2011 Year 5 General Paper Promotion Examination

essay 6 Discuss the view that science and technology give us hope for the future.

The famously morose philosopher Thomas Hobbes is known for giving the following description of life on earth: "nasty, brutish and short." In that context, this description may actually have an uncomfortable modicum of truth - in that age, without the advances civilisation embraces today, it could be quite valid to sound the death knell for human civilisation. But let us glance into the past, and notice all the inventions and innovations that have heralded a new age - the Gutenberg press, the wheel, modern medicine. I fervently believe that science and technology, and the promise they hold, give us hope for the future.

Science and technology in this essay, will refer to innovations or advances in our knowledge of the human body and life on earth. The ultimate purpose of science has always been human improvements, and coupled with technology, they guarantee the survival and prosperity of the human race. Of course, gazing into the crystal ball is futile and fruitless, so it is best we extrapolate what the future brings by examining the past and the present, and identifying trends.

Some detractors - sceptics, Luddites, 'unenlightened beings' - hold a very pessimistic view of science and technology, believing that it is possible for the hubris of scientists to cause us to cross the boundary. Science and technology, when in the hands of unscrupulous characters, are potent and can be manipulated to cause greater harm to human society, and this makes one apprehensive about their impact. A whole panoply of examples point towards this. Genetically modified food, for instance, brought about the Green Revolution, and many perceived it as a panacea for food shortages and the abject poverty of the Third World. It could have been that, But because the technology developed by multinational giant Monsanto was undertaken with the sole aim to increase its profits and gain, it has only led to ruin. They charged high prices for such high yield varieties, and these seeds were in fact specially engineered to only be planted once (i.e. seeds from the plant produced could not be replanted), sending farmers back to the market place to line the pockets of the MNC. Such exploitation does not bode well for the future of science. Science has also been used as an excuse to lead to inhumane cruelty. The Angel of Death, Nazi scientist Josef Mengele, is notorious for having carried out deviant experiments on twins, such as cutting off their arms and sewing them together. This fear of cruelty resulting from science has touched the hearts of the common man as seen from the spate of dystopian movies, such as The Island, which warns against a technology that harvests organs, that feeds on this fear.

However, to discount the promise of science and technology on that basis is myopic. These are exceptions, and the fact that we feel revulsion and condemn them, demonstrates that it has not been accepted. The scientific community is acutely aware of this fact, which explains its hesitations in carrying out stem cell transplants, or creating designer babies. Our understanding of cloning is already at a very advanced level, yet former President Bush of the United States of America issued a ban on human cloning. Our moral compasses have been trusty in restraining such excesses in the past, and we have no reason to fear a dystopian future created by ourselves. The logical solution, additionally, to such fears, is to tackle them by instituting stringent regulations and guidelines. The enforcement of such guidelines should assuage such fears, and allow us to focus on the positive side of science instead. It would be a pity to relinquish this tool (of science and technology) just to prevent its abuse.

One way in which science and technology grant us hope for the future is that they guarantee us a future in the first place, by ensuring our survival. Ever since the accidental discovery of antibiotics by Alexander Fleming in the 19th century, science has constantly developed to meet our needs. We now not only have access to over-the-counter medicines for the slightest discomfort, but to complex treatments such as chemotherapy and kidney dialysis. Humans today are enjoying longer

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life spans. We are also constantly reacting to new threats. Malana, for instance, is a virus that leads to large numbers of casualties, especially in areas with poor sanitation and room for its vector, the mosquito, to breed. To tackle this, scientists have discovered a technique to silence a gene of the mosquito, such that it does not transmit malaria. Ailments and diseases that cause suffering and devastation will likely be conquered sometime in the future. A real threat to our survival now is global warming, and in rapid response to it, innovations such as solar panels, alternative forms of energy, methods to monitor climate changes, have emerged. In this cruel evolutionary struggle, science and technology have aided us in the past, and continue to help us triumph.

