

A Happier Singapore

TEAM: FAMOUS FIVE (Black 8)

SIDDHARTH PANDEY
PRANSHU RANJAN SINGH
EDUARD ANTHONY CHAI
NYON YAN ZHENG
TAN KOK KENG

Business Problem Statement

In the year 2013, the United Nations recognized that "the pursuit of happiness is a fundamental human goal". In 2017, Singapore was **ranked 26th, falling 4 spots** from its ranking in 2016.

Singapore has been perceived to be a stressful place to live in. **Currently, we ranked 34th** (out of 156 countries) in the World Happiness Report in the year 2018. There appear to be signs of a decreasing trend.

Business Goal

To make Singapore a happier place to live in.

Being branded as a happy place to live in, Singapore can attract fellow Singaporeans who have emigrated to return and to further attract foreign talents and investors to come to Singapore.

Our target audience is the policymakers of Singapore.

Questions

The questions we would like to answer from this study are:

1. How does Singapore rank in the World Happiness Report over the past few years?
2. How is the Happiness Score computed?
3. What is the unemployment and income level trend in Singapore?
4. What is the population trend in Singapore?
5. What is the life expectancy trend in Singapore?

Metrics

The key metrics used in this study are:

1. Happiness score and its component factors
2. Unemployment rates and number of foreign workers
3. Residents income level
4. Gross Domestic Product (GDP)

5. Consumer Price Index (CPI)
6. Population
7. Life expectancy

Data Collection

The data that were collected for this project and the sources are given in the table below.

Data	Source
World Happiness Score for year 2018	World Happiness Report
World Happiness Score for year 2015, 2016 and 2017	Kaggle
Foreign workforce numbers	Ministry of Manpower
Unemployment	Ministry of Trade and Industry Singapore
Taxable Individuals by Chargeable Income Group	Inland Revenue Authority Singapore
Consumer Price Index	Singapore Statistics
Population in Singapore	Singapore Statistics
Marital Status, Marriages and Divorces *	Singapore Statistics
Cause of deaths *	World Health Organization

** Data was not used in the final dashboard

The links to the data are listed in

Appendix I.

Data Modelling

From the data that we have collected in the Data Collection phase, we come up with Relational Model that shows the relationship between different tables in the Relational Database. Please refer to Appendix III for the Relational Model.

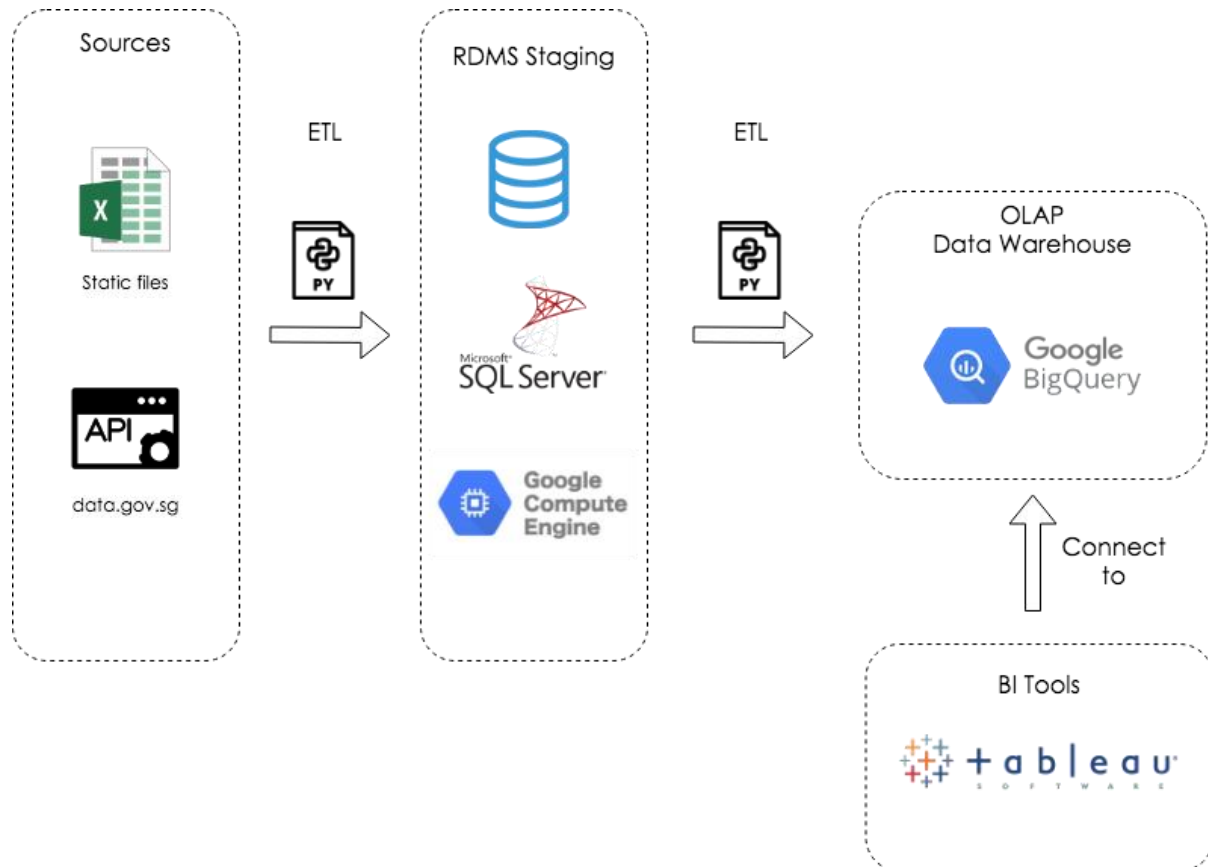
Next, we denormalize the Relational Model to come up with three fact tables. Each fact table expresses the denormalized relationship between relational tables under some context. The fact tables are:

