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CASE STUDY:  
Does all new tech  
worsen inequality

# 04

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POLICY

# TECHNOLOGY & INNOVATION



## CASE STUDY: DOES ALL NEW TECHNOLOGY WORSEN INEQUALITY

By Zoë Balroop and Thomas Lambert

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### **IEA:**

*The IEA is the UK's original free-market think tank which was founded in 1955. Their aim is to improve the understanding of the fundamental institutions of a free society by analysing the role of free markets in solving economic and social problems. Since their inception, they have worked with prominent Nobel Prize-winning economists including Frederich Hayek and Milton Friedman. They have many internship opportunities for both undergraduate and postgraduate students. These include a 3-month general internship, the Epicenter Internship, and the IEA Global internship. They also have a Summer Internship aimed at undergraduate students specifically. Additionally, they are holding an essay competition where students can win a monetary prize for debating whether the current upswing in inflation is transitory or not.*

### **The Cross:**



*Located in the historic town of Kenilworth in the heart of Warwickshire, The Cross is an award-winning pub that combines Michelin-starred food with a welcoming, relaxed atmosphere. Under the guidance of chef-owner Andreas Antona and head chef Adam Bennett, they have held a Michelin star for over six years and are proud to boast three AA Rosettes. They received a Good Food Award Gold Seal in 2021. The Cross is housed in a Grade II listed 19th-century inn and has been sympathetically restored to retain its heritage alongside contemporary touches that make it a fabulous place to enjoy great food, a casual atmosphere, and informal but attentive service. During the pandemic, Andreas launched a nationwide meal delivery service, inspired by dishes served at The Cross and its sister restaurant Simpsons in Edgbaston. He is now building on its success with the launch of Soko Patisserie, producing ethical, artisan chocolate and Antona Bespoke catering services.*

*The Cross at Kenilworth is recruiting kitchen and front-of-house staff to join its fantastic team. They have various positions available, offering four days a week with a good rate of pay and pension. Please send your CV and covering letter to [enquiries@thecrosskenilworth.co.uk](mailto:enquiries@thecrosskenilworth.co.uk)*

# BRIEFING NOTE

Technological innovation is the force upon which capitalism and the global economy is built. It has allowed humanity to escape the Malthusian Trap and in the last century alone has lifted billions of people out of poverty and unalterably changed the world. Yet from the mid 20th century until now, outstanding innovation has been paired with a historic rise in inequality; through the exploration of three 21st century technologies: Cryptocurrencies and Blockchain, AI, and Genome Editing we will explore the question of whether technological innovation necessarily leads to a rise in inequality.

## OVERVIEW

- Blockchain and Crypto offer the chance to democratise the ownership of stable assets, reduce transaction costs and give free access to the financial system to those around the world, giving all the opportunity to build and maintain wealth. Yet the benefits of these technologies have largely amassed to the wealthy in the developed world.
- AI both destroys millions of low-wage jobs and is used as management tools removes human nuance in the hiring and promotion process, destining people to remain at the bottom. Yet, the disappearance of 'bad jobs' offers humanity the chance to lead more fulfilling lives, and AI may in fact create more jobs than it destroys.
- Genetic Engineering offers the improvement of humanity, the reduction in hereditary disease and disability, and an improvement of the human condition. Yet worldwide usage is restricted with legal barriers and high costs meaning when on the market, it would be available only to the rich, exacerbating existing social and economic inequalities and raising the possibility of an upper class of 'superhumans'.

## PROBLEMS OF WEALTH AND FINANCE THAT CRYPTO AND BLOCKCHAIN SEEK TO ADDRESS

### The cost is high for those without access to the digital financial system or stable assets

- Globally around 1.7 billion people do not have access to a bank account, virtually all of those live in developing countries, and even in the US 22% of Adults remain under or unbanked.<sup>1</sup>
- Those with limited or no access to bank accounts and financial services face high costs in fees and interest on financial products, spending an average \$3,000 a year on these costs.<sup>2</sup>
- Most people lack access to formal savings systems, holding their savings in cash or other informal systems and losing out on financial security and the opportunity to build wealth; just 27% of adults worldwide reported saving formally<sup>3</sup>, and are therefore exposed to high inflation such as the current 19.5% rate in Turkey.<sup>4</sup>

### Wealth inequality is the greatest social injustice facing developed and developing societies: cryptocurrencies aren't the solution

- Developed and Developing economies suffer from large inequalities in income and wealth. Inequality in wealth remains greater than that of income; in the UK the wealthiest 10% hold 44% of all wealth<sup>5</sup> but earn 'only' 36% of income<sup>6</sup>.
- Inequality in wealth continues to grow as the rate of return on wealth outgrows growth in income and taxes fall and become more regressive. The share of house-hold wealth of the 1% has grown from 29.9% in 1989 to 35.5% in 2013<sup>7</sup>.
- Wealth inequality remains an issue of unequal access to savings opportunities, as those in the top percentiles of wealth earn higher yields than those in the middle and bottom. Research in Norway has shown the investment return from 2004-2015 was 50% for those in the 75th percentile, while those in the top 0.01% earned a return of 140%.<sup>8</sup>
- The distribution of wealth of crypto assets closely mirrors the existing inequality pyramid, with 2% of individuals holding 71.5% of all bitcoin wealth.<sup>9</sup>

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<sup>1</sup> World Bank Global Findex Database, 2017, [The Global Findex Database 2017: The Unbanked](#)

<sup>2</sup> Financial Health Network, 2019, [Financially Underserved Market Size Study](#).

<sup>3</sup> World Bank, 2017, [Global Findex](#).

<sup>4</sup> Turkish Statistical Institute, 2021, [Consumer price index annual](#).

<sup>5</sup> Office for National Statistics, 2018, [Wealth in Great Britain Wave 5: 2014 to 2016](#).