Science and technology also give us hope as they are vehicles for human advancement. Not only do they fulfill our physiological requirements of Maslow's Hierarchy of Needs, they also allow us to achieve self-actualisation, allowing the prosperity of the human race. This has happened in the past with the Neolithic Revolution, which developed tools, freeing up time for the settlers to develop pottery, music and other forms of art, and also with the Industrial Revolution, when the invention of the steam locomotive, division of labour and travel had allowed a greater integration of societies. We can in fact see strains of that now with the increasing ubiquity of social media, a novel form of technology. Humans all over the world are connected to it, and are able to utilise it as a form of expression, and to rally communities together for common causes, such as the Arab Spring. We may never know if such systems and new ways of life benefit us and enrich our lives, or if they will achieve any form of permanence as Zhou Enlai famously commented about the impact of the French Revolution: "It's too early to tell." But the very fact that humans are able to adapt and build on past changes and advance with the aid of technology and science give us tremendous hope and anticipation for the future and what it may bring.

Another role that science and technology increasingly fulfill is that of an equaliser, to develop communities all around the globe. H.G. Wells, in an oft-quoted line, called education "a great equaliser" and the only thing that stands between us and "catastrophe". Science and technology allow us to act on that, Laptops donated by the Bill and Melinda Gates Foundation have been brought to subsistence-level communities in Africa, and have achieved phenomenal success as children there were able to access a dizzying array of information and in a much more interactive manner than with books. Science and technology have also been capitalised upon to develop new forms of nourishment for impoverished communities, including Plumpy'nut, a peanut and milk powder mixture that only requires water to become a nutritious meal for families. The fortunate thing is that these technologies are also brought to them and distributed by aid workers. Finally, it also leads to the fulfillment of rights of disenfranchised communities all over the world. Saudi Arabia, for instance, is often lambasted for its lack of civil liberties and its repression of women, and for hiding behind the veil of "culture" to satisfy their actions. The subjugated women had harboured a docile, compliant attitude in this hostile community. However, the advent of social networking and the Internet led to a growing awareness of their rights, and earlier this year, they organised their first protest by breaking the law and driving without a guardian. The king had recently capitulated to societal pressures and allowed women the right to vote from 2015 onwards as a concession. inequality has long been a problem we have tried to solve, albeit unsuccessfully. But science and technology have shown us that they are in fact viable and we can take advantage of them to aid the disadvantaged.

Science has carved out its place in society, right from the establishment of the scientific method by a group of scientists led by Francis Bacon, and as a tool to advance human society, it has much promise. Of course, it is volatile, and while it explains the invention of household appliances, Twitter, and travel, it is also culpable for the invention of the atomic bomb, and poisons like Agent Orange. We can only trust that fellow humans will have the compunction of conscience to prevent such atrocities, and that a kind of moderated rationality will be our guide. Science and technology distinguish us from primates or creatures of the animal kingdom that make do with what they have and never look beyond that. So, because of the promise of science and technology, they instil in us a profound sense of hope and optimism for the future.



Marker's comments:

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Fluently written – thoughtful, balanced and cogent arguments substantiated by relevant and up-to-date examples. You are also able to strike a balance between personal conviction and evidential substantiation. Just be careful that you do not slip into an informal tone in your use of contradictions.



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Science, defined as the empirical study of Man's environment and technology, is an attempt by Man to understand and control his surroundings. Although it may be argued that the original and main aim of science is to benefit and advance the state of mankind as a whole, the way science and technology are marketed foreshadows a grim future where profitability is likely to be even more highly valued.