1. Happiness: It is derived from Happiness Index relational table and adds additional Region attribute.
2. Employment: It combines Unemployment Rate, Unemployed Citizen, Population and Foreign Workforce relational tables data.
3. Living Cost: It combines Consumer Price Index, Population and Taxable Individuals relational tables data and also contains some derivable attributes such as tax payers rate.

Refer to

Appendix II for the Entity-Relationship Diagrams for each of the fact table.

Technical Approach



We design our architecture with scalability, stability, performance, and cost in mind. Scalability is necessary when we are dealing with big data. We need the capability to scale from single machine to hundreds of machines at ease. And when we scale up, we need to make sure the services are stable. We also need to make sure that the performance is good, if not high, all the time. Cost is definitely one of the thing that we need to consider when building a system. Cloud is the best solution we have right now to scale easily, stable environment, high-performance, and cost-friendly. For this project, we choose Google Cloud Platform (GCP) as our cloud provider.

Sources

The data is collected in the form of Comma delimited and Excel files from different sources. Many of these file have visual elements like titles, sub-heading, description embedded in them. For initial ETL process to run, such additional elements are needed to be removed first, and then each of the

excel file is converted to plain comma delimited files. In addition to some name standardizations across different files some manual cleaning is done to bring each file to a standard format.

Extract, Transform, and Load (ETL)

Python scripts is used to do ETL from raw data to staging database and from staging to data warehouse.

Relational Database Management System (RDMS) Staging

Microsoft SQL Server is used as our staging. SQL Server is setup and hosted in the cloud using Google Cloud Platform Compute Engine. Google Compute Engine offers high performance virtual machines that gives customer capability to scale with ease and friendly pricing.

Data Warehouse

Google BigQuery is our data warehouse solution of choice. The serverless nature of BigQuery helps customer to focus more on data management instead of the warehouse infrastructure. The infrastructure will auto-scale according to customer needs, ensuring high-performance when doing analytics. On pricing point-of-view, customer is only billed based on the query made which makes it cost-efficient.

Business Intelligence Tool

We use Tableau to do our data analysis. Tableau also provides Google BigQuery connector that allow us to connect to our data warehouse easily.

Data Pipeline Flow Overview

1. Data is downloaded from various sources and initial data cleaning is done.
2. Python scripts are run to do initial data ETL from cleaned data to SQL server. Data transformation to its normalised form is done here. These scripts then can be automated using scheduler to keep the data updated.
3. Next, another set of python scripts are run to load data from staging to BigQuery. In this stage, tables from SQL Server are joined to create multiple fact tables which will be stored in BiqQuery. These scripts can also be automated through scheduler.
4. From here, we can use tableau to connect to BigQuery and start doing analysis.

Dashboard

The dashboard could be assessed at: [link](#)

