Visual Analytics

Final Project Report

AY2021 Semester 2

BA2101 Ms Joanne Foo

Module Group:	ITBW 21-01
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<u>**Executive Summary**</u>

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- The business objective is to find out how the factors such as housing, salary, crime rate, facilities, retirement, racial harmony, education and jobs affect the lives of 50-60 year old Singapore residents so that users will know what to expect if they live in Singapore at the age of 50-60.
- Hypothesis: Is Singapore a good place to live / work in?

  It is analysed that most of the factors affected Singapore residents' lives positively, hence, the majority of the factors supported the hypothesis that Singapore is a good place to live or work in.
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- User Requirements

1	Salary	As a singapore citizen, i want to earn more than $7000 a month so that i can achieve financial freedom
2	Racial harmony	As a singapore resident, i want to continue being in a racially diverse environment, so that i can be in a workplace without racial discrimination.
3	Facilities	As a Singapore citizen/resident, I want to have adequate public facilities (public parks, public transport) so that I can commute around Singapore easily and have convenient access to facilities and recreational activities
4	Crime Rate	As a Singapore citizen/resident, I want to have a safe living environment (low crime rate, dependable police force) so that I can feel at ease.
5	Retirement	As a Singapore citizen, I want to have financial security so that I can enjoy my retirement.
6	Education	As a Singapore citizen, I want to have a good education system for my family.
7	Jobs	As a Singapore resident, I want to have a good work-life balance so that I can have a happy work life. As a Singapore resident, I want to have opportunities to have career advancements at my job.
8	Housing	As a singapore resident, i want to have access to affordable housing so that i can put aside more funds into my living needs

<u>Business scenario</u>

 Foreigners who wish to consider Singapore as a place to live or work in may have difficulty finding a compiled and detailed analysis of various factors in Singapore which affect the lives of residents. Our analysis provides users with information that will help them gain a better understanding of how factors in Singapore affect each other and how it affects the lives of residents.

<u>Recommendations</u>

- If users are coming to Singapore to look for a job, it is recommended that users secure a place to live in before moving to Singapore as it would take a lot of time to search for an affordable place if they do not have a stable source of income.
- It is recommended that users should expect racial discrimination at workplaces as there is no guarantee that such event may never occur and should save as much as possible for retirement and especially for 'rainy days' (a pandemic that affected livelihoods).
- It is recommended that users should be vigilant on scams and be aware of their surroundings to avoid falling for commercial crimes and avoid outrage of modesty cases.

<u>Insights</u>

- Singaporeans generally are leading a happy life as many have sufficient amounts for monthly retirement spending.
- Low racial discrimination at workplaces. However, many must note that racial discrimination cannot be completely eliminated. As long as we play our part to help significantly reduce the racial discrimination to an almost negligible amount, it will have an endless ripple to the future generations to come.
- Housing in Singapore is affordable for people who have a stable income, otherwise housing may be expensive for people who have an unstable or lower than average income.

Project plan

Project team organisation

Rawtbhik - leader

Zowie

Parik

Jialeng

Project schedule and task allocation (Gantt chart)
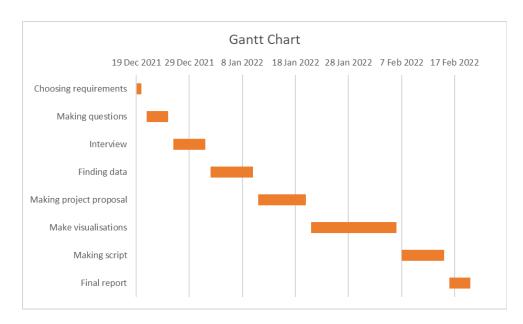
Zowie - housing and salary

Jialeng - crime rate and facilities

Rawtbhik -retirement & racial harmony

Parik - education & jobs

https://docs.google.com/spreadsheets/d/1ozPDtlkldWDcw5OIqvnlymCT4jvNqit6QOheoEGUdJg/edit?usp=sharing

Gantt Chart

	19 Dec 2021	29 Dec 2021	8 Jan 2022	18 Jan 2022	28 Jan 2022	7 Feb 2022	17 Feb 2022
Choosing requirements	▮						
Making questions		▬					
Interview			▬				
Finding data				▬			
Making project proposal					▬		
Make visualisations						▬	
Making script							▬
Final report							▬

Software tools used for development

Power BI

Microsoft words

Google Docs

Retirement
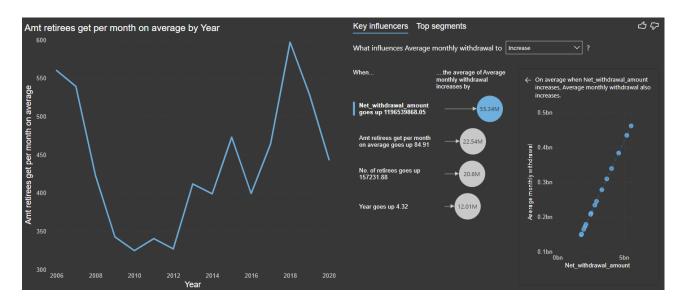
Retirement Sum Scheme

[Explanation from left to right]

