Science and Technology

“The great growling engine of change - technology.”

~ Alvin Toffler

The Big Scope

1. Private- vs Government-funded research
2. Impacts of Science and Technology
3. Reservations of Science and Technology
4. Future of Science and Technology in Singapore

Key Aims

1. Amass knowledge and improve understanding of the world we live in
2. Solve real-world problems or improve existing solutions to problems
3. Improve the quality of life

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01

Private- vs Government-funded research

Comparisons between private and government fundings (Pros)

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Private-funded research	Government-funded research
• More efficient in R&D as they are profit-incentivised • E.g. IBM is one of the most prominent research institution worldwide and holds the record since 2013 for the most patents generated by a company for 20 consecutive years.. Other inventions include the ATM and the hard disk drive	• Greater emphasis on the value of research since they aren't as profit-driven • Research work strives to increase understanding of fundamental principles, which is not intended to yield immediate commercial gains
• Private corporations may conduct R&D as part of its corporate social responsibility (CSR), leading them to fund basic research and offer sponsorships or internships such as the AXA-research fund and the L'Oreal-UNESCO prize for women scientists.	• Government grants offer stability in an unpredictable free-market conditions. • Government grants allow for safe access to financial assistance to the benefits of individuals, institutions, and corporations.

Comparisons between private and government fundings (Cons)

Private-funded research	Government-funded research
• Profit motive of private corporations may be counterproductive and obstruct the progress of R&D when they believe the financial costs outweigh the increase in revenue • E.g. Royal Dutch Shell intends to freeze its research and investments in wind, solar and hydrogen power, citing the high opportunity cost of not utilizing oil and gas. The company had already sold much of its solar business and pulled out of a project last year to build the largest offshore wind farm, near London	• Some projects can escalate the level of taxation to the immediate harm of the public • As fiscal tools, government grants could potentially increase the state's debt loads in the long term as well • Since they are not profit-incentivised, this also means their research work could be slow and span over a few years

02

Impacts of Science & Tech

1. Acquiring knowledge and improving our understanding of the world

Some renowned theories which changed our perception of the world and the face of human evolution includes:

- Theory of Plate Tectonics - Explains for the large scale motions of the Earth's lithosphere and accounts for the various landforms and physical processes of the earth
- Darwin's Evolution and Natural Selection Theory - Explains that all living things are the product of inherited characteristics of biological populations over successive generations and that some biological traits either become more or less common to ensure the survival of that particular species.
- Law of Gravitation - Explains the nature of gravity and gravitational pull between 2 objects; useful for planning to put a satellite into orbit or charting the course to the moon

2. Providing a spectrum of job prospects

The advancement of science and technology has led to the creation of new jobs in the medical, research, pharmaceutical and biotechnological fields due to demand for highly educated experts and highly-skilled engineers.

Since 2000, Singapore's government pronounced biotechnology as the fourth pillar of its economy. With increasing international competition, Singapore has gradually moved its emphasis from manufacturing technology to the biomedical sciences. With an eye towards becoming an advanced biotechnology hub, Singapore has pumped in $2.3 billion in investments, grants and incentives to grow the sector. As a result, in recent years, demand for jobs in the field has been burgeoning.

2. Providing a spectrum of job prospects

Recognising the advantages of advancing research for science and technology, governments invest heavily in nurturing talents that can contribute back to the growing economy..

E.g. The Agency for Science, Technology and Research (A*STAR) is offering $286 million in scholarships for students to pursue Ph.D.'s in biomedical sciences at home and abroad, in exchange for their commitment to work in Singapore for up to eight years.

However, while there has been the creation of new jobs, it is only limited to the above-mentioned industries. The advancements in science and technology has also led to the decline of other industries such as manufacturing,. In some occasions, even jobs that require training and skill have been displaced. For example, shorthand and typewriting have been replaced by word-processing, voice- recognition and computer-aided design and manufacturing systems.