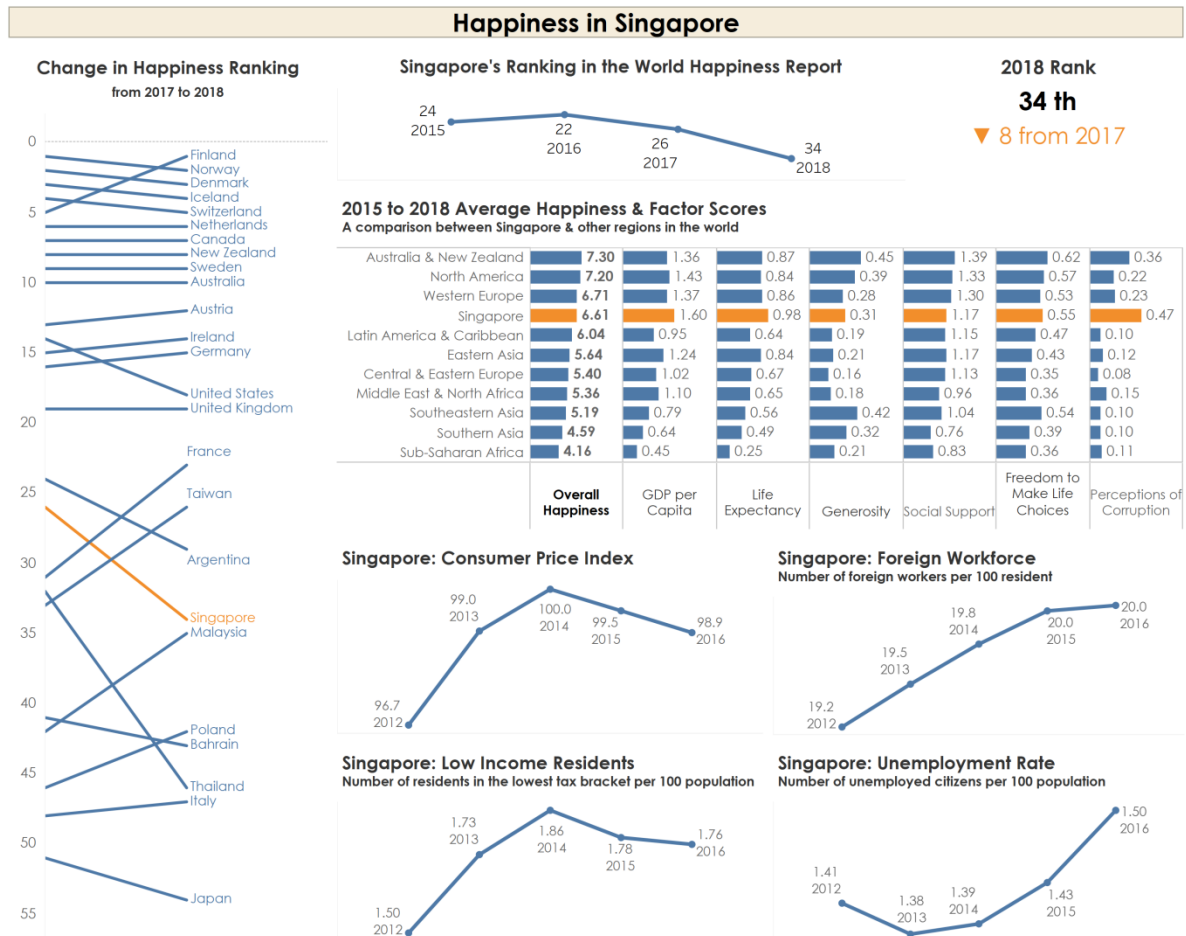


Figure 1 Dashboard

Analysis and Insights



Figure 2 Happiness ranking from the year 2015 to 2018

According to the World Happiness Report for the year 2018, Singapore currently ranked 34th in the world in terms of happiness and our ranking has been declining in the past 2 consecutive years. From the year 2015 when we

were ranked 24th, we are now 10 places lower in the year 2018. Interestingly, our nearest neighbouring country, Malaysia, climbed 7 places from 42nd in year

2017 to 35th in the year 2018.

Average Happiness Score (2015 to 2018)

A comparison between Singapore & other regions in the world

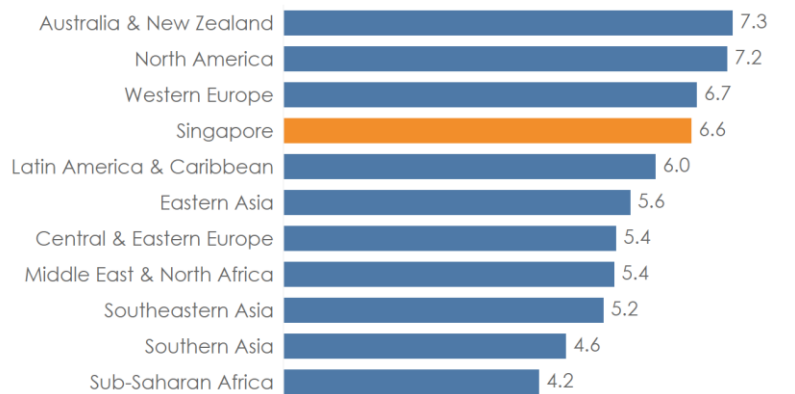


Figure 3 Comparison of average happiness score between Singapore and other regions in the world

The average happiness score from the year 2015 to the year 2018 is 6.61 points. Figure 3 shows that the average happiness in Singapore is just slightly below those in the developed country regions of Australia and New Zealand, North America and Western Europe. We can also see that Singapore happiness is generally higher than all the regions in Asia.

We further analysed the 6 factors explaining the happiness score. The 6 factors are levels of GDP per capita, life expectancy, generosity, social support, freedom to make life choices and perceptions of corruption. According to the World Happiness Report, these factors were selected to compute the happiness score as they were broadly found in the research literature to be important in explaining national-level differences in life evaluations.

2015 to 2018 Average Happiness & Factor Scores
A comparison between Singapore & other regions in the world