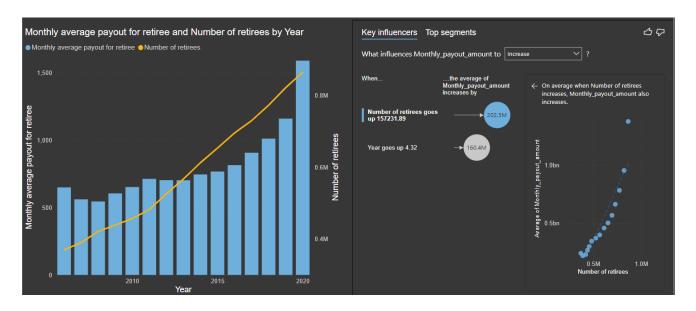- Monthly payout via the retirement sum scheme shows that the **average monthly payout increases** as Singapore **fights against the 'Silver Tsunami'.**
- In 2020, the average payout each retiree managed to collect is $1500 per month with the total number of retirees being 864,241.
- Key influencer to help describe the fluctuations happening to the monthly payouts with the help of several factors.
- This would help businesses or employers to help pay their employees via CPF to help with their retirements.

Other Retirement Withdrawal

[Explanation from left to right]
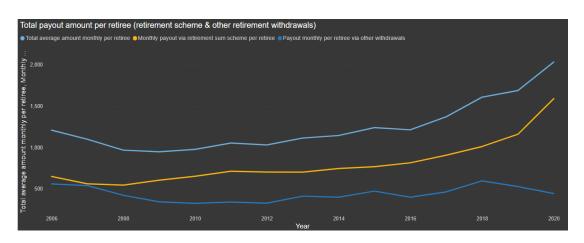
The visual shows the trend of the possible average monthly payout retirees are getting according to different years. As the number of retirees increase, the amount of **monthly average payout also increases**

- In 2010, retirees only received an average of 324.81 per month during that year under other retirement withdrawals.

- Additional column was added with a simple Mathematical division concept used, whereby dividing the total monthly payout by the number of retirees present in Singapore (assuming that 65 & above are all retirees).

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1  Monthly average payout for retiree = 'retirement sum scheme'[Monthly_payout_amount] / 'retirement sum scheme'[Number of retirees]
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- Similarly the Key influencer is used to find what affects the monthly withdrawals that

is under the other retirement withdrawals and it shows that factors such as total withdrawal that is withdrawn every year and number of retirees has an impact on the monthly withdrawals.

Total Payout amount (including retirement sum scheme & retirement withdrawals)
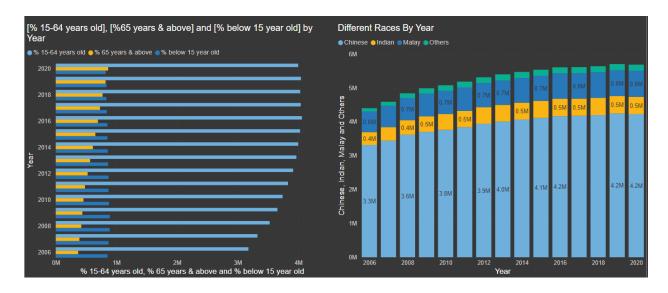

This visuals shows the average total amount of retirement payout that retirees receive for every month for the year. In 2008, 2009 and 2010 retirees received less than $1000 per month to spend. Overall, this shows that recent years retirees are **getting more than the sufficient amount** for spending as mentioned by

- The latest Household Expenditure Survey (HES) 2017/18 that included information on how much retiree households in Singapore spend. Spending is about $600-$1300 per month today (varies depending on the income)

- This dataset would provide insights to businesses to help increase the employer's contribution via CPF to help with retirement.

For those who are worried about financial security, they should not be afraid as the government for many decades has helped Singaporeans to segregate their savings with the help of CPF to cater for

retirement, medical health screening fees and housing fees/ mortgage etc. Moreover, these visuals that are being shared would also help businesses or employers to consider helping employees by increasing the company's employer's CPF contribution on every employee's payslip in order to help with retirement.

Racial Harmony/Diverse Society

[Explanation from left to right]

Left:

This dataset is helpful in providing the trends of the different age groups. Working adults have increased within a decade and this would help businesses or the government to provide more jobs to the people to increase the country's productivity.