<sup>6</sup> World Inequality Database, 2019, [Income Inequality, United Kingdom, 1980-2019](#)

<sup>7</sup> The Russell Sage Foundation Journal of Social Science, 2016, [How Wealth inequality shapes our future](#)

<sup>8</sup> Stanford, 2020, [HETEROGENEITY AND PERSISTENCE IN RETURNS TO WEALTH](#)

<sup>9</sup> Glassnode, 2021, [No. Bitcoin Ownership is not Highly Concentrated – But Whales are Accumulating\\*](#)

## **International transfers and remittances remain a significant cost for both individuals and business**

- Reduced international transaction and remittance costs. According to OFX, an international Foreign Exchange company, Foreign transaction fees are on average 3%, and the average remittance cost remains at 6.38% in Q1 2021, compared to costless transfers within developed countries<sup>10</sup>.
- Transaction and exchange costs remain one of the highest-earning sectors of the global banking market, earning banks, and costing consumers, over \$400 billion dollars a year according to a McKinsey global bank report<sup>11</sup>.
- There is a consistent issue in acquiring financing for SMEs, who often have limited credit history and face high lending fees from established financial institutions. Global trade financing alone faces a \$1.5 trillion shortfall according to the ICC<sup>12</sup>.

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<sup>10</sup> World Bank, 2021, [Remittance Prices Worldwide Quarterly](#)

<sup>11</sup> McKinsey & Company, 2019, [Global Transaction Banking: The \\$1 Trillion question](#)

<sup>12</sup> ICC Banking Commission, 2020, [ICC Global Survey On Trade Finance](#)

## AI AND ALGORITHMS IN THE WORKPLACE

**Increasing use of algorithms as management tools for large workforces is leading to tunnel-vision efficiency goals, which is, in turn, worsening working conditions for lower-skill workers**

- Bottom-up mobility is becoming increasingly difficult as algorithms manage huge workforces, especially in the gig economy. Percolata, a Silicon Valley company that provides algorithms to monitor employee productivity and sales conversion rates, has conducted 'twin study' tests which so far suggest that algorithms 'boost sales by 10-30%'<sup>13</sup>. There are therefore incentives for companies to continue to increase algorithmic use in management.
- A 2018 survey of the Los Angeles retail sector showed that 44% of industry staff experienced timetabling fluctuations of more than 10 hour differences week on week<sup>14</sup>. These inconsistencies, logical for a machine but completely impractical for human beings, exacerbate income uncertainty, difficulties at home, and higher stress.
- In 2014, the Chili's restaurant chain installed over 45,000 tablets across 823 of its stores. At the end of a meal, customers were prompted to fill out a satisfaction survey, which then informs workers' performance evaluations<sup>15</sup>.

**AI and automated jobs are expected to make millions of low-skilled workers redundant, putting the least well-off in society out of a job.**

- Exact estimates on how many people will be affected by AI-induced job loss varies according to different studies and researchers, but a pair of Oxford Academics have estimated that 47% of American jobs are at high risk of being fully automated by the mid-2030s<sup>16</sup>.
- Oxford Economics' academic department further suggested that 20 million manufacturing jobs will be lost worldwide to robots by 2030<sup>17</sup>.
- A report conducted by McKinsey Global Institute has found that women may be particularly at risk with regards to mass job loss. Jobs such as clerical work, scheduling and book-keeping are all very susceptible to automation, and 72% of such jobs in advanced economies are held by women<sup>18</sup>.
- Similarly, in the US, ethnic minorities and people of colour, many of whom work in customer service jobs, have been identified to be significantly more at risk than their

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<sup>13</sup> Financial Times, 2016, [When your boss is an algorithm](#)

<sup>14</sup> Data&Society, 2019, [EXPLAINER: - Algorithmic Management in the Workplace](#)

<sup>15</sup> Data&Society, 2019, [EXPLAINER: - Algorithmic Management in the Workplace](#)

<sup>16</sup> Forbes, 2019, [Is AI Going To Be A Jobs Killer? New Reports About The Future Of Work](#)

<sup>17</sup> Forbes, 2019, [Is AI Going To Be A Jobs Killer? New Reports About The Future Of Work](#)

<sup>18</sup> Forbes: McKinsey Global Institute, 2019, [Is AI Going To Be A Jobs Killer? New Reports About The Future Of Work](#)

caucasian counterparts, with McKinsey going on to estimate that 132,000 Black workers could be displaced by 2030<sup>19</sup>.

- COVID19 has forced companies to slash operational costs where possible, with the pandemic making job automation more desirable than ever for those in survival-mode. It is thought that at the peak of the pandemic in the US, 40 million jobs were lost and several economists estimate that 42% of those jobs are gone for good<sup>20</sup>.

**The need to manage new programs and machinery, as well as the benefits they themselves bring will create just as many, if not more, opportunities than AI destroys.**

- In 2019, Amazon announced that it plans to spend \$700 million training approximately 100,000 workers in the US by 2025<sup>21</sup>, in an attempt to help these workers attain more highly skilled jobs in the future. This decision stems directly from their recognition that very soon automated technology will replace repetitive, low-skilled jobs.
- A Gallup and Northeastern University online survey posed to approximately 12,000 adults shows varied opinions on the perceived benefits and threats of AI in the near future. The results show that the general public is clearly weary, but also somewhat optimistic, about the potential for AI. 60% of British adults believe that AI will eliminate more jobs than it will create, yet 70% of adults also believe the effects of AI on our lives will overall be “very” or “mostly” positive<sup>22</sup>.
- The World Economic Forum predicts that automation will displace 75 million jobs worldwide, but will counter this by generating some 133 million new ones by 2022<sup>23</sup>.

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<sup>19</sup> Forbes: McKinsey Global Institute, 2019, [Is AI Going To Be A Jobs Killer? New Reports About The Future Of Work](#)

<sup>20</sup> Time, 2020, [Machines and AI Are Taking Over Jobs Lost to Coronavirus | Time](#)

<sup>21</sup> Forbes, 2019, [Is AI Going To Be A Jobs Killer? New Reports About The Future Of Work](#)

<sup>22</sup> Forbes, 2019, [Is AI Going To Be A Jobs Killer? New Reports About The Future Of Work](#)

<sup>23</sup> Forbes: World Economic Forum, 2019, [Is AI Going To Be A Jobs Killer? New Reports About The Future Of Work](#)

## POTENTIAL CONSEQUENCES OF HUMAN GENOME EDITING

Human Genome Editing has only been authorised to research publicly-supported screening methods for fatal diseases, and so its current trajectory poses no risks to social inequality; only the possibility for health benefits.