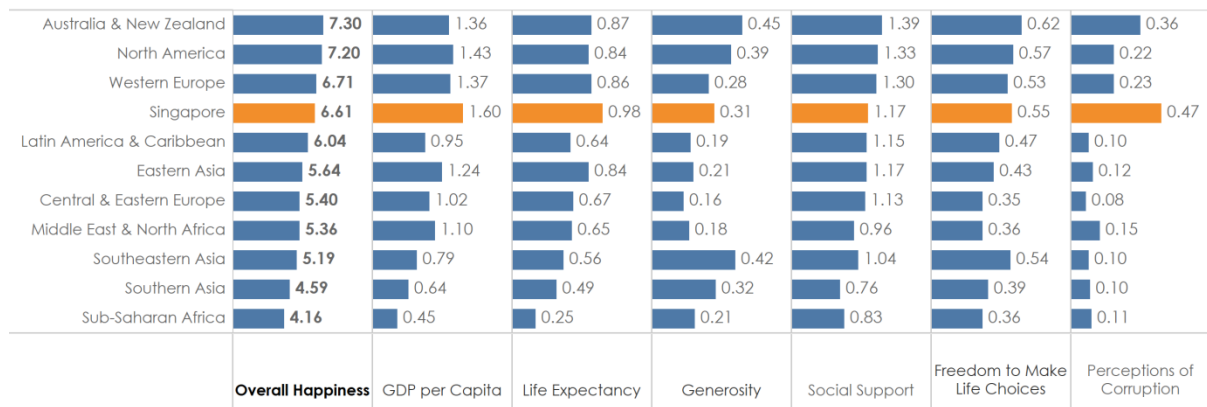


Figure 4 Breakdown of Happiness Score by Factors

High scores in GDP per capita, life expectancy and perceptions of corruption

From Figure 4, we see that Singapore scored higher than all the other regions in 3 factors: GDP per capita, life expectancy and perceptions of corruption.

Factor: GDP per capita

The GDP per capita factor, computed from the GDP per capita in terms of Purchasing Power Parity (PPP) shows that Singapore's economy and currency strength is contributing positively to the happiness score. This is supported by the World Economic Outlook Database by the International Monetary Fund where Singapore ranked 4th in the world in GDP per capita in PPP terms at International Dollars 85,500 in the year 2017. [1] As the PPP takes into account the relative cost of living and the inflation rates, GDP per capita in PPP is often considered a good measure of a country's standard of living. Residents in Singapore generally have a decent standard of living.

Factor: Life expectancy

The high score in the life expectancy factor shows the residents in Singapore generally tend to live longer than other regions in the world. This is also in line with the World Health Statistics for 2016 by the World Health Organization (WHO) which showed that Singapore ranked third in the world at 83.1 years

after Japan and Switzerland in terms of health-adjusted life expectancy. [2] This could be explained by the high quality of healthcare systems in Singapore that is easily accessible to all the residents in Singapore. Bloomberg ranked Singapore's healthcare system as the most efficient in the world in the year 2014. [3].

Besides the efficient health care system, the Ministry of Health of Singapore also has many initiatives to promote a healthy lifestyle in Singapore. One of which is the Health Promotion Board that was set up in the year 2001, acting as the main driver for national health promotion and disease prevention programmes with a vision to see a nation of healthy people. [4] Hence, it does not come as a surprise that Singapore scores highly in the life expectancy factor.

Factor: Perceptions of corruption

The perceptions of corruption factor are computed from the survey questions "Is corruption widespread throughout the government or not?" and "Is corruption widespread within businesses or not?". This high score for Singapore in this factor is also similarly reflected in the Transparency International 2017 Corruption Perception Index, ranking Singapore 6th out of 180 countries. [5] Generally, residents in Singapore perceived that the level of corruption in the country is low.

A lower score in generosity, social support and freedom to make life choices

The remaining 3 factors where Singapore did not score so well are generosity, social support and freedom to make life choices.

Factor: Generosity

The generosity factor in the happiness score is measured by the poll question "Have you donated money to a charity in the past month? ". Singapore's average score of 0.31 was lower than in many regions including the Southeast Asia region's average of 0.42.

The Office of the Commissioner of Charities (COC) reported in its latest report for the year 2016 that tax-deductible donations fell sharply by 36 per cent in the year 2016, a year after the Golden Jubilee year in 2015. The Office of COC attributed the fall with the economic uncertainty that may have an adverse effect on charitable giving and the tax deduction of 300 per cent reverting back to 250 per cent after the year 2015. [6] [7]

As there are no official statistics available on the level of donations between countries, we are unable to directly compare if residents in Singapore are more or less generous than other countries. However, the government could put more initiatives in place to instil the culture of giving in Singapore in order to boost up the generosity score, as the famous Sri Lankan Buddhist monk, K. Sri Dhammananda once said “Happy is he who makes others happy”.

Factor: Social support

Social support factor in the happiness score is measured by the poll question “If you were in trouble, do you have relatives or friends you can count on to help you whenever you need them, or not?”. Singapore’s score for this factor is below the average score from the regions Australia & New Zealand, North America and Western Europe. From the factor score, it seems that many of the residents of Singapore think that they do not have sufficient social support.

One report from the Lien Centre for Social Innovation in the year 2011 aimed to identify some of the needs of the vulnerable groups in Singapore and the possible approach to addressing them. [8] Some of the challenges identified by the report are:

1. Basic relief and security needs of the disabled and mentally ill are not adequately covered by State provision
2. Single persons who are heading poor households and workers who are in the lower-income bracket cannot fulfil criteria to access adequate housing, medical benefits or financial assistance
3. Foreign workers have limited access to work-oriented protection schemes or aid schemes
4. Migrant communities face difficulties assimilating into the Singapore community and Singaporeans with migrant communities

Also, with the ageing population problem in Singapore, more and more elderly population are living alone, apart from their children who are busy

working, therefore a possible lack of social support for these group of elderly residents of Singapore.