More importantly, these datasets would be helpful for businesses/governments who are **willing to do campaigns** to **reduce racial discriminations** at workplaces with the help of visual statistics.
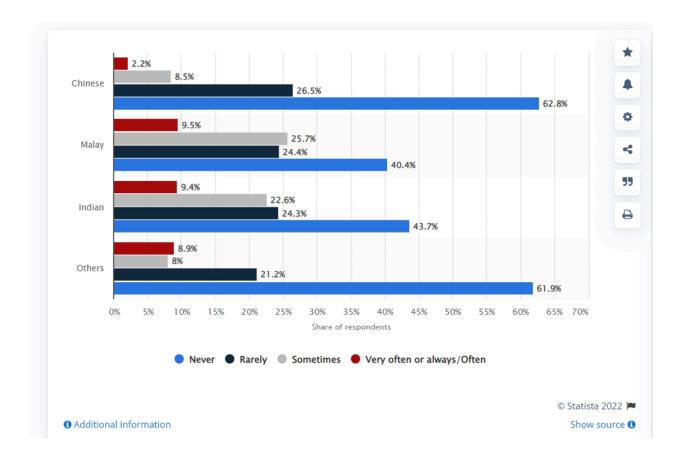
Right:

This dataset shows the stability in the ratio of ethnic groups in Singapore. Since the trend of the different ethnic group's population is consistent, shows that there is not much

discrimination in Singapore. And If there's so, this could result in fluctuating population numbers among the different ethnic groups which is possibly due to people fleeing the country as there is social unrest happening in Singapore.

• Singapore: discrimination when at work by ethnicity 2019 | Statista

(not in included as I would need to pay a sum of money to get the data which is $52.48 SGD)

Share of respondents who felt racially discriminated against when at work in Singapore as of January 2019, by ethnicity

This helps support the user story which claims that there is not much discrimination at workplaces. Therefore Singapore is a very safe place. According to a survey on racial and religious harmony in Singapore, 62.8 percent of Chinese respondents stated that they had never felt discriminated against in the workplace or at work. By comparison, 40.4 percent of Malay respondents stated that they never felt discriminated against at work.

Singapore is a multi-ethnic and multi-religious society, with citizens categorised into four main ethnic groups, known as CMIO: Chinese, Malay, Indian, and Others. Those categorised under the "Others"

include Eurasians, Caucasians, Arabs, and Filipinos, among others. Those from an ethnic Chinese background make up the majority of the population in Singapore.

Therefore, discrimination at workplace is not severe and is not life threatening that would make people think twice before settling in or working in Singapore.
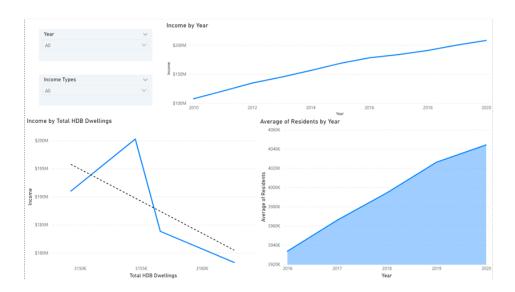

Salary

https://data.gov.sg/dataset/income-of-individuals-by-income-type-annual

(2016) Income of individuals in Singapore

https://www.singstat.gov.sg/find-data/search-by-theme/population/population-and-population-structure/latest-data

(2019) number of residents living in different housing types
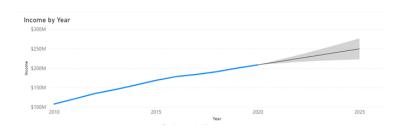

These visuals were used as it is most helpful in visualising the change in income over the years, as well as how housing is affected by income.

An interviewee mentioned that even though her income increases over the years, she would not live a
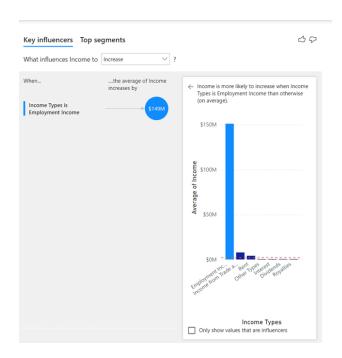
more expensive life. For example, starting to indulge in Michelin rated food everyday would not be sensible in the long run. She also mentioned that if she spends most of her income on her wants, then she would not be able to save a large amount by the time she retires.

Hence, the visuals are effective in showing that the majority of Singaporeans are able to have a growing income while living a minimal lifestyle.

The visuals allow users to know if Singaporean's income has increased over the years, where more Singaporeans can afford to live in more pricier housing options. This will allow for a deeper analysis of the relationship between income and housing, for example, if an increase in income will indicate an increase of more expensive housing, and a decrease of government housing units.

Forecasting is done on "Income by Year" to accurately visualise the expected total income in Singapore in the near future. Some interviewees mentioned that they are looking for a stable income, especially in cities like Singapore where it is an expensive place to live. This proves that Singapore's overall income will continue to rise, hence users will be reassured that they can attain a growing income if they choose to work in Singapore.