A superficial analysis of the impacts of science and technology would most definitely concur that they address the basic needs of humans and is what sets us apart from animals. Man has evolved to be able to use his intelligence to question and investigate his environment (science) and from what he has learnt, apply this knowledge to create tools (technology) that give him an advantage over his environment. This continues today, not in the form of flintstones or medieval knives, but in the area of medicine and healthcare. Medicine is made largely available to all on a global scale, and perhaps the most notable example of how medicine and healthcare have helped to achieve a better standard of living is how mankind has completely eradicated the smallpox disease that claimed so many lives in its heyday. The invention of vaccines for diseases such as smallpox is arguably one of the greatest benefits science and technology have brought about. Further development in the area of medicine and healthcare ensures that such successes are not shortlived, and serves as a reminder of how it has and will progress. Scientists have already found a vaccine for a certain type of cancer, once thought to be uncurable, and billions of dollars worldwide are being pumped to further this endeavour.

What seems like hope for the future, in fact, is a misguided sentiment. To say the motivation of science and technology is to further the standards of living of mankind, is to be almost delusional. Man is hardly altruistic in his endeavours. Through the laws of Darwinism, everything Man does should only be to benefit himself selfishly and exclusively. Sadly, this is true.

Technology requires the establishment of institutions to further the progress of science in order to provide sufficient knowledge to create useful products out of the knowledge gleaned. It also requires companies to market it, for Thomas Edison may have invented the light bulb, but leading lighting manufacturer Osram, has its brand name labeled conspicuously on many light bulbs in the world. In a world where capitalism is the zeitgeist and where money does make the world go round, the profitability of technology is the main motivator for the further focus and development of it. The presence of technology in the lives of everyday people does not depend on the usefulness of the technology, but on one's ability to affect it. The differences in the various types of mobile phones in the market may be due to a variety of consumer preferences, but is also a result of competition between companies to market and profit from the sales of their products over the sales of another. To a large extent, the technology that can best benefit mankind if made freely and widely available is being marketed at a costly price and thus made available only to a select few. Even in Singapore, a First World nation that is at the forefront of healthcare and medicine, there is a segregation between "Private" and "Government" practices, with the former being the more costly and largely regarded as more effective. In essence, the profitability of technology results in a divide between those who can afford it and those who do not have the means to afford it. The latter, being at a disadvantage, will find it harder to progress and thus continue to be at a further disadvantage while those already at an advantage will only continue to progress. While villagers in rural areas of Kenya suffer from severe poverty and face starvation, the technology to produce more nutritious food is being marketed to healthy Americans at exorbitant prices.



To further expand on the fact that profitability is "the name of the game" when it comes to science and technology, even the men and women who are involved in the pursuit of science are marketed as commodities. These people, scientists, are valued for the profit their research reaps, Even the areas of research that these scientists are restricted to are those that are deemed profitable. Uncanny as it seems, it makes perfect sense when one considers that the products of these researchers are marketed to generate profit, and as with the case of demand and supply, the only way profits can be made is if the products are in demand and are profitable. Therefore the research undertaken by most scientists is focused on creating profitable products. The research deemed unprofitable is restricted, or even abandoned. Not only does this devalue the intrinsic value of science as a pursuit of all knowledge, where research could be done to answer more immediate needs such as global warming or global poverty, it is instead directed to less useful adverts. Such an example would be how billions of dollars and many brilliant minds are involved in the Large Hadron Collider experiment that does little to benefit anybody around the world, but exists because of the hype and profit the "pursuit of how the universe was born" provides. The scientists involved here have also been paid large sums of money to contribute. They are being bought and sold from company to company based on how profitable their talent is. This experiment also shows how those advantaged by science and technology have the freedom to further delve into it with little concern for others who do not have the same basic technologies that these people do. The "excess" is used to create more excess, while those who lack, further lack and suffer. These "excesses" will not cease; they will only continue proliferating. Like begets like and profit begets profit, as Man is intrinsically selfish. This can be seen from how little research is done on reducing starvation in the world while expensive health supplements are marketed in First World countries.

The profitability of science also creates an unnatural incentive to those who seek it. There is much at stake as it is profitable and with society becoming more and more concerned with money, there is much hype and attention given to those who push the boundaries of science. Fame and recognition are also dividends from the pursuit of science, if progress is achieved. This sometimes tempts scientists to fake results such as the Korean cloning researcher who falsified findings from a human cloning experiment for fame and recognition. The motivation of science and technology, as can be seen, is often not to benefit others but to benefit self.

