costs incurred by other players in the market, and therefore highly uncompetitive.

Second, the 7nm fabrication technique represents the zenith of China's capabilities with the available Deep Ultraviolet (DUV) lithography tools. The United States's sanctions that cut off Beijing's access to the most advanced lithography tool in the market – the Extreme Ultraviolet (EUVs) – meant that China had to rely on DUVs to fabricate the Kirin 9000 chipset. While DUVs can technically be used to make 7nm chips, the



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process is extremely messy and inefficient, thus lowering its yield. For instance, the SMIC technique used multiple rounds of masking or layering on the wafer to manufacture a 7nm chipset, leading to multiple exposures. On the other hand, the TSMC with the EUVs can perform the same task of high complexity with a single exposure.

Third, it is doubtful that Huawei-SMIC could produce the current chipsets on a large scale. The fact that the U.S. and its allies have restricted China's access to even DUVs lately means that large-scale production of 7nm chips would be a challenge for Chinese companies.

Thus, low yield rates, inefficient and costly procedures along with difficulty in achieving the scale are likely hurdles in Huawei's attempt to commercialise its new technology product. This is significant because the failure to achieve commercialisation will impact incremental innovation as they reinforce each other. And products that fail to innovate alongside their competition eventually fade away.

### The U.S. and China systems, a comparison

Besides, there are several other challenges that plague China's chip ecosystem compared to the U.S.-led ecosystem. The fact that America's encompasses the most advanced economies of the world confers upon it several advantages that China's isolated ecosystem will find nearly impossible to compete with.

First, the extensive and distributed nature of the U.S.-led tech ecosystem allows individual countries to achieve functional specialisation according to their respective comparative advantages. The existing supply chain – where the U.S. specialises in EDA tools and designing, the Netherlands in producing lithography tools, Japan in manufacturing specialised materials, and Taiwan and South Korea in fabrication – corroborates the claim.

China, on the other hand, not only has the

mandate to become self-sufficient in each segment of the value chain but has to also achieve sophistication in each of these to remain competitive. Achieving specialisation in any one segment of the chip value chain itself is highly capital intensive; to achieve so in each of them is impossible. It is also important to remember that advanced chips are only one of the many core technologies that China aims to become self-sufficient in. Given that the Chinese ecosystem is not as elaborate as the U.S.'s and is rather isolated, there are limits to Beijing's potential with its finite resources.

As for the U.S.-led ecosystem, the costs can be distributed among the participating countries, most of which have much higher per-capita income than China. Therefore, to compete with a larger pool of resources, China will need to strike a higher success rate on every dime it spends on research, which is difficult to achieve given that breakthroughs in basic research are capital intensive and may not yield success as often. If that alone is not enough to burden the scientific community, the pressure to perform and deliver in China's authoritarian system further compounds the problem. To sum it up, China's appetite to absorb failures is extremely limited when compared to the U.S. and its allies. This makes for quite an uncondusive environment for innovation given that it thrives best in a free environment. Finally, the U.S.-led tech ecosystem allows it to source talent from diverse regions, owing to its open immigration policy and distributed network. China, on the contrary, will have to solely rely on its national or overseas talent pool as the movement of human capital to China becomes more difficult due to deepening rivalry in the high-tech sectors.

Going forward, China's tech ecosystem faces a daunting challenge to succeed in everything all by itself. It may score a victory in odd areas, but replicating the feat in every single domain is impractical.

## Ridding India of food insecurity

India may be the fastest growing large economy of the world, but it is also facing accelerating food-price inflation. The rise in the price of food first accelerated sharply in 2019, and has climbed in most years thereafter. In July this year, annual inflation exceeded 11%, the highest in a decade. An implication of continuing high food-price inflation is that a section of the population could be facing hardship in consuming food of adequate nutritional value.

We now have some evidence to this effect. The 'State of Food Security and Nutrition in the World' of the Food and Agriculture Organization (FAO) estimates the proportion of the population across countries unable to afford a healthy diet (reported in this newspaper on August 31, 2023, under a datapoint). The figure for India in 2021 is devastating to note – an estimated 74% of the population cannot afford a healthy diet. Given a population of 1,400 million, this makes for approximately one billion Indians. A shrinking ability of households to finance their food requirement is evident also in studies undertaken in India itself.