A key influencer visual is used on the dataset "Income of individuals in Singapore", to find out what influences income to increase by analysing "Income" and explaining by "Income type". The AI generated results will then give us a reliable analysis of the relationship between variables in the analysis.

The model will help users weigh their options when deciding on their main source of income in Singapore. it also allows for a wider perspective on how income is generated in Singapore. As Employment income takes up a majority of income generated, we can say that working in Singapore equates to being able to find a job that gives you financial stability. Hence, financial stability would allow for financial freedom by the time you retire.

Salary may differ if a company discriminates against employees (gender, race, nationality). A solution to discrimination in workplace is to encourage workers to discuss about their salary with people in a similar rank as them (e.g. intern with intern).

This allows people to find out if their salary is lower than someone in a similar work position, so they can bring it up to their superiors/Ministry of Manpower and receive a fair salary.

This also shows job hunters which companies are more inclusive and would give minorities a fair salary.

In conclusion, Singapore is a good place to live and work in as it is evident that there is a steady growth in income, which leads to financial stability and financial freedom. With this, users can be reassured that

working in Singapore means that they would be able to have enough disposable income to rent or buy a comfortable living space, even with inflation in Singapore's economy.

Housing

https://data.gov.sg/dataset/residential-dwellings-annual
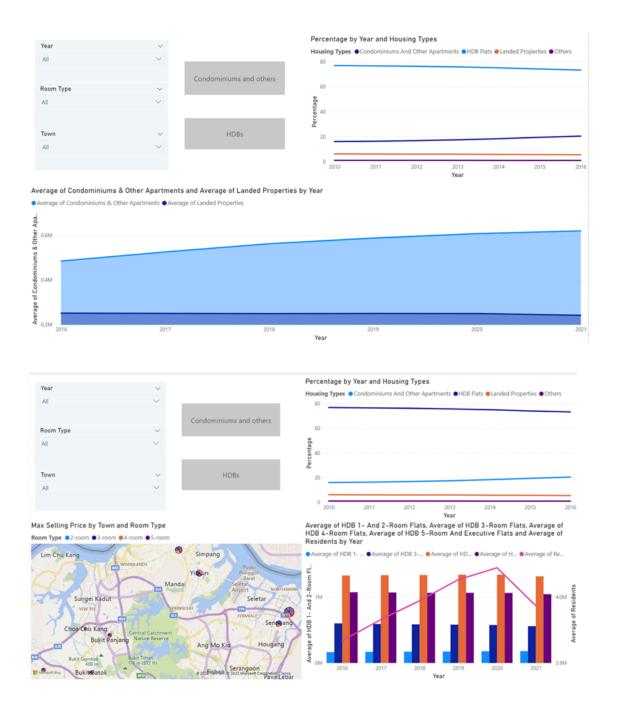
(2016) Number of residential dwellings

https://data.gov.sg/dataset/price-range-of-hdb-flats-offered

(2016) price range of HDBs.

From the dataset "Price range of HDBs", there was an average of $30,000 increase in price of HDB flats in Singapore from 2016 to 2019. A price increase could be due to inflation, or a change to higher quality materials to build HDBs.

The dataset "Number of Residential Dwellings" shows that from 2014 to 2016, there was a steady decrease of about 1.0 and 0.1 in the number of HDBs and landed properties respectively, while there was a steady increase of 1.0 in the number of condominiums and other apartments.
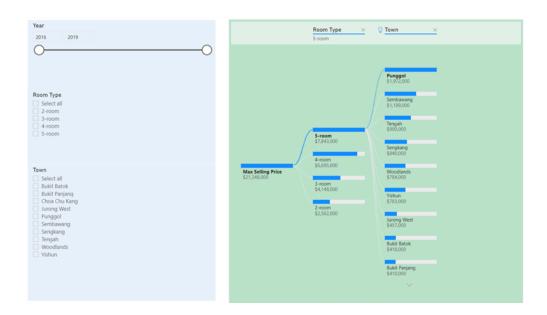
This could be due to the removal of older HDBs and landed properties because of the old materials used, or to clear land to build condominiums.

These visuals were used as it is useful in showing Singapore resident's choice of housing type over the years. From the visuals, we can tell how the preference in housing type changes as more people lean towards more modern looking buildings like condominiums.

It is also useful to compare the prices of housing. Interviewees mentioned that affordable housing is important to people living in Singapore as it allows families to afford better healthcare, more financial freedom, independence, stability and security.

Hence, the visuals allow for a greater insight of the relationship between income and housing, for example, if an increase in income will indicate an increase of more expensive housing.