Science and technology are means for mankind to extend their selfish ways. The greater the benefits, the more Man will manifest his selfish tendencies. With this increasing trend, science and technology hold little hope for the future.

Marker's comments:

A convincing attempt that employs a wide range of examples across temporal and spatial contexts.



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The Age of Enlightenment is often remembered as the era of rationality. In this post-Renaissance period, science began to develop its systematic and rigorous nature as we know it today, and began to be applied extensively in our daily lives. The steam engine, electricity, the telegraph are just a few examples of the numerous inventions which first made their appearance then. It seemed, with scarcely a doubt, that continued development of science and technology is the way to go in securing a future with high standards of living, which is the "hope for the future". However, in light of more recent developments in the fields of science, it is my view that science and technology at once bring hope and potential disaster to mankind's future.

Proponents of the view that science and technology will bring us hope for the future often point to the immense successes that have been achieved through scientific and technological pursuits. In the last two centuries, much of the world has experienced significant improvements in standards of living, and there is convincing evidence that scientific methods in other fields of study such as economics prompted the Industrial Revolution, which greatly increased the productivity of Western economies and their wealth. Medical advancements in the Western world also greatly improved the lives and extended life expectancies of its inhabitants. These advancements no doubt improved the standards of living in countries where science and technology were pursued and gave the inhabitants hope for the future, in stark contrast with more technologically backward nations of the time such as those in Africa or most of Asia.

Because of these past successes, there is an oft-held belief that science and technology will continue to improve lives by solving problems that the world faces today. Two of the major issues that we face today include climate change and environmental degradation. Many of our industrial activities pollute the Earth's atmosphere, land and seas, creating negative side-effects such as global warming. Many science and technology proponents thus argue that science can be one way to solve this problem. Advancements in technology for alternative energy sources such as solar panels and nuclear power plants, for example, can potentially avert climate change disasters by greatly reducing the pollution that our energy generation activities produce. Yet another impending global crisis science is claimed to be able to be solve is the food crisis. Currently, there are 7 billion people in the world, and this number is projected to increase to about 9 billion by 2040. Already, a large proportion of our world today are living in abject poverty, and are starving. With a further 2.5 billion mouths to feed, most of them in the developing world, there is much doubt about the sustainability of our current food sources. Science, once again, is proposed as the way to avert such a Malthusian catastrophe. Genetically modified (GM) food has revolutionised the harvest of crops, allowing not only higher yields, but also earlier harvests, and is expected to be able to continue to do so. Should worse come to worst and our planet Earth becomes uninhabitable, there even exists the possibility of 'terraforming' other planets and changing our home planet! Thus, prima facie, it seems that science and technology can solve many problems that we face today, and continue to bring us hope for yet higher standards of living.

However, recent developments in science and technology have also proven that the opposite can be true. Instead of improving lives, science and technology can also create its own disasters. Perhaps the most tirelessly clichéd, yet ultimately pertinent, examples would be the two World Wars in the early half of the 20th century. The First World War saw the advent of chemical warfare. Phosgene, chlorine and mustard gas were employed on the battlefields as deadly weapons and so were novel weapons such as the heavy machine gun and trench warfare. The First World War eventually ended with over a million fatalities, an unprecedented number compared to earlier conflicts. The Second World War, of course, notoriously saw the development of the Atomic bomb, which incidentally killed almost a million Japanese civilians alone. The atomic bomb project,



Project Manhattan, was also singlehandedly run and seen through to success by brilliant scientists of the day such as Oppenheimer and Szilard. After the World Wars, the two major emergent superpowers, the Soviet Union and the United States, then stood on opposing ends of the Cold War, with the prospect of a nuclear Armageddon and mutual assured destruction hanging on a balance. How, then, have science and technology given hope for the future in these cases? To those embroiled in never ending wars that employ large-scale killing machines, and for us who come after, we must always remember that technology also has the potential to destroy lives on an unprecedented scale.