Factor: Freedom to make life choices

Freedom to make life choices is measured by the poll question “Are you satisfied or dissatisfied with your freedom to choose what you do with your life?”. One cannot avoid not discussing the high living cost in Singapore when freedom to make life choices is mentioned. The Economist Intelligence Unit Worldwide Cost of Living report in 2018 ranked Singapore as the top most expensive cities in the world. [9] With the high cost of living and high property prices, residents in Singapore have to work hard to earn a living and constantly worry about interest rate hikes, a weak economy and high unemployment rate. This could be the reason why they have little freedom to make life choices such as giving up their jobs if they are unhappy with it or going on holiday as much as they like.

Other factors not in the happiness report

The World Happiness Report acknowledged that some important factors such as unemployment were left out due to lack of comparable international data for all the countries. In the sections below, we look at some additional factors that were commonly quoted to be a source of unhappiness in Singapore such as the cost of living, number of foreign workers and unemployment levels.

Cost of Living: Prices of Basic Consumer

The Consumer Price Index (CPI) is designed to measure the average price changes in a fixed basket of consumer goods and services commonly purchased by the households over time. [10] It is commonly used as a measure of consumer price inflation. The CPI is also used as inputs in the formulation of government policies, as well as in the compilation of economic statistics at constant prices.

The CPI reflects the collective experience of inflation for all households. It does not correspond to the experience of any particular household as no two households have exactly the same spending patterns.

The CPI covers only consumption expenditure incurred by resident households (i.e. headed by Singapore Citizens or Permanent Residents). It excludes non-consumption expenditures such as loan repayments, taxes, purchases of housing property and other financial assets.

The ten main divisions in the CPI are food, clothing and footwear, housing and utilities, housing durables and services, health care, transport, communication, recreating and culture, education and miscellaneous goods and services. To maintain the relevance of CPI, the weighting pattern and the CPI basket of goods & services are updated once every five years. In the compilation of the CPI, weights are required to reflect the relative importance of each item in the basket. The current base period for the CPI is 2014.

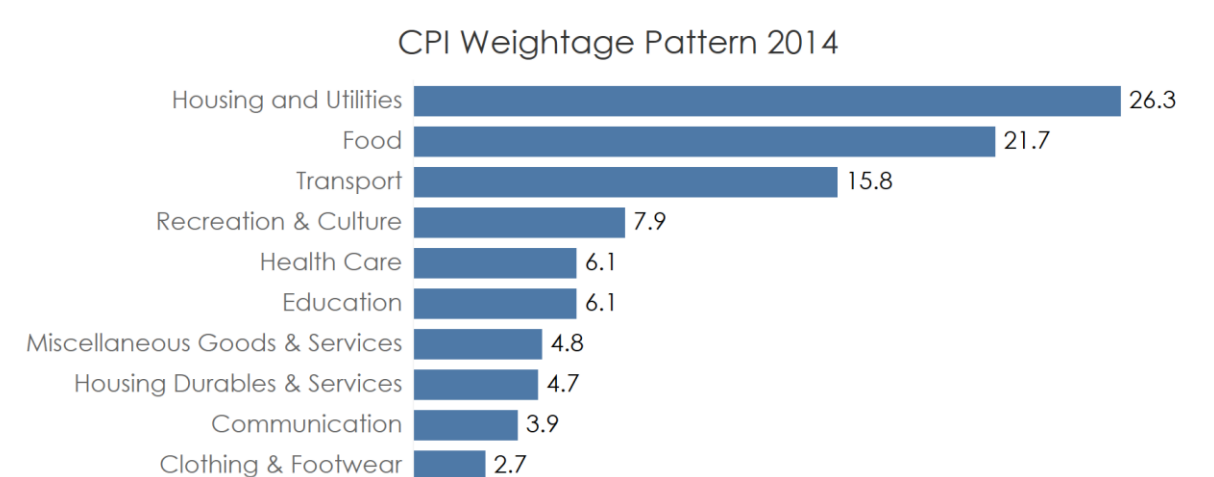


Figure 5 Weights of each component in the CPI

In the first quarter of 2018 [11], the CPI rose by 0.2 per cent on a year on year basis, easing from the 0.5 per cent increase in the previous quarter.

Among the CPI categories, food was the largest positive contributor to headline inflation in the first quarter, with prices rising by 1.3 per cent on a year-on-year basis on the back of price increases for food servicing services like hawker food and restaurant meals, as well as non-cooked food items such as fish & seafood and vegetables.

Meanwhile, education costs rose by 2.9 per cent due to higher fees at kindergartens & childcare centres, commercial institutions, universities and

polytechnics. Other significant increases include healthcare costs which increased by 2.3 per cent as a result of more expensive hospital services and outpatient services.