A decomposition tree is used on both datasets by analysing "Maximum Selling Price" and explaining by "Room Type" and "Town". It is a great way of summarising the data such that users will be able to see the max prices of a certain flat type in different areas of Singapore at a glance. Hence, users can compare prices easily, as well as have a good gauge about housing prices in Singapore.

From the model, it shows that the max selling price of a 2-room HDB flat is $116,000. Hence, it is evident that even smaller public housing in Singapore is very expensive, which is why some people would rather continue staying with their parents than buying their own flats.

A solution to this is to give more subsidies to Singapore residents according to their average family income and household size. This is to ensure that they can get a HDB unit that is suitable for their household size, and they can afford to pay their utility bills with their income.

Another solution would be to give greater career support to low-income families so that they can get a more progressive career to support their family needs.

 Housing is affected by changes in income as there are more jobs emerging with time.

It is also affected by a change in Singaporean's mindset. As there are more available resources to construct more condominiums, Singaporeans start to prefer living in condominiums to have a more

modern living space. Many Singaporeans still stay in HDBs due to tradition or they would rather use the extra money to upgrade their current homes than buy a condo unit.
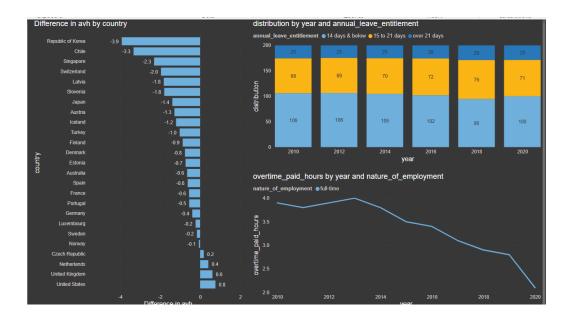
Hence Singapore citizens are not concerned about getting a big extravagant house, just affordable and meets their lifestyle needs (enough parking lots/ public transport nearby)

In conclusion, Singapore is a good place to live or work in as it is evident that housing in Singapore can be affordable with a growth in income as well as government financial support.

Work-Life Balance

Links:

1) https://www.rug.nl/ggdc/productivity/pwt/?lang=en**(difference in avh)**
2) https://data.gov.sg/dataset/average-weekly-paid-hours-worked-per-employee-by-industry-and-type-of-employment-annual?view_id=febb518b-53d3-49dc-8aaa-8007aad140a2&resource_id=ecc88c54-6d33-4d1c-9af5-896825386d56 **(annual paid leave)**
3) https://data.gov.sg/dataset/distribution-of-full-time-employees-by-annual-leave-entitlement?resource_id=c8222b98-2309-4037-9587-32e143f57fb0 **(Overtime hours by years)**
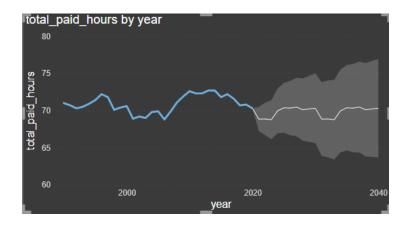

With decreasing hours of usual work, this shows that Singapore is trying to not overwork the employees in Singapore. This means that the employees are less stressed from work and get more time to spend with their families. Singapore is 3rd in the most decreased hours of work compared to OECD countries. This shows that Singapore is trying to strive for work-life balance.

To reduce the stress of the workforce, companies are also giving more days of vacation for the employees annually to give them a break or a time to rewind and spend some time off with their families. The number of annual leave from above 21 has increased by 4% in a decade and the number of annual leave from 15 to 21 has increased by 2%. This shows that the companies are valuing the time of the employee by giving them breaks in between so that they will be mentally ready and prepared for

work.

The number of overtime hours have also **decreased** throughout the years from **3.9 to 2.1 hours**. By doing this, employees are not burnt out and tired to go to work the next day. It gives them **sufficient rest to be productive** tomorrow.

A solution for work-life balance is to **stagger the work rate**. There can be a 3:2 ratio work day where 3 days employees come to the office and work and the 2 days are work from home. By doing this, people can save time as they do not need to commute to the office everyday.
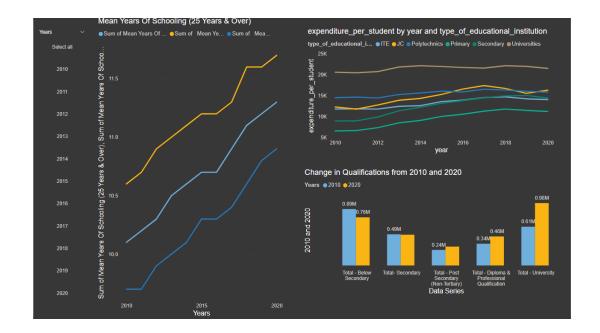