### Why this finding is plausible

A study reported in this daily (August 30, 2023 under a datapoint), of the trend in the price of food in Mumbai city over 2018-2023 found that while the cost of preparing a thali at home has risen by 65%, in this period, the average wage of a manual worker rose by 38% and that of a salaried worker by 28%. The implied reduction in purchasing power is considerable, and it would be reasonable to expect that food consumption has been impacted. This would be in line with the reported rise in the prevalence of anaemia, mostly induced by nutrient deficiency, in the latest National Family Health Survey undertaken over 2019-21. Over 50% of adult women were estimated to be anaemic. This suggests that the FAO's finding, that over half of India cannot afford a healthy diet, is plausible. Even if we were to assume that the agency has overestimated numbers by 100% we would be left with 500 million people in this category. This is larger than the population of all the countries of the world other than China.

Ensuring that Indians have access to a healthy diet is the most important task of economic policy today. Macroeconomic policy, relied upon to control inflation, has proved to be useless in the context. The Reserve Bank of India has failed in this task, with the inflation rate mostly higher than the target for four years by now. Its approach of contracting output when the



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inflation rate rises – misleadingly termed "inflation targeting" – does nothing to manage food inflation stemming from the supply side. Central banks are incapable of solving this problem, it must be said within any time frame. It is necessary to intervene on the supply side to ensure that food is produced at a steady price by raising the yield on land.

### The significance of the Green Revolution

India has rich experience in this area, having engineered a Green Revolution in the 1960s, but it is not being tapped. At the time, reeling under extreme food shortage following two successive droughts, the government orchestrated a supply-side response by providing farmers with high-yielding seeds, cheap credit, and assured prices through procurement. This succeeded spectacularly. Within a few years India was no longer dependent on food imports.

If there was a single event that aided India's quest to be self-reliant in the highly polarised climate of the Cold War, it was this. Western economists have pointed to the success of the United States' mission to land a human on the moon as an example of an entrepreneurial state. However, to have engineered the Green Revolution in India at a time when it was a desperately poor country challenged by having to ensure food security to a staggeringly large number is perhaps more significant.

With hindsight, we can see that mistakes were made, among them the rampant use of chemical fertilizer, fuelled by subsidy, which degraded the soil. There was also the reliance on procurement prices rather than productivity increase to ensure farm incomes, which fuelled inflation. We also see that the policy was almost exclusively focused on cereals rather than pulses, the main source of protein for most Indians. However, rather than carping about the errors made in an extraordinarily successful economic policy intervention, we should be correcting them now. At the same time, we should focus on the specific goal of lowering the cost of producing food. The first Green Revolution had a specific agenda – of making India self-sufficient in food. In this it succeeded eminently, and in a remarkably short time, but without paying any attention to the cost of producing food. For this, a second agricultural revolution is needed now. To contain the rising price of food would require action on many fronts; a mission mode is necessary. As for policy, it is clear that procurement prices, cash transfers, the Public Distribution System, and priority lending required of public sector banks are not sufficient. Yield increasing interventions on the

farm are needed to at least contain the cost of production, if not to actually lower it. Agricultural yield is lower in India than in East Asia, pointing to the potential for an increase. Attention is needed to extend irrigation to 100% of the net sown area, an end to restrictions on leasing of land, a quickening of agricultural research and the re-institution of extension.

### Initiatives to work on

Expanding on each of these proposals would be in order. It has been pointed out for some time that increased public expenditure on irrigation is not reflected in an increase in irrigated area – whether due to waste or the diversion of funds has not been established. The ongoing fragmentation of already small land holdings lowers the capacity for productivity-enhancing capital investment, for which leasing is a solution. India's network of public agricultural research institutes needs to be energised to resume the sterling role they had played in the 1960s. Finally, extension has now more or less vanished from where once the gram sevak was a familiar figure in the village, playing a crucial role in the dissemination of best practices. It must be revived. These initiatives should be dovetailed into a programme for the manifold increase of protein production, which India is severely deficient in.

In all the areas identified above, the role of States is crucial. In the 1960s, the States that were chosen for the spread of the new technology worked closely with the central government. This would have to be replicated in order to make a difference to the country as a whole, with the central government taking the States along in a spirit of co-operative federalism. At the same time, it may be asked if the States are playing their part to enhance agricultural productivity rather than relying on food allocations to their Public Distribution System from the central pool.

But, a non-ideological approach would be needed, whether at the Centre or in the States, if a difference is to be made. A noticeable feature of the first Green Revolution was that by relying on private enterprise, the then Prime Minister, Indira Gandhi, chose a capitalist approach (with the objective of making India self-sufficient in food), unmindful of any damage that would be caused to her socialist image. It was the Green Revolution that made the first dent on poverty in India. So, the poor did benefit from this strategy. Similarly, now, in order to ensure that all Indians have permanent access to a healthy diet, no approach consistent with ecological security must be off the table.