- At the time of this report's publication, Human Germline Genome Editing (hGGE) is monitored by The Human Fertilisation and Embryology Authority, and can be researched in the UK with the appropriate licensing. It is, however, prohibited by UK law to be practiced as part of female IVF treatment. It is hoped that such genome editing could help correct, and prevent inheritance of, genetic mutations which can cause one of 10,000 that result from mutations of a single gene<sup>24</sup>.
- Any embryo that has undergone genetic modification cannot be placed into a woman's uterus, and instead must be destroyed after research and tests are complete<sup>25</sup>. This is a fairly standard baseline regulation, adopted by many countries. However, In November 2018, Chinese scientist He Jiankui genetically modified embryos to be supposedly HIV resistant, which he then proceeded to fertilise; eventually, twin girls were born<sup>26</sup>. China has since investigated and censured He's work, but the scenario brings into question the efficacy and need for international ethical laws for hGGE.
- A month after he announced the first ever genetically modified twins, a poll was conducted by The Associated Press-NORC Centre for Public Affairs Research to better understand American adults' opinions on the subject of genetic engineering in human fetuses. The poll found that 70% of Americans would be inclined to one day use genetic-editing technology to prevent children from inheriting incurable or fatal diseases such as cystic fibrosis or Huntington's disease<sup>27</sup>.
- The same AP-NORC poll concluded that roughly 2/3 of Americans would also be in favour of using gene editing methods to screen for and eliminate non-fatal conditions such as blindness, and even to reduce the risk of diseases which could develop later on in life, such as cancer<sup>28</sup>.

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<sup>24</sup> UK Parliament, 2020, [Human Germline Genome Editing](#)

<sup>25</sup> UK Parliament, 2020, [Human Germline Genome Editing](#)

<sup>26</sup> Nature, 2019, [The CRISPR-baby scandal: what's next for human gene-editing](#)

<sup>27</sup> STAT, 2018, [Poll: Americans support gene-editing embryos to prevent diseases - STAT](#)

<sup>28</sup> STAT, 2018, [Poll: Americans support gene-editing embryos to prevent diseases - STAT](#)

## **Genes relating to physical characteristics can correlate to success in later life, meaning genetic engineering does have the potential to exacerbate social inequality.**

- A study has shown that over a 30-year career, taller people tend to be more financially successful, with a 6 foot person making an estimated \$166,000 more than someone measuring 5 foot 5 inches in height. Furthermore, almost all Fortune 500 CEOs are at least 6 foot 2 inches tall, even though it is only true for 3.9% of Americans<sup>29</sup>. Additional studies have also found a correlation between physical beauty according to cultural norms and associated higher earnings - but not competence or ability.
- Furthermore, 85% believe that scientific mistakes, such as altering the wrong DNA code sequence, is a risk that is somewhat likely to occur. Overall, Americans stand more opposed to than in favour of funding hGGE research, with 48% voting against passing a government bill for it, 26% in favour of, and the rest of the population taking no strong stance<sup>30</sup>.
- Approximately 2/3 of differences in scholastic achievements can be explained by children's genetics according to research. A sample of 6,000+ twins - all part of the UK representative Twins Early Development Study - found that academic achievement of identical twins was remarkably stable, aligning with each other by 70% when tested<sup>31</sup>. The study concludes that, excluding differences caused by intelligence, genetics have a substantial 60% influence over academic success throughout compulsory schooling years.

## **Designer babies are high end services that only the rich can afford; its inaccessibility for those from lower socioeconomic backgrounds will therefore worsen intrinsic divides in society**

- As of July 2021, the carrier screening (specifically for hereditary diseases) industry is worth \$1.7 billion in America, and the National Institutes of Health announced that it will be giving out \$38 million<sup>32</sup> worth of grants over a five year period to encourage research into disease predictions using polygenic risk scores in diverse population samples.
- Currently IVF costs roughly \$8000, with add-ons for medication costing an additional \$3000-\$5000. With regards to the future of CRISPR babies, more commonly known as designer babies, pre-implantation genetic diagnosis cost roughly \$3500, with the luxury of gender selection setting couples back \$18000. The price of surrogacy ranges from \$20,000-\$120,000. Sperm specimens often cost between \$250-\$400, and the most desirable eggs (from white, athletic, tall, high SAT-scoring women) cost \$50,000<sup>33</sup>. These practices are expected to become much more common-place by 20-30 years time, with the

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<sup>29</sup> Forbes, 2017, [Genetic Engineering Will Make Income Inequality Much Worse](#)

<sup>30</sup> STAT, 2018, [Poll: Americans support gene-editing embryos to prevent diseases - STAT](#)

<sup>31</sup> BBC, 2018, [How much is academic achievement shaped by genes?](#)

<sup>32</sup> Scientific American, 2021, [A New Era of Designer Babies May Be Based on Overhyped Science](#)

<sup>33</sup> Trybiotech, 2020, [Cost of Having a Designer Baby Designing a Baby: the Market and the Concerns – ST112 WA2018](#)

designer baby market clearly able to generate huge profits for businesses offering relevant services, while only really being accessible to the richest in society.

- CRISPR-Cas9 technologies are not yet 100% safe, and furthermore success rates for implanting embryos are typically still as low as 1/3, meaning it is often necessary to pay for repeated attempts - a process which is extremely costly over time<sup>34</sup>.
- Over time the cost of human genome editing is decreasing as more private companies are able to offer these services. In 2009, genome sequencing itself cost an additional \$50,000, whereas today it is more like \$1500. In a few decades, when genetic alterations are cheaper to manufacture, many experts in the field predict that it could cost as little as \$100 per genome edit<sup>35</sup>. While this would significantly augment its accessibility in society, ethical questions remain, and these costs are additional to all the costs associated with IVF and surrogacy which are also part of the process.