Forecasting is done on the number of paid hours worked in the next 20 years. The number of paid hours will **decrease by 7 hours** in the next 20 years. This shows that Singapore will try to reduce the working hours to **strive for work-life balance**. It will try to make Singapore a good environment to work in. This is a good indicator for our audience as they are closing to retirement and would like to have less stress, thus with a reduced number of working hours there will be **less stress** and will be able to **spend more time with their families.**

Education

Links:

1) https://tablebuilder.singstat.gov.sg/table/TS/M850591(mean years of schooling)
2) https://tablebuilder.singstat.gov.sg/table/TS/M850581(educational attainment)
3) https://tablebuilder.singstat.gov.sg/table/TS/M850011(educational recurrent expenditure on student)

Mean Years Of Schooling (25 Years & Over)

expenditure_per_student by year and type_of_educational_institution

Change in Qualifications from 2010 and 2020

The government has been increasingly spending its money on education a lot. There is an increase in expenditure for all institutions. With more investment in education, it leads to the better facilities and experience of the school which makes the students highly educated and skilled.

The **mean years of schooling** has also **increased from 10.1 to 11.3 years** which means that there is a **good education system** in place for the students to excel which will help them in the future for getting **good jobs** and a **better quality of life**.

A solution for mean years of schooling to continue increasing is for the government to either give subsidies or bursaries to entice the students to continue studying so that they can get benefited by these types of incentives which will motivate them to continue their schooling years for a longer period of time.
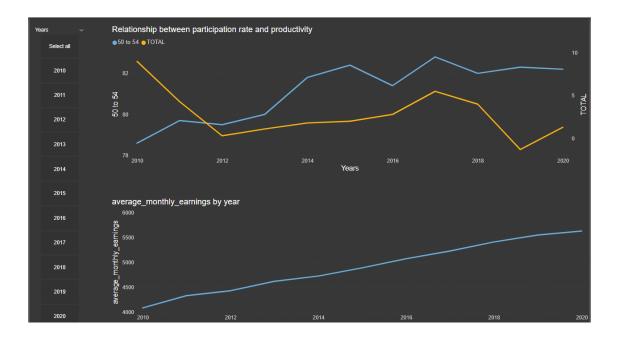
The percentage of citizens that have completed their education very early have **decreased by 0.23 million**. This means more and more people are **continuing their education**. The percentage of citizens that have increased their education in university is from **0.61 to 0.98 percent** which is a big increase. This means that more and more students are gradually completing their studies at university.

An interviewee mentioned that education is a very important factor to staying in Singapore. With increasing investment and mean years, more and more students graduating with degrees from universities, it shows that Singapore has been focused on improving the education in Singapore despite
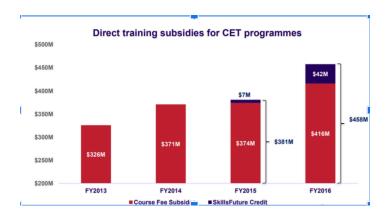
being at the top consistently in rankings of the PISA.

Career Advancement

1) https://stats.mom.gov.sg/Pages/LabourForceTimeSeries.aspx(training participation rate)
2) https://data.gov.sg/dataset/average-mean-monthly-nominal-earnings-per-employee-by-sex-annual(average mean earnings)
3) https://tablebuilder.singstat.gov.sg/table/TS/M015211#(value added per worker)

The training participation rate has increased gradually. This shows that Singapore is trying to upskill the employees in Singapore by giving them a better chance to have career advancements.

Link:https://www.ssg-wsg.gov.sg/content/dam/ssg-wsg/ssgwsg/news/pdfs/14_sep_2017/annex-b---state-of-the-training-industry-report-2016_final.pdf

This data shows the **subsidies** placed by the government for the programmes. The government has been **making the courses cheaper** so that more residents sign up for the courses and improve their skills. The government has been supporting the residents financially and **finding ways to motivate more people to enhance their skills** by making courses cheaper.

To increase participation rate, the government can give subsidies to courses and for citizens above a certain age such as 50 which are closing in on retirement, they are given higher subsidies. This makes the courses really cheap, and more citizens are inclined to go for the skills training.

The training participation rate and the productivity rate graph is related to each other as with more training participation, more employees are more skilled. **Increased employee productivity** is driven by the **skills advancements** made possible through employee training. From 2012 to 2018, as the **participation rate increased**, there was an **increase in the productivity** of the employee. Thus, if higher participation rate, there is a higher change in the productivity of the worker.
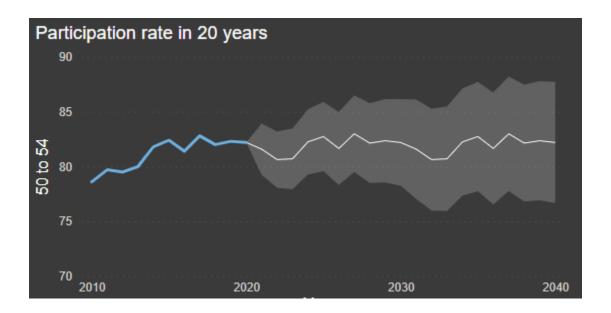