Singapore: Consumer Price Index

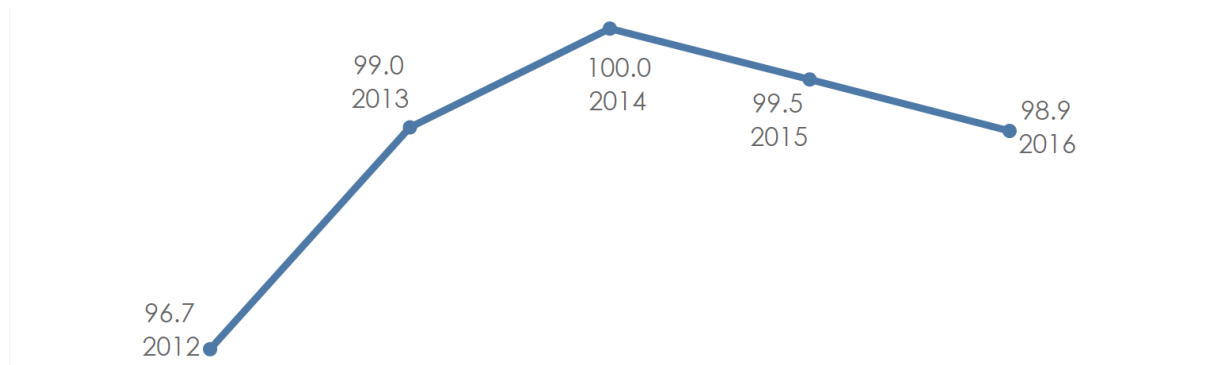


Figure 6 Dashboard component: CPI

Figure 6 tracks the consumer price index in the dashboard. The cost of living in Singapore has over the years been consistently raised as a key concern of Singaporeans [12]. The dominant sentiment was that pay increases have failed to keep up with rising expenses and perhaps also lifestyle expectations. This concern likely is a factor in determining the happiness of the population.

The proportion of Low Income Group in the Population

Figure 7 tracks the proportion of lower income group in the population. This is based on the number of residents in the lowest tax bracket per 100 population. Rising costs of basic items and services also have a proportionately larger negative impact on the lower income groups. A growing lower income group with the cost of living trending higher will no doubt adversely affect the overall happiness of the general population.

Singapore: Low Income Residents

Residents in the lowest tax bracket per 100 population

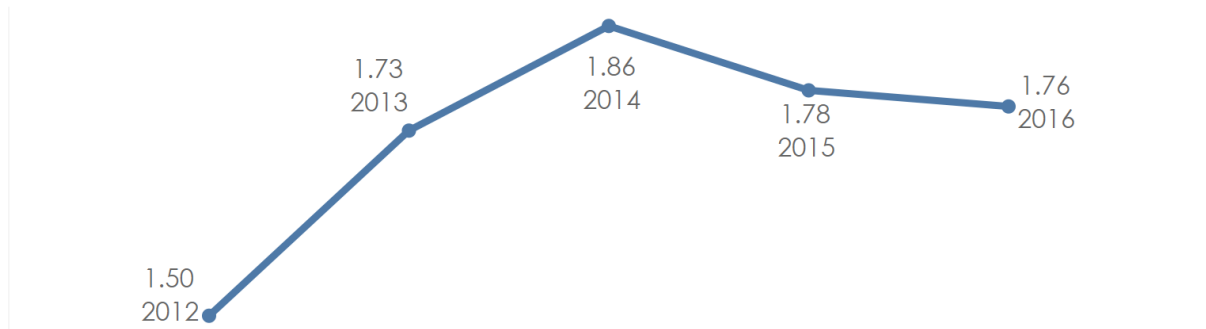


Figure 7 Dashboard component: Low Income Residents

As a proxy for the proportion of the lower income groups in the population, income tax data from the Internal Revenue Authority of Singapore (IRAS) is used. Singapore's personal income tax rates for resident taxpayers are progressive [13]. This means higher income earners pay a proportionately higher tax, with the current highest personal income tax rate at 22%.

The indicator used as a proxy for the proportion of lower income is the percentage of the population in the assessable income tax bracket of SGD 20,000 to SGD 25,000.

Foreign Workforce

Singapore: Foreign Workforce

Foreign workers (excl FDW & construction) per 100 resident

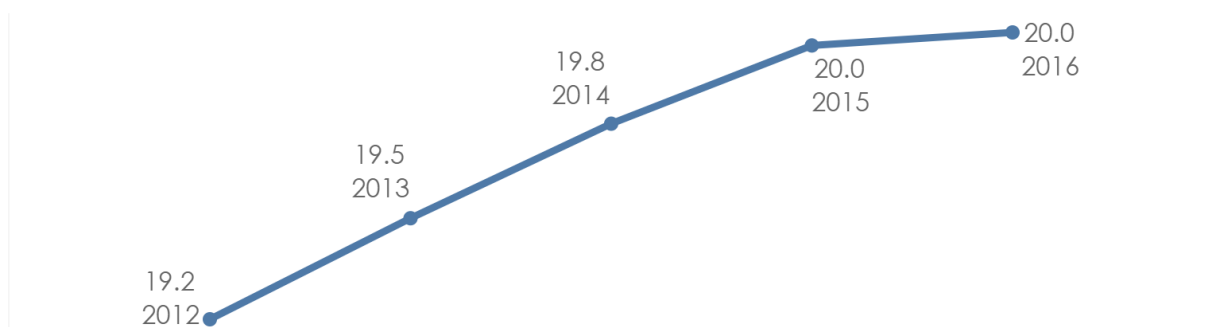


Figure 8 Dashboard component: Foreign Workforce

The inflow of foreigners has always been an issue which concerns Singaporeans and the most often cited reason being a strain on infrastructures such as transport and housing. [12] In particular, how housing

affordability is affected by purchases of foreigners figures prominently on the minds of many. Additionally, in times of economic slowdown, tensions are heightened when foreigners and locals compete together in a shrinking job market. [14] In Figure 8 we see that the number of foreign workers (excluding foreign domestic workers and construction) for every 100 resident has been steadily rising since the year 2012.