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<sup>34</sup> The Guardian, 2017, [Designer babies: an ethical horror waiting to happen?](#)

<sup>35</sup> The Guardian, 2017, [Designer babies: an ethical horror waiting to happen?](#)

# INSIGHT

## OVERVIEW

Technology is the driving force behind human advancement. It has brought humanity into the fourth industrial revolution, alongside all of the positive and negative effects thereof.

Is it time to ask the question of whether the benefits of continued technological progress outweigh the costs? This question is explored through the lens of three of the 21st century's potentially most impactful technologies: Bitcoin and Blockchain, AI and Algorithms, and Human Genome Editing. All three topics have the potential to change the world for both 'good' and 'bad'. Whether it be the emergence of a new class of genetically modified superhumans, or the breaking down of barriers to access financial systems, there are both huge gains to be made but also massive potential for reversion. The question is which will it be?

## Blockchain and Cryptocurrencies and their potential to increase financial equality

A major opportunity for blockchain and cryptocurrencies to make a difference is in the area of remittances. Low income workers in developing nations that send remittances across borders are faced with much higher costs (an average fee of 6.38%<sup>36</sup>) and delays than those in developed countries transferring money domestically. This means it is much more expensive for a worker working internationally to send money back home to support family than it is when living in the same country. According to a 2020 OECD report, ‘the promise of the underlying blockchain technology still holds for improving the cross-border payment systems and impact remittances cost’.<sup>37</sup> Price reduction and efficiency gains are possible through providing an intermediary currency, for example bitcoin, with low transfer fees, the potential for reduction in costs of KYC requirements and the simplification of the international clearing process. Remittances make up 4.91% of global GDP, and above 20% in 9 countries<sup>38</sup>, and play an important role for hundreds of millions of the world’s poorest. The widespread adoption of these technologies and the possible halving of costs<sup>39</sup> would be a significant increase in the money available for many of the world’s lower income workers.

Many domestic currencies in developing countries fail to do their job; they fail as a store of value, means of exchange and as a unit of account. Inflation in developing countries poses a large barrier to saving and the opportunity for individuals and families to maintain their wealth, by eating into spending power and reducing the value of savings. In Brazil investors have already put \$421 million into a bitcoin ETF<sup>40</sup>, although not the most accessible form of investment, it still highlights the issues facing domestic investors and the evident need for alternative investments. The fixed-supply nature of cryptocurrencies also protects crypto investments from inflationary pressures due to an increase in the money supply. While this must be measured against the characteristic volatility of cryptocurrencies, stable coins tied to the value of major currencies such as the Dollar or Euro mean there is much promise for these instruments to provide better stores of value for those in developing countries.

Finally, these technologies provide great opportunities for increased access to the financial system for the un- and underbanked. The main causes are not having enough money for an account, lack of perceived need and the cost of opening and maintaining accounts<sup>41</sup>. Crypto and blockchain can help by lowering the costs of participating in the financial system, as well as the problem of low value transactions. They offer a new ‘open access’ financial system where inclusion is limited only by access to the internet and a capable device.<sup>42</sup> It enables those underserved by traditional finance

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<sup>36</sup> World Bank, 2020, [Remittance Prices Worldwide Quarterly](#)

<sup>37</sup> OECD, 2020, [Can blockchain technology decrease the cost of remittances?](#)

<sup>38</sup> World Bank, 2020, [Remittances, percent of GDP - Country rankings](#)

<sup>39</sup> OECD, 2020, [Can blockchain technology decrease the cost of remittances?](#)

<sup>40</sup> Financial Times, 2021, [Cryptocurrencies: developing countries provide fertile ground](#)

<sup>41</sup> World Bank Global Findex Database, 2017, [The Global Findex Database 2017: The Unbanked](#)

<sup>42</sup> World Economic Forum, 2021, [Cryptocurrencies can enable financial inclusion. Will you participate?](#)

institutions access to cheap and quick transfers, as well as a new potentially lucrative alternative asset class of the type not easily available to the world's poor.

There are no perfect solutions to a global issue such as inequality, and these technologies face their own drawbacks. Much of the wealth created by crypto and blockchain will be concentrated in a small class of people. Those 'early adopters' who now have significant amounts of cryptocurrencies will enjoy much of the increase in value predicted if cryptocurrencies continue their journey to the mainstream. And in the same vein, the enormous value of the companies in the space will be channelled to founders, owners, and early investors. These technologies do face problems such as: the environmental cost of blockchains and cryptocurrency 'mining'<sup>43</sup>, as well as issues such as the need for technological literacy, possible problems regarding regulation and also the irreversibility of transactions. Finally, and possibly most importantly, these technologies do nothing to tackle the root causes of national and international inequality. Although the cost of exclusion from the financial system is not insignificant for low-income families, and reduction in remittances costs are important, none of these are the root causes of inequalities in income and wealth.

As with all new technologies, crypto currencies and blockchain technologies face massive barriers to more widespread adoption. They also have the possibility of exacerbating existing wealth and social inequalities as the wealth generated flows to a small and exclusive group of society. Furthermore, these technologies don't tackle any of the underlying causes of inequalities of wealth and income. Yet their potential to dramatically increase financial inclusion and decrease the costs of domestic and international money transfers mean they ultimately have huge potential for increasing inclusivity and working toward decreasing global inequalities.