Exhibit 1: Number of Employer-Sponsored Training Places (Thousands), 2010-2017*

Dataset: Economic Survey of Singapore Second Quarter 2021 Feature Article

This graph shows that the number of employers that sponsor for the training places have improved from **117 to 282** which means that the employers are **investing in the development of the employees** by increasing the number of training places being added. This means that the companies in Singapore have been **increasingly sending their employees for lifelong learning** to improve their skill sets so that they will have relevant skill sets in the

industry.

The **average monthly earning** has increased gradually from **4000 to 5629** in the last decade. The salary is always improving year by year because of the **employee skills advancements** every year. Singapore is putting the employees in the right position to have a better pay and position at work.
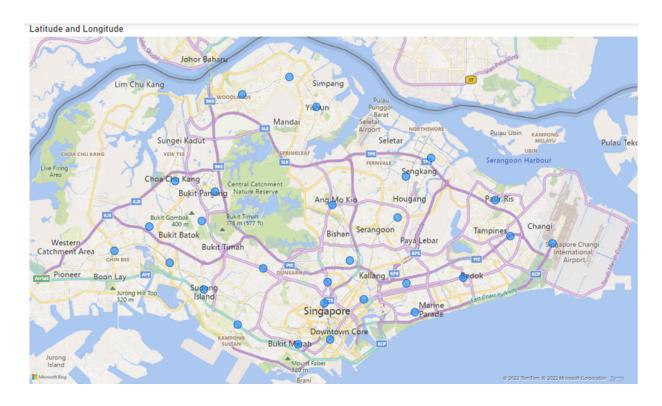
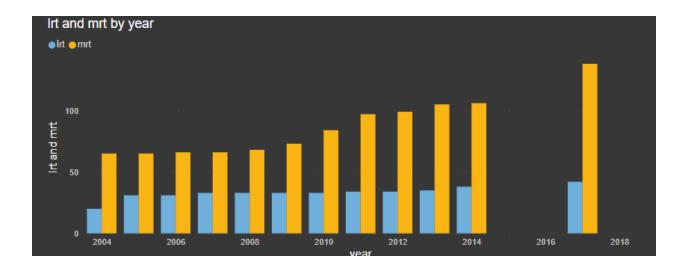With better participation rate and better salary, Singapore is a good place to work or live in.

The participation rate will **increase** from **82 to 87 percent**. This shows that Singapore is constantly trying to **upskill and also aim for lifelong learning** for their manpower. This will be a good indicator for our audience as they are very close to retirement and need opportunities for lifelong learning.
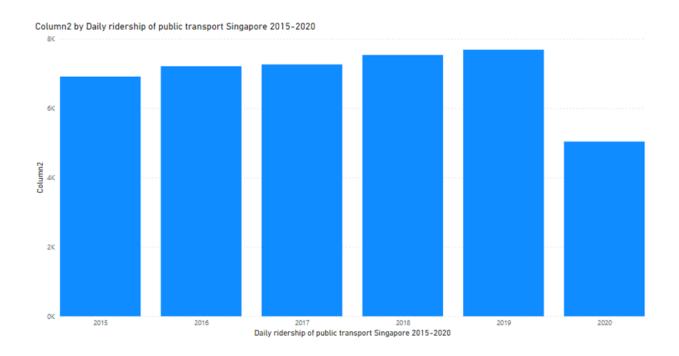
Facilities

Facilities is a segment where the government has been investing its money in. From community clubs to public transport, these facilities are frequented and used by the people living in Singapore.

In this map visual it shows that there are community clubs in every neighbourhood in Singapore, showing that Singapore is a good place for people to live in as there are facilities provided by the government in each area and neighbourhood and they are **strategically placed**, making them easily accessible by the residents in Singapore, **providing convenience** to them. This makes Singapore a good place to live in as facilities are provided and convenient to access. Citizens can just go to their nearby community club for recreational activities which are provided by the government organisations. People of all ages frequent community centres where they are able to engage in activities they enjoy as community centres provide subsidised classes or facilities.