3. Combating climate change

As climate conditions continue to degrade worldwide, many are turning to S&T to find solutions to reduce mankind's negative impacts on the environment

- China's Tianjin Eco-city project - The rapid and large scale urbanization, as well as the environmental challenges in China, have promoted sustainable urbanization which calls for the 'building a resource-conserving and environmentally friendly society'. One such initiative is the Sino-Singapore Tianjin eco-city, an inter-governmental collaboration between China and Singapore in developing eco-cities.
- Singapore's HDB and its advanced usage of satellite imagery and big data science in Punggol new town - Utilising advanced technology to map the patterns of energy production and consumption so as to use energy in a more sustainable manner (e.g. Identifying the solar strength in a neighbourhood to strategically install solar panels)

3. Combating climate change

- Wind: A total of about 240, 000 wind turbines operate around the world. Although wind power only generated 5.7% of worldwide electricity usage in 2010, several countries have already achieved relatively high levels of efficiency, such as Denmark (28%) and Portugal (19%).
- Solar: BP solar estimates that a 1-kilowatt system eliminates 135kg of carbon dioxide from being released into the atmosphere and saves up to 400 gallons of water consumption monthly. However, few were installed, compared to other forms of power generation due to the high installation costs. The costs have since declined with China's foray into the market, with dozens of suppliers producing panels at a fraction of the current cost.
- With current levels of technology, solar panels can only convert approximately 22% of solar energy into electricity, but the efficiency in conversion has developed dramatically over the last five years, and solar panel efficiency should continue to rise steadily over the next five years.

3. Combating climate change

- Other usage of Green technology: Development of cleaner catalytic converts, proliferation of electric/hybrid cars which have several benefits over conventional internal combustion engine automobiles, including a significant reduction of local air pollution and reduced greenhouse gas emissions. In a bid to promote them, governments have established tax credits, subsidies, etc to alleviate the cost of purchasing one.

- E.g. In Japan, the Green Vehicle Purchasing Promotion Measure was passed to establish tax deductions for tonnage and acquisition of the vehicles for environmentally friendly and fuel efficient vehicles.

4. Improving the quality of life

- Advancements in technology have also extensively benefited the medical field with the groundbreaking development of surgical tools and procedures that can be used to reduce the likelihood of failure and death by many folds..
- E.g. Photodynamic therapy can be used to treat cancer while the keyhole surgery serves to minimize pain and reduce recovery time for patients. Devices such as the artificial pacemaker have been invented to extend the life of patients suffering from health conditions such as Bradycardia (slower heartbeat than normal).


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Reservations of Science & Tech

1. Ethical or Religious concerns

- The tension between science and ethics has existed since long ago. From the very beginning, mankind has been perpetually breaking boundaries and crossing borders to expand our locus of research in a bid to find out more about our world and our very existence.
- Some critics believe that ethics & religion should not be heavy-handed in curtailing the progress of science. After all, the definitions of ethics or religion are fluid and evolves over time. Hence, they should not handicap research as it may impede the acquisition of knowledge.
- E.g. The dissection of human cadavers for medical examinations was prohibited in many European countries until the 14th century due to beliefs that the body was sacred. The field only progressed when Andreas Vesalius popularized dissections to study the human anatomy accurately.

2. Exploitation of technology

- In some war-torn countries rifed with political conflicts, the exploitation of technology to instill fear and command for submission is commonplace. Ironically, these technological equipments such as drones, should greatly reduce the chance of taking casualties as compared to conventional operations due to its accuracy and precision features.
- E.g. At least 470 civilians have been killed by drone strikes in Pakistan since 2004. The victims include American citizens, such as the radical Islamist Anwar al-Awlaki, who was killed in 2011 in an attack in Yemen.
- Furthermore, it is widely recognised that the use of drones removes the human element of compassion and guilt from violence and conflict, making it easier to kill. Peace researcher Niklas Schörnig states that, “If the decision over life and death is handed over to a computer, no one is responsible in the end for the people who are dying". To put it simply, Schörnig believes the officer who launches the drone, but does not fire the weapon, can distance himself from the act as easily as the programmer.

04

Future of Science & Tech in Singapore

Singapore’s Smart Nation Initiative

The Smart Nation Initiative was launched by PM Lee Hsien Loong on 24 November 2014. The aim was to construct “a nation where people live meaningful and fulfilled lives, enabled seamlessly by technology, offering exciting opportunities for all.” Within our communities, technology will enable more people to connect to each other more easily and intensely; and in our future, we can create possibilities for ourselves beyond what we can imagined possible.

One key area under close inspection is the application of technology in security monitoring and defense. Boosting surveillance is a prominent aspect of Singapore’s counter-terrorism strategy, even more now than ever in lieu of the rising threat of transborder terrorism. One example of the application is the centralised monitoring system. Its advantages include 24/7 monitoring, reducing the dependence on manpower and deterring or managing threats with its alert system.