Unemployment

Singapore: Unemployment Rate

Unemployed citizens per 100 residents

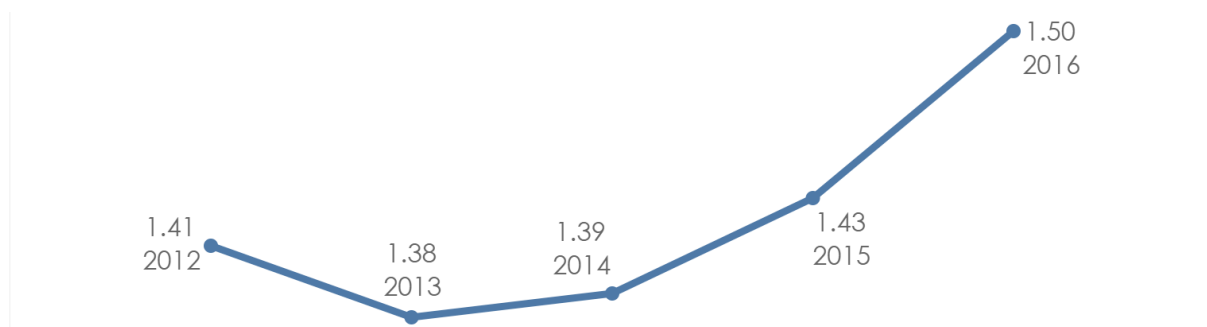


Figure 9 Dashboard component: Unemployment

In Figure 9, we also see that the number of unemployed citizens for every 100 population has also been increasing since the year 2013, after the dip in the year 2012.

This perceived, if not causal, the link between the inflow of foreigners and unemployment rate, given that it weighs heavily on the population, makes the tracking of these two indicators useful in explaining any variation in the happiness index.

However, we also acknowledge the current government initiatives through the Industry Transformation Maps to create new and redesigned jobs with better wages for Singaporeans. This is also complemented with the initiatives through the Skills Future to provide Singaporeans the opportunity to master new skills based on current needs so that they can continue to be employable.

Recommendations

The policymakers of Singapore should monitor the factors affecting happiness closely and provide necessary interventions if any factor continue to deteriorate. Some of the recommendations based on the current level of happiness in 2018 given below.

1. Review qualifying donations tax deduction rates and launch campaigns to increase and encourage giving amongst residents in Singapore.
2. Actively identify vulnerable groups such as elderly single persons, the disable and also single parents to provide help and social support.
3. Design a national mental health action plan to monitor and treat mental illnesses in Singapore. Mental health monitoring should begin in schools and universities.

Conclusion

We hope that with the Happiness Dashboard, the policy makers of Singapore would treat the level of happiness in Singapore more seriously and so that Singapore would no longer be branded as a stressful place to live in.

As for the project, our group has gained firsthand experience in building data warehouse and apply the strategies in visualizations that are in line with the graphical excellence and graphical integrity principles.

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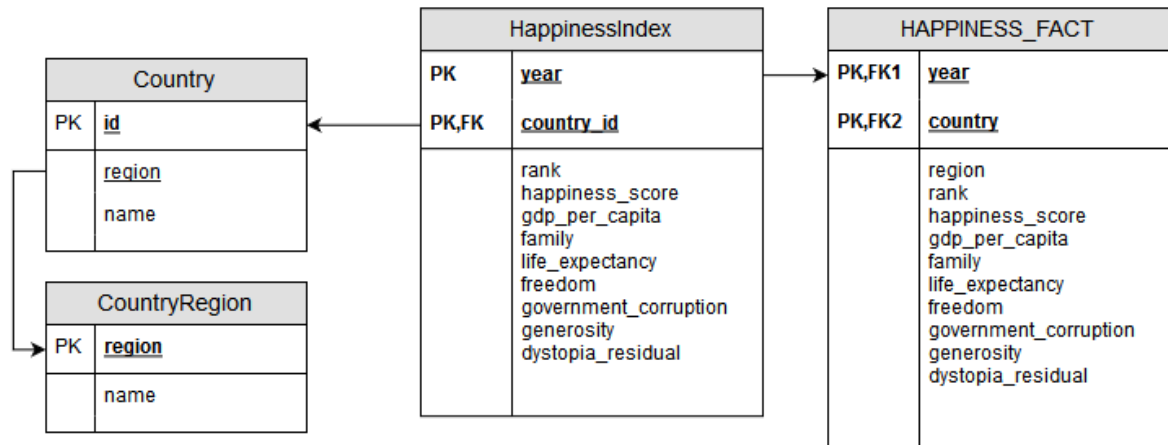
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Appendix I