The number of mrt and lrt stations increasing shows that the government has built more stations for the people, making its public transport even more accessible by connecting the whole country together. With more mrt and lrt stations, this improves the public transport infrastructure and improves the lives of the people living in Singapore as owning a car is expensive in Singapore. By taking public transport which is subsidised by the government, the people can save money on private hire cars for their commute which are costly.
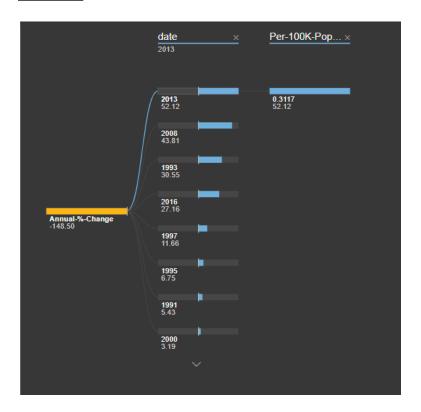

This dataset shows that the daily ridership of public transport has been increasing from 2015-2019
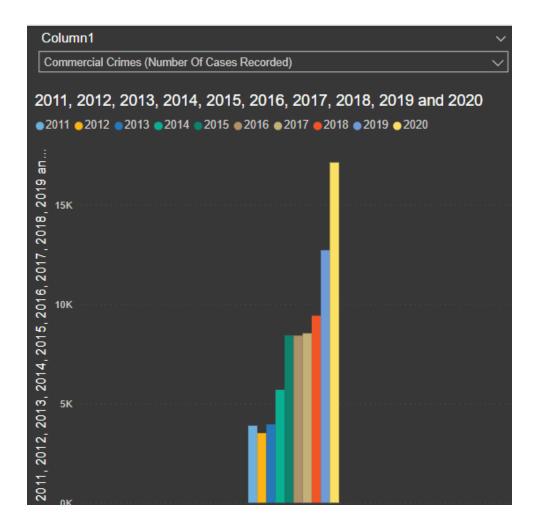
steadily. The ridership on public transport has been increasing steadily, from 6914 average passengers a day in 2015 to 7691 passengers in 2019. There is a decrease from 2019 to 2020 due to the covid-19 pandemic. However the data from 2015-2019 show that more people in Singapore have been making use of the public transport services provided by the government.

This shows that the public transport infrastructure is growing stronger in Singapore as more people are making use of it to commute to and fro from places such as work and school.

Crime Rate

For crime rate, The stems of the decomposition tree shows the average % change in the number of crime rates per year in Singapore as well as the number of crimes occurring per 100k population. By studying the numbers shown in the decomposition tree, the crime rate has decreased per year in Singapore, showing that Singapore is a good place to live in as it has a safe infrastructure. This changes citizens' mindsets as they do not have to worry as much as others in other countries as Singapore is a safe country with a low crime rate to prove it.

A slicer is used to show the crime rate of the various types of crimes in Singapore. This shows the number of crimes per segment and its trends. In general, each of the categories have a downward trend in its numbers, supporting the decomposition tree visual where the crime rate is decreasing. Most of the crimes in Singapore mainly consist of scams, outrage of modesty and cyber extortion cases. Commercial crimes have been on a rise, with a huge jump of 12,710 cases in 2019 to 17,123 cases in 2020. Action can be taken to combat these. For example, scam cases can be tackled by conducting public education on scams online where most of it happens and through advertisements.

- Outrage of modesty cases can be combated by advising members of the public to stay vigilant by being aware of their surroundings. Public education videos can be screened at MRT stations to educate the public on what they should do if they ever encounter such a situation as most cases occur on public transport.

- The number of violent crimes in Singapore reached a peak in violent crimes in 2014, but has been decreasing steadily since. The murder/homicide rate in 2018 was **0.16,**

a **18.89% decline** from 2017. while countries like the United States have a rate of 4.96, showing that Singapore is a lot safer compared to other countries.

In conclusion, Singapore is a good place to live in as there are many facilities that are easily accessible and provided by the government and is also a very safe country to live in with low crime rates.

Problems encountered

In the process of the project, we encountered a few problems individually and as a group.

Individually:

- Finding raw and suitable datasets to support our hypothesis
- Deciding on suitable visuals that will be able to accurately describe the several factors.
- Inconsistent data in certain datasets
- Insufficient data to support certain arguments

Group:

- Deciding which factors to take into consideration

Future Enhancements

Some future enhancements we can consider when doing a data-based project are:
- Seek for available datasets before deciding on the factors to expand on.
- Form our arguments based on the data, rather than finding data based on our arguments.
- The survey method should not be an interview as there is a high chance of diverting from the topic, whereas using a form allows to have more direct responses.

Conclusion

- As a group, most of the factors have supported the hypothesis that Singapore is a good place to live or work in.
- Singaporeans feel that Singapore is a good place to live or work in as there is a growth in income, which can lead to more disposable income. With that, the disposable income can be spent on or used for better recreation and housing.
- Good education and work-life balance, career advancements, stable salary, affordable housing, and low racial discrimination, increase in the number of facilities and decrease of the crime rate in Singapore are factors **encouraging** for our target audience to stay or work in singapore. However, Inflation for example, may deter users from living or working in Singapore.
- Overall, as a group, we **strongly believe** that Singapore is a **great place** to live or work in.g