## **Algorithms and AI will redefine labour market norms**

The ever-increasing use of automated software in the labour force, namely algorithms and artificial intelligence, produces various consequences which for the most part contribute negatively to issues pertaining to socio-economic divides. Since the industrial revolution, gradual mechanisation of production methods has been a vital part of continued modernisation, allowing society to increase productivity and efficiency<sup>44</sup>, but even since the 18th century these changes have come at a cost to societal welfare. This section will explore the extent to which these changes will worsen inequality amongst the general workforce. Today, these technological advancements are even more significant as algorithmic management becomes the norm, especially in the gig

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<sup>43</sup> Digiconomist, 2021, [Bitcoin Energy Consumption Index](#)

<sup>44</sup> iot: The Economist, 2020, [The Impact of Artificial Intelligence - Widespread Job Losses](#)

economy<sup>45</sup>. This will radically shift working dynamics such that bottom-up mobility will become a thing of the past for those working under algorithmic rule. By prioritising efficiency over human management, there is significantly less opportunity for interaction between the lower skilled workers in a business model, and those at the top with more senior roles. This means less progression within companies, and by reducing mobility those just starting out will miss out on the opportunity to work their way upwards as was typically done in the past. As algorithms become more commonplace, this 'rut' will clearly hinder moves to reduce social and income inequality.

Even as AI manages to more closely mimic humanity with further refinement and testing, it still cannot begin to comprehend the complexities, emotions and nuances of the human psyche. In turn, workers whose schedules are decided by algorithms are inherently disadvantaged because computers cannot understand factors such as needing afternoons for childcare, or time off for family/ illness, and so they distribute timetables which are often simply not feasible. Additionally, schedules of this sort tend to fluctuate greatly, and/ or be delivered at the last minute<sup>46</sup>. This leads to higher stress, difficulties at home, and income uncertainty not dissimilar to zero hour contracts.

Evolving and excessive use of technology in labour management allows for higher levels of employee monitoring to borderline invasive levels, infringing upon basic human rights pertaining to our need for some degree of privacy and self-ownership. This can manifest in the form of excessive customer feedback in the name of market research and employee feedback, especially seen in cases of self-employment under huge gig economy giants such as Uber and Deliveroo<sup>47</sup>. More generally, these companies epitomise many of the issues discussed which result from increasing AI and algorithmic use in management. In the US, there are approximately 800,000 people who rely on companies such as these for their income<sup>48</sup>; that means 800,000 people who must constantly endure the stress of not knowing when their next job will be, how much they'll make, and whether they will be justly reviewed by customers who usually dismiss feedback measures. Many people undoubtedly are guilty of skipping through server reviews, unaware of any effect it may have on workers. In many cases complaints end up directed at the self-employed workers of the gig economy giants, when in fact the brunt of the blame should be borne by the corporations that these workers are serving (such as restaurants using UberEats to deliver their products)<sup>49</sup>. However, as customer feedback and customer services become increasingly automated, this demonstrates another example of the increasing lack of nuance in everyday B2C interactions. Thus, those stuck in lower skilled/ entry level jobs will find it increasingly difficult to progress to higher value added jobs, punishing those from lower socioeconomic backgrounds, slowly eliminating opportunities to reduce societal and income inequality.

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<sup>45</sup> Financial Times, 2016, [When your boss is an algorithm](#)

<sup>46</sup> Data&Society, 2019, [EXPLAINER: - Algorithmic Management in the Workplace](#)

<sup>47</sup> Data&Society, 2019, [EXPLAINER: - Algorithmic Management in the Workplace](#)

<sup>48</sup> Financial Times, 2016, [When your boss is an algorithm](#)

<sup>49</sup> Financial Times, 2016, [When your boss is an algorithm](#)

One of the most commonly researched areas of AI's impact on mankind pertains to the estimated job losses - and job creations - associated with mass automation. Typically, research on expected shifts and losses to the labour force tend to vary widely on exact numbers, but general trends agree that manufacturing and repetitive jobs will be some of the most at risk and most easily replaced<sup>50</sup>. McKinsey Global's studies have also shown that women and ethnic minorities tend to be majority holders of admin-intensive jobs, putting them in the highest risk category<sup>51</sup>. Therefore, while the exact percentages of future redundancies may not be agreed upon, it is clear that from the socioeconomic makeup of those working lower paid and repetitive jobs, job losses induced by automation will exacerbate gender and racial inequalities measured by factors such as the gender wage gap and racial inequalities in the workplace. Not only this, but policy responses to help combat these consequences may not be readied in time for the fast-paced changes to workplace automation. This stems from the fact that the COVID19 pandemic has encouraged incorporation of technology wherever possible, and this newfound desirability will accelerate moves to automate jobs<sup>52</sup>. This said, these analyses fail to consider the positive impact AI and automation may be able to provide, with specific regards to job creation and opportunities to upskill. Amazon has long since announced their plans to fund training sessions for their workers who are at risk from automation, increasing their skillset in order for them to progress to a more protected job<sup>53</sup>. Additionally, many institutions, including the World Economic Forum, have found evidence that AI will certainly create jobs alongside those it forces into extinction<sup>54</sup>; in fact, the net surplus created could be greater than the loss we will see, so if we look optimistically, automation could actually be a catalyst for improving lower skilled workers' prospects. This could be through necessary upskilling training schemes for those at risk, or the creation of completely new jobs, helping narrow divides in social and income inequalities by offering higher value added job options for those currently working menial income jobs.

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<sup>50</sup> Forbes, 2019, [Is AI Going To Be A Jobs Killer? New Reports About The Future Of Work](#)

<sup>51</sup> Forbes: McKinsey Global Institute, 2019, [Is AI Going To Be A Jobs Killer? New Reports About The Future Of Work](#)

<sup>52</sup> Time, 2020, [Machines and AI Are Taking Over Jobs Lost to Coronavirus | Time](#)

<sup>53</sup> Forbes, 2019, [Is AI Going To Be A Jobs Killer? New Reports About The Future Of Work](#)

<sup>54</sup> Forbes: World Economic Forum, 2019, [Is AI Going To Be A Jobs Killer? New Reports About The Future Of Work](#)