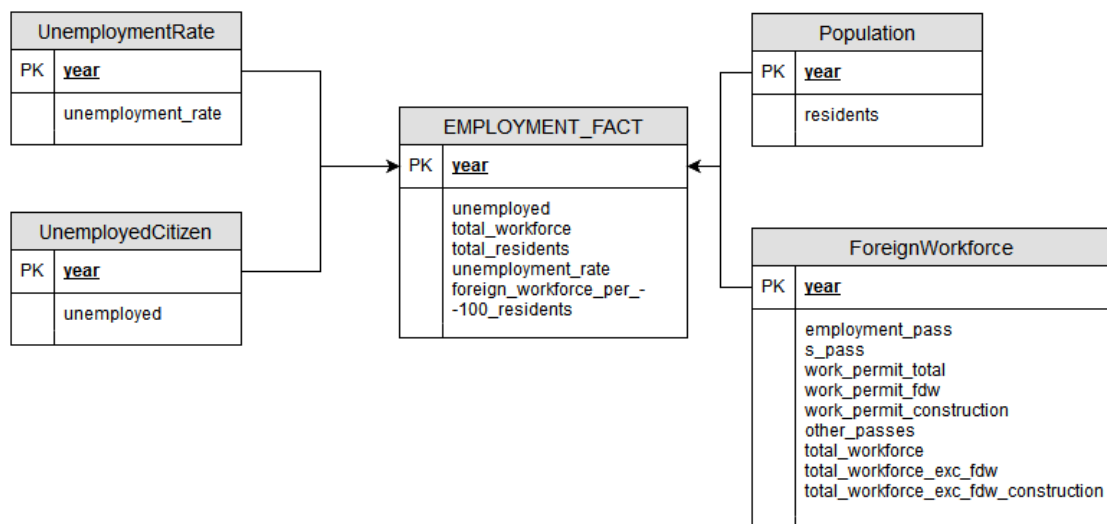
1. World Happiness Report
<http://worldhappiness.report/>
2. Kaggle
<https://www.kaggle.com/unsdsn/world-happiness>
3. Ministry of Manpower
<https://www.mom.gov.sg/documents-and-publications/foreign-workforce-numbers>
4. Ministry of Trade and Industry Singapore
<https://www.mti.gov.sg/ResearchRoom/>
5. Inland Revenue Authority Singapore
<https://data.gov.sg/organization/inland-revenue-authority-of-singapore>
6. Singapore Statistics – Consumer Price Index
<https://www.singstat.gov.sg/find-data/search-by-theme/economy/prices-and-price-indices/>
7. Singapore Statistics – Population
<https://www.singstat.gov.sg/find-data/search-by-theme/population/population-and-population-structure/latest-data>
8. Singapore Statistics – Marital Status, Marriages and Divorces
<https://www.singstat.gov.sg/find-data/search-by-theme/population/marital-status-marriages-and-divorces/latest-data>
9. World Health Organization
http://www.who.int/healthinfo/global_burden_disease/estimates/en/index1.html

Appendix II Fact Tables

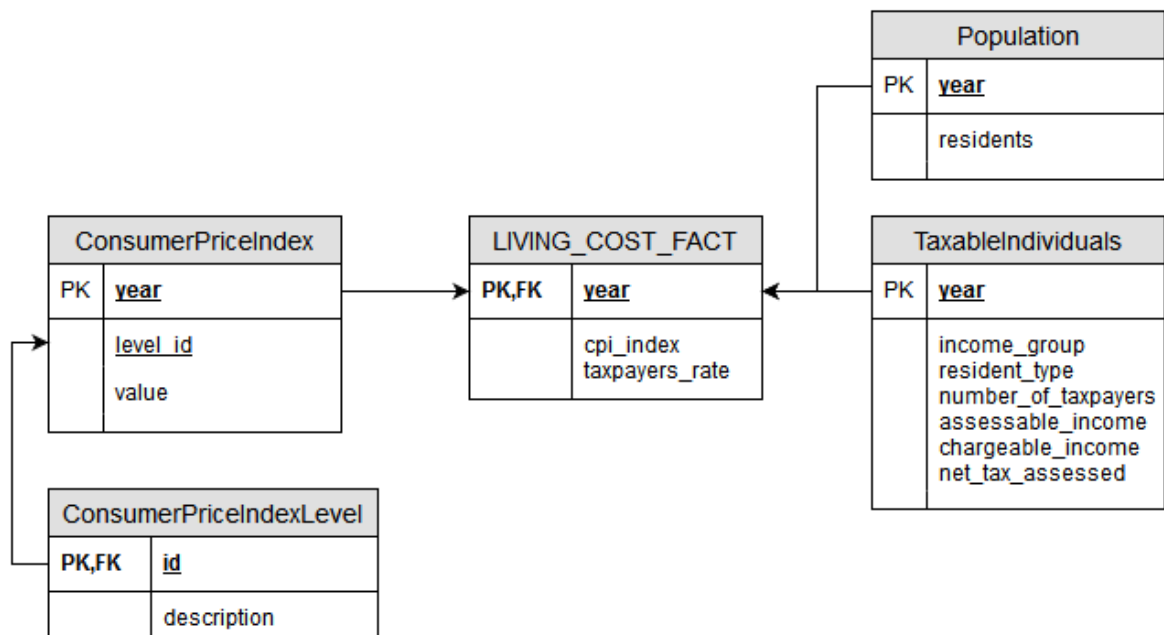
Fact Table 1: Happiness Index



Fact Table 2: Employment



Fact Table 3: Living Cost



Appendix III Relational Diagram