Visions of Smart Nation Initiative

Support for seniors

Help seniors through technology such as integration sensor apps and remote monitoring modes

Mobility via transportation breakthroughs

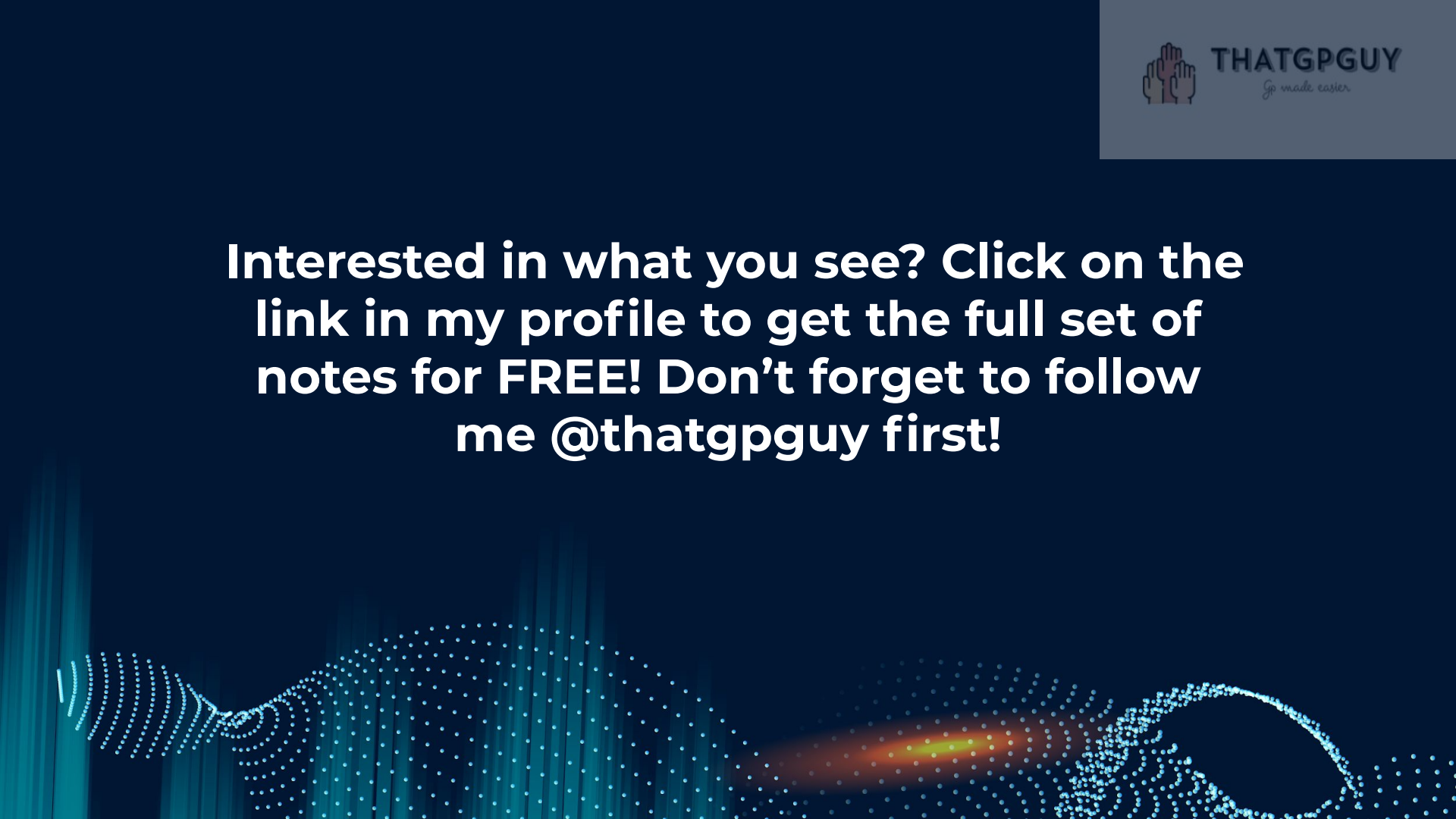
Providing information for commuters through responsive management of public transport systems

Safe and secure data marketplace

To become a safe and secure data marketplace where datasets are shared with the public to build applications and services

Possible Essay Questions

1. “The advancement of technology means the proliferation of crime.” Do you agree?
2. Is the pursuit of nuclear technology still desirable in the modern world?
3. To what extent should technological advancements be regulated?
4. “Scientific progress is more important than ethical considerations.” Do you agree?
5. “The power of green technology in solving environmental crises is overrated.” Discuss.
6. “To pursue progress in science and technology, boundaries must always be pushed.” How far do you agree with this statement?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THANKS!

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