## The societal impact of Human gene editing will depend on future regulations

The potential consequences associated with the extensive applications of human germline genome editing (hGGE) seems hauntingly limitless to the everyday citizen. However, the current use of these developing techniques has so far been nothing but benign, with intended future use limited only to advancing healthcare in order to screen for fatal diseases pre-birth. This section will explore the extent to which we have a genuine cause for concern regarding the future of hGGE, especially where social justice and equality are concerned. Supportive of genetic modification, many people are in favour of these techniques being developed if used only for the benefit of fetal health. Protective measures are also preemptively in place: worldwide, governments have their own regulatory bodies monitoring all activity pertaining to hGGE, with research proposals required to undergo approval processes before they can be realised, at least according to UK Parliament<sup>55</sup>. Furthermore, actual practice of such techniques are still currently prohibited in relation to any reproductive methods such as IVF; modified embryos cannot under any circumstances be implanted into a uterus for fertilisation and must instead be destroyed after testing is completed<sup>56</sup>. The strict monitoring of current and outlined future practices therefore shows that while many fear the possible repercussions of human genetic engineering, there is in fact limited scope for any of these concerns to become a reality. In turn, any arguments suggesting that hGGE will worsen inequality, while founded upon facts, should be read with these regulations kept in mind.

Being such a novel area of research in the world of technology and innovation, full ethical and regulatory procedures have yet to be completely ironed out, allowing for anomalous testing to slip through the cracks of international governmental monitoring. There is only one recorded case so far, originating in China<sup>57</sup>, and the 'crime' was punished accordingly to prevent similar deviations from allowed hGGE practices. While in this case genetically modified embryos were illegally fertilised and brought to life, there are still questions as to whether the modifications performed had any true effect, and thus whether the experiment was of any real threat, save to the law. The fact that an incident of this magnitude can occur though, clearly incites panic among the general public, and while the majority of adults are in favour of exploring what hGGE can do for fetuses with life-threatening gene-related issues, the majority also have shown opposition to fund genetic engineering research beyond this particular intended use<sup>58</sup>.

Opposition to hGGE tends to stem from preexisting beliefs that genetic makeup correlates to success and wealth later on in life, and therefore rumoured manifestations of such research, for example designer babies, will be inherently unfair and unethical by giving modified children unnatural advantages. Note that there is no single specific gene for intelligence, and given the

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<sup>55</sup> UK Parliament, 2020, [Human Germline Genome Editing](#)

<sup>56</sup> UK Parliament, 2020, [Human Germline Genome Editing](#)

<sup>57</sup> Nature, 2019, [The CRISPR-baby scandal: what's next for human gene-editing](#)

<sup>58</sup> STAT, 2018, [Poll: Americans support gene-editing embryos to prevent diseases - STAT](#)

varying influences of nature versus nurture, there is also no guarantee that intelligence results in wealth and/ or success<sup>59</sup>. However, the perceived unfair advantages discussed are a cause for concern, as studies have shown correlations between height and success, as well as beauty (as defined by cultural norms) and success<sup>60</sup>. In addition, genetics have been proven to be a factor in determining scholastic success, which in many cases begins to determine probable career success<sup>61</sup>. These findings combined with the fact that designer babies will initially be marketed as high end products/ services, affordable only to the rich, will wreak havoc on the existing nature of presently unacceptable levels of inequality<sup>62</sup>. If only those who are already financially successful and wealthy have access to the means by which they can rig the system in favour of their offspring's future success, socioeconomic divides in society will be unimaginably worsened, with wealth and income inequalities following suit in a dystopian fashion, much to society's detriment.

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<sup>59</sup> Cambridge Brain Sciences, 2020, [22 Genes Linked to Intelligence](#).

<sup>60</sup> Forbes, 2017, [Genetic Engineering Will Make Income Inequality Much Worse](#)

<sup>61</sup> BBC, 2018, [How much is academic achievement shaped by genes?](#)

<sup>62</sup> Trybiotech, 2020, [Cost of Having a Designer Baby Designing a Baby: the Market and the Concerns – ST112 WA2018](#)

## CONCLUSION

- Blockchain and Cryptocurrencies come with their own set of problems: regulatory, environmental and the flow of wealth, as well as the failure to tackle underlying causes of inequality. Yet, their potential to transform existing arrangements for remittances flows, financial inclusion and accessibility mean they will in the long-term, so far as it's possible to predict, work to tackle inequality, and promote a more equitable world.
- The attractiveness of automation across management and admin roles as well as low-skilled repetitive jobs will change labour force dynamics from stunting career progression to eliminating certain jobs altogether, presenting many ways in which inequality can be worsened if left unchecked.
- hGGE when performed in accordance with existing rules and regulations is a force for good and undoubtedly a medical breakthrough with the ability to save countless fetuses. Ethical concerns and coherence of international law still have a capacity for improvement to ensure this field doesn't exacerbate socioeconomic divides as a byproduct of its good intentions.

# POLICY RECOMMENDATIONS

## OVERVIEW

The following policy recommendations have been made with the aim of addressing the impact on inequality that our given technologies can exacerbate.

- Action 1 - Invest in understanding the environmental impact of blockchain before legislating for a shift to lower computationally costly algorithms, and ensure stablecoins are safe stores of wealth.
- Action 2- The UK must formalise legislation to limit the impact of AI and algorithmic data on the labour market.
- Action 3 - Rather than banning the inevitable, the UK should continue to push the boundaries of hGGE regulations, while carefully balancing benefits versus risks to ensure future uses are for the greater good

## ACTION 1:

**For blockchain technologies and cryptocurrencies to effectively scale, the climate problem must be addressed, requiring research and legislation by governments to promote the use of less energy. Furthermore, for stablecoins to maximise their utility, they must be fully backed by liquid assets and fiat currency**

Given how recent crypto technology is, there is much room, and a great need, for legislation to tackle the myriad of issues that they still have. An area which has received much recent attention is that relating to cryptocurrencies' role in financial markets and debates over taxation and classification amid the growing increase in wealth stored and the continued sophistication of the financial products available<sup>63</sup>. Yet, in terms of inequality and access, there are more important areas to address. The usefulness of this technology is in its potential to open up financial access and decrease transaction costs, thus, to achieve maximum utility from this adoption must become more widespread, necessarily increasing the load on the blockchain networks. As crypto solutions become more popular and are used more, one of the greatest challenges is in terms of the environmental cost of the underlying blockchain technology: its energy usage and environmental cost of the computers which 'mine' and verify the blockchain. An illustration of the energy problem is the bitcoin network, which is set to consume 110 TWh just this year, more than that of Argentina or Norway.