Thus, we see that technology has also had a history of destroying hopes of a better future, and it is my view that apprehensions of a repeat of such a history are not unfounded. Though there exist international conventions banning the use of chemical, biological and nuclear weapons, there is a chance that they will be used as long as they exist. For one, rogue nations like North Korea and Iran are notorious examples of states which defy these conventions and conduct unauthonsed nuclear weaponry development programmes. The recent escalations in tensions between North and South Korea last year over the sinking of a South Korean ship in disputed waters ended with North Korea threatening to use its nuclear weapons – a grave reminder to the world that the horrors of nuclear weaponry can potentially resurface in today's world. For sure, terrorist organisations feel no obligation to be bound by such conventions, and the Sarin attacks on the Tokyo subway in 1995 is again a reminder of the horrors of chemical warfare. Thus, I see a definite potential for science and technology to create disasters in the future, instead of creating hope.

It is also my answer to proponents of science and technology that while science and technology have the potential to resolve the world's problems, there are also many costs to such developments. While I agree wholeheartedly that further research should continue to be funded and supported in the hopes of finding the silver bullet to the world's imminent crises, I must also warn against the naïve view that these advances come at no cost, and with no further intentions other than to contribute to the betterment of society. It must be recognised that many scientific and technological pursuits today are driven by impetuses other than innocent goodwill. The Internet, for example, was first developed as a communications network for military use. Even the rocket that, literally, fuels space exploration was developed as a side-product of intercontinental ballistic missiles, hence, of course, its significance in the Cold War. Because of these other intentions, there are many costs involved in scientific and technological research other than monetary ones. For example, the proposed use of nuclear power plants to generate electricity so ardently supported by proponents of science and technology runs the risk of causing nuclear proliferation. In other words, since the technology of nuclear energy is similar to that of developing nuclear weapons, there is a possibility that it will exacerbate the destruction of hope caused by nuclear warfare. Iran, for instance, hid its nuclear weaponry development programme under the claim of developing nuclear energy. Also, there is a chance of accidents at nuclear plants such as the ones in Chernobyl and Fukushima, causing a nuclear fallout that can spread over a large area and affect the health of millions: not just their own health but also that of their unborn children. While I agree that such possibilities are low, the extremely devastating effects that they can bring about should it occur make it a significant risk to be considered. Also, there are also many potential devastating effects concerning Genetically Modified foods. Having ethical grey zones aside and simply considering practical results, we must consider the possibility of an ecological disaster. By creating new species of animals, for example, it is possible that they can overturn the food chain and the delicate ecological balance, creating far-reaching effects that are unable to be predicted even with our best technologies. Furthermore, the proliferation of herbicide-resistant crops, for example, only prompts farmers to spray more herbicide, knowing that their crops are resistant. This will only serve to worsen the land and pollution of underground water, at the same time creating the possibility of super weeds that are resistant to our best herbicides. Not surprisingly, of course, research into GM food is largely funded by agrochemical conglomerates such as Monsanto which also produces and markets herbicides. This similar concept of resistance can be carried over to the field of medicine, where there are signs of emerging strains of viruses and bacteria seemingly resistant to our current antibiotics and antiviral drugs. It is postulated that these "superbugs" developed as a result of the



overuse of such drugs. Thus we can see how there are costs in scientific and technological pursuit that may lead to its own host of problems for the world instead of hope for solving the world's problems.

Ultimately, the effects of science and technology depend on the user. Should a new kind of immense energy be discovered, it is up to the wielder whether he would want to create or destroy with this power. Science and technology can indeed give us hope for a better future and solve our problems, but the opposite is an equally possible prospect that we must also consider. Otherwise, we may end up being destroyed by our misplaced faith and crushed hopes.

Marker's comments:

This is one of the more mature and balanced essays on the topic. Coherent and persuasive arguments supported adequately by apt exemplification. Well done!



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