The main source of this is the nature of the 'consensus algorithm used', the method by which blockchain systems validate transactions. The current 'antiquated' <sup>64</sup> 'Proof of Work' method used by bitcoin, and the second largest cryptocurrency Ethereum, results in high power usage and expensive transactions. Similarly, the mining of cryptocurrencies has become dominated by purpose-built machines which require frequent upgrading/replacing. This contributes to the large and growing e-waste problem, where only 17% equipment is recycled<sup>65</sup>. In respect of these environmental issues some degree of regulation is required to incentivise new, and existing crypto currencies to adopt computationally cheaper consensus algorithms, many of which are already in wide use such as Proof of Authority or Proof of Stake systems<sup>66</sup>. Doing so could dramatically reduce the energy consumption of 'mining', thus reducing hardware costs at the same time. However, as Lei, Masanet and Koomey argue<sup>67</sup>, it is important that regulation does not run ahead of understanding. There is a need, therefore, for publicly funded research to create a detailed understanding of the environmental impact with clear energy-usage data that would direct policy responses.

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<sup>63</sup> The New Yorker, 2021, [The Challenges of Regulating Cryptocurrency](#)

<sup>64</sup> The New York Times, 2021, [Can Crypto Go Green?](#)

<sup>65</sup> United Nations University, 2020, [Global E-Waste Surging: Up 21% in 5 Years](#)

<sup>66</sup> The New Yorker, 2021, [The Challenges of Regulating Cryptocurrency](#)

<sup>67</sup> ScienceDirect, 2021, [Best practices for analyzing the direct energy use of blockchain technology systems: Review and policy recommendations](#)

For cryptocurrencies to act reliably as a means of exchange and store of value they must be stable. There already exist coins for this purpose, stablecoins, which are pegged to the value of a fiat currency, e.g., the USD. The way forward for ensuring stability, and the prevention of a 'bank run' on the coins, if they are not fully backed, is not clear. One way forward could be the creation of state-backed coins with implicit state support, yet this would defeat the purpose of decentralised currencies as free from government control and could open the possibility of governments directly controlling and monitoring transactions. The same issue arises with currencies created by private companies, for example Facebook's Libra. Instead, we would propose the creation of national regulations classifying stable coins as a unique category of cryptocurrencies, such that there would be requirements for backing with liquid assets, and ideally fiat currency. Although international cooperation would be helpful, it would not be necessary for the effective use of cryptocurrencies as enabling international transfers and inclusion, as like national currencies, there is no need for multiple parties, e.g. countries to back them as long as one does.

## **ACTION 2:**

**The UK needs to formally draw up legislation associated with AI and algorithmic data use to minimise foreseeable risks to the labour market, or else become a policy taker rather than policy maker**

We have already discussed the various impacts AI and algorithmic management can have on the workforce, examining winners and losers as we move steadily towards increased automation. Not only are exact figures relating to job gains versus job losses unclear and unagreed upon, but legislation in this field is similarly ambiguous at present. The UK has stated that it aims to be a global leader in AI innovation and legislation, but without even a statutory and official definition for what AI in the UK is<sup>68</sup>, how can we expect the government to lay out air-tight regulations surrounding its use? Many critiques of global inaction pertaining to preemptively regulating AI markets concern themselves around the lack of action; there is a plethora of academia studying how we ought to go about regulating issues of AI ethics, big data, and job security, however there is disturbingly little evidence of turning this research into formal law of some kind soon<sup>69</sup>. Furthermore, when looking at reports on the current UK regulatory stance, the body of most texts, upon observation, seem much more concerned with AI implementation strategy<sup>70</sup>, than ensuring we have suitable regulations in place for when our use inevitably escalates rapidly. These points combined suggest that the UK needs to better prioritise this legal framework which will be crucial in providing a sound foundation upon which we can then expand our AI technologies, knowing that consumers and sellers alike will be protected.

Our insights section focused on the consequences both AI and algorithms may potentially have on several aspects of the labour market as we know it today: debilitated job progression, dissatisfactory and unfair working conditions, as well as job instability in the face of automation. To decrease risks perpetuating further income and social inequality in society, we need to see the UK follow bodies such as the EU Commission in attempting to safeguard workers' rights<sup>71</sup>. Under the proposed regulations put forth by the EU Commission in April 2021, issues surrounding employment with regards to AI have been classed as a "high risk" category<sup>72</sup>. This seems an appropriate acknowledgement of the need to protect this sector from potentially undesirable consequences come the reign of AI and algorithms. By contrast, following Brexit the UK has declined to share this proposed legislation<sup>73</sup>, and therefore in comparison lack the same initiative and care that the EU have demonstrated here. Given the UK's aim to be a leader in AI innovation

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<sup>68</sup> Global Legal Insights, 2021, [AI, Machine Learning & Big Data Laws and Regulations | United Kingdom | GLI](#)

<sup>69</sup> Lexology, 2019, [The Impact of AI Legislation on Employment](#)

<sup>70</sup> Global Legal Insights, 2021, [AI, Machine Learning & Big Data Laws and Regulations | United Kingdom | GLI](#)

<sup>71</sup> Forbes, 2020, [AI Laws Are Coming](#)

<sup>72</sup> Farrer & Co, 2021, [What is the EU's new Regulation on Artificial Intelligence?](#)

<sup>73</sup> Global Legal Insights, 2021, [AI, Machine Learning & Big Data Laws and Regulations | United Kingdom | GLI](#)

and legislation, compounded with their admission that we are likely unable to beat the USA and China in AI development<sup>74</sup>. This means that the UK should surely be putting more resources into formulating a safety net, such as the guaranteed training and reskilling for those at risk, and limits on the intrusivity of algorithms and the reach of their data consumption.

That said, even the drafted legislation from the EU Commission will likely not come into effect until 2024 at the latest<sup>75</sup>. We have seen over the last few decades the incredibly rapid implementation of new technologies into our everyday lives, and thus legislation of this importance, with such widespread effects, we hope will be pushed through faster than for example the GDPR legislation which took 4 years<sup>76</sup>. On top of the timeframe, their proposed legislation, while deeming employment issues ones of high risk, will not affect AI systems introduced to the market before the regulations come into full effect (unless pre-existing systems are not substantially changed after the introduction of regulations)<sup>77</sup>. Failure to provide protection in an adequate time frame will allow AI and algorithms to perpetuate inequalities before they can be nipped in the bud. Therefore, while the EU's move is one of the first official attempts of its kind, there are still improvements to be made in protecting all spheres of the workforce, not just from changes made in 2024 and beyond.

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<sup>74</sup> Global Legal Insights, 2021, [AI, Machine Learning & Big Data Laws and Regulations | United Kingdom | GLI](#)

<sup>75</sup> Farrer & Co, 2021, [What is the EU's new Regulation on Artificial Intelligence?](#)

<sup>76</sup> Farrer & Co, 2021, [What is the EU's new Regulation on Artificial Intelligence?](#)

<sup>77</sup> Farrer & Co, 2021, [What is the EU's new Regulation on Artificial Intelligence?](#)

### **ACTION 3:**

**Rather than banning the inevitable, the UK should continue to push the boundaries of hGGE regulations, while carefully balancing benefits versus risks to ensure future uses are for the greater good**

At this point in our report, it is clear that neither scientific nor technological innovation stops to take a break, if anything it only gathers momentum and pace; Human Germline Gene Editing is no exception to the rule. Following hGGE misconduct after a breach of law in China, whereby genetically modified embryos were fertilised, leading to the birth of twins, it is evident that both scientifically and ethically more is needed by way of legislation<sup>78</sup>. Yet, there are numerous queries and concerns as to the efficacy of implementing new regulations, especially on the global level. Predicted global policy challenges arise quite simply as a result of a lack of cohesion in international hGGE law enforcement.

The International Commission, formed as a result of the 2018 Hong Kong International Summit on Human Genome Editing, was the initial response to rectify the Chinese researcher's breach of regulation. Its purpose was to help ensure that such malpractice never occurs again, by defining criteria required before hGGE could ever be considered for clinical use, and producing legal and ethical frameworks for regulatory bodies such as the World Health Organisation (WHO) to use as advisory materials<sup>79</sup>.

A single universal legislation accepted and executed worldwide is yet to happen though. At present restrictions on hGGE are strict, ranging from complete bans where germline modifications are categorically prohibited and followed up with criminal sanctions such as in the majority of Europe, Australia, Canada and Brazil, and those with less severe regulations allowing hGGE for research purposes<sup>80</sup>. The UK falls into the latter category, and has also demonstrated their position as a leader and front-runner in hGGE policy making. They were the first parliamentary body to explicitly allow Mitochondrial Donations - to help overcome fertility issues - in the 2015 Mitochondrial Donation Regulations Act<sup>81</sup>. Being 'the first to openly challenge the fragile global policy with regard to germline gene modification'<sup>82</sup>, the UK ought to continue to develop their regulations, keeping up with the changing times. CRISPR technologies are becoming less theoretical and more of a reality which needs time and thought.

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<sup>78</sup>Science Media Centre, 2020, [expert reaction to report from the International Commission on the Clinical Use of Human Germline Genome Editing](#)

<sup>79</sup> The Royal Society, 2020, [Heritable genome editing not yet ready to be tried safely and effectively in humans](#)

<sup>80</sup> Oxford Academic: Journal of Law and the Biosciences, 2020, [Rewriting the human genome. rewriting human rights law? Human rights, human dignity, and human germline modification in the CRISPR era](#)

<sup>81</sup> Oxford Academic: Journal of Law and the Biosciences, 2020, [Rewriting the human genome. rewriting human rights law? Human rights, human dignity, and human germline modification in the CRISPR era](#)

<sup>82</sup> Oxford Academic: Journal of Law and the Biosciences, 2020, [Rewriting the human genome. rewriting human rights law? Human rights, human dignity, and human germline modification in the CRISPR era](#)

Bans and harsh sanctions may have been appropriate before hGGE became a clinical possibility, but with that day ever-nearing we ought to demand more realistic regulations. Scientists, being stakeholders, will push their research to market when it is deemed safe enough, and the government needs to continue to embrace the revolutionary impact it can have on foetal healthcare rather than stifle a potential breakthrough. At the same time, it would not be unreasonable to limit the extent to which hereditary genes can be edited; edits to screen for and eliminate fatal pre-birth diseases are entirely reasonable and beneficial, however as discussed in Insights, edits to other characteristics, unrelated to health, would prove to exacerbate inequality in various forms.

Therefore, continued allowance of research should not be disrupted in the UK, and other countries should seek to follow suit by considering granting research permits to allow for medical advancements while monitoring the ethical outcomes of hGGE practices. Measures such as the Human Fertilisation and Embryology Authority's prohibition of the placement of modified embryos inside a uterus<sup>83</sup> seem sensible to maintain in the near future until regulations specifying safety requirements for clinical uses can be established thoroughly worldwide. Overall, to help reduce social inequalities, policy in this area needs to look realistically to the future; crucially, it should not hinder medical advancements, yet should still ensure no unethical and unnecessary use of hGGE techniques, such as wholly superfluous offerings of Designer Babies.

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<sup>83</sup> BioNews, 2021, [Gender based prohibitions in the Human Fertilisation and Embryology Act](#)

## CONCLUSION

We feel it is inevitable that all of these technologies will be regulated as they become a larger and more important part of daily life across the world. The question is whether governments can legislate intelligently, with enough data and initiative so as to ensure good policy. They must make the first moves or risk legislating against yesterday's problems.