



BidBetter

Leveraging Visual Insights for Smarter Tender Bidding

USER GUIDE



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1. Introduction



BidBetter - Leveraging Visual Insights for Smart Tender Bidding

INTRODUCTION

FLOW OF BID VALUE TO PRODUCT CATEGORY

TENDER DESCRIPTION

RELATIONSHIP BETWEEN MINISTRY & SUPPLIERS

MEANS COMPARISON BY YEAR

Introduction

GeBIZ encompasses the public sector's request for quotations and tenders within the procurement procedure set out by Ministry of Finance. Records of Government Procurement via GeBIZ between 1 April 2016 and 31 March 2022 are available on data.gov.sg. In this project, we aim to extract valuable insights on government procurement by categorizing the products or services from the raw text provided by GeBIZ.

While the database of historical tenders is extensive, it is not organized or visualized in a manner that allows for patterns or insights to be easily derived without having some knowledge of data analytics methods and applications.

Therefore, our R Shiny application seeks to address this.

Understand the product categories derived through text analysis using:

Sankey Diagram - Visualise the volume of total awarded amount by ministry level to product category.

Pareto Chart + Word Cloud - Provides additional information on categorical spending per ministry and common recurring text

Network Diagram - Plots the relationship between Ministry, Agency and Individual Suppliers

Further Interactive Inferential Stats using:

Pairwise testing - Compare means of bid tender value between years, using one-way ANOVA to examine statistical significance

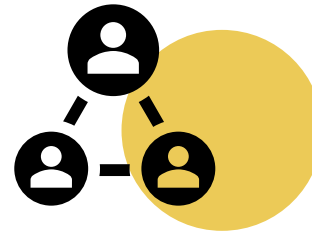
Essential Information



GEBIZ: TYPE OF BID

Value	Category	In GeBiz?	Description
Up to S\$6,000	Small Value Purchase	Optional	May purchase direct or off the shelf
S\$6,000 to S\$90,000	Quotation	Yes	Invitation to quote on GeBiz
Above S\$90,000	Tender	Yes	Open, selective, or limited tender

- Small value purchase (i.e. awarded value < SGD 6K) have been removed from this dataset
- The field "type of bid" differentiates:
ITQ - Invitation to quote (SGD 6-90K)
Tender - High value bids above SGD 90K



PROCUREMENT CATEGORY

tender_no.	tender_description	category
1	NEA000ETT19300029 PROPOSED ERECTION OF INTEGRATED WASTE MANAG...	Construction & upgrading for MRT lines & buildings
2	MPA000ETT16000051 TUAS TERMINAL RECLAMATION, WHARF CONSTRUCTI...	Equipment & systems servicing
3	HD8000ETT17000225 CONSTRUCTION OF POLDER AT AREAS A AND C OF P...	Construction & upgrading for MRT lines & buildings
4	LTA000ETT16100049 CONSTRUCTION OF KIM CHUAN DEPOT EXTENSION F...	Construction & upgrading for MRT lines & buildings
5	LTA000ETT19300138 DESIGN AND CONSTRUCTION OF CHANGI EAST DEPOT	Construction & upgrading for MRT lines & buildings
6	LTA000ETT19300194 BUS CONTRACTING - BULIM AND SEMBAWANG-YISHU...	Construction & upgrading for MRT lines & buildings
7	JTC000ETT18300204 INTEGRATED BUSINESS PARK DEVELOPMENT ON CC1, ...	Construction & upgrading for MRT lines & buildings
8	LTA000ETT19300153 DESIGN AND CONSTRUCTION OF PASIR RIS INTERCHA...	Construction & upgrading for MRT lines & buildings

↑GeBiz Data↑

- TextMineR is used to process tender description retrieved from GeBiz
- **13 categories** of product / service are defined through clustering of tokenized text



SUPPLEMENTARY DETAILS

The dataset was supplemented with the following information through process flow:

- **Ministry**
(which the procuring agency reports to)
- **Primary Industry Type**
(based on ACRA registration of winning bid company)

2. Overview tab with Sankey Visualising the flow of amt (\$) awarded

► VIEW OF SANKEY PLOT:

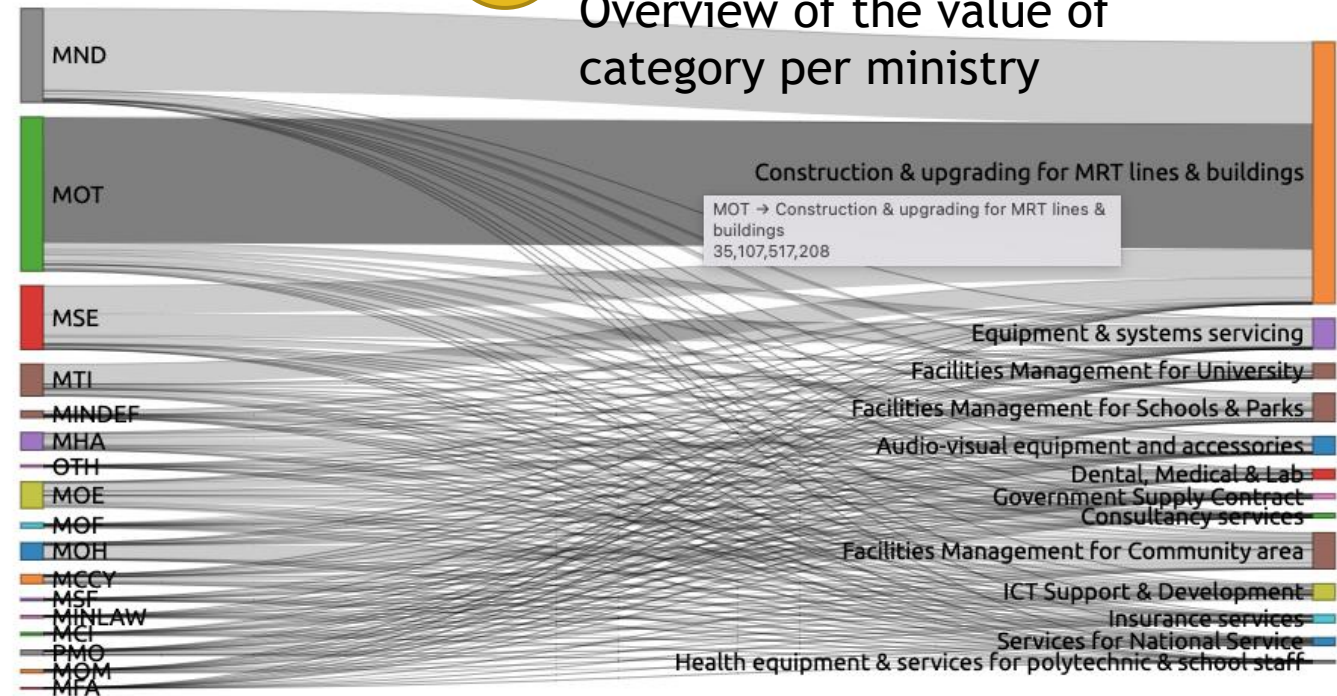
Select Type of Bid
All

Select Category
All

Select Ministry
All

Select Date Range
2016-04-01 2022-03-31

Reset Filters



3

Total amount awarded -
Overview of the value of
category per ministry

1

Ministry - Aggregated view
of government agency
spending at a ministry level

2

CATEGORY - 13 procurement
categories derived from Text
Analytics on TextMineR

2. Overview tab with Sankey

Visualising the flow of amt (\$) awarded

► USER INPUT:

1

Type of Bid:

All

ITQ - Invitation to quote (SGD 6-90K)
Tender - High value bids above SGD 90K

2

Product Category:

All

Product category as defined by Text Mining, namely;

- [1] "Dental, Medical & Lab"
- [2] "ICT Support & Development"
- [3] "Consultancy services"
- [4] "Facilities Management for Schools & Parks"
- [5] "Construction & upgrading for MRT lines & buildings"
- [6] "Facilities Management for University"
- [7] "Services for National Service"
- [8] "Health equipment & services for polytechnic & school staff"
- [9] "Audio-visual equipment and accessories"
- [10] "Insurance services"
- [11] "Facilities Management for Community area"
- [12] "Equipment & systems servicing"
- [13] "Government Supply Contract"

3

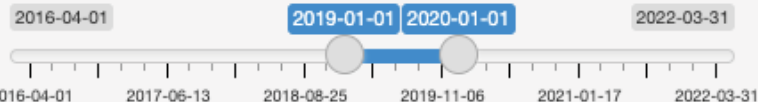
Ministry:

All

Narrow the scope of visualisation by Ministry

4

Dates:



Select the date range of awarded bid
(i.e. the date which the bid was awarded)

2. Overview tab with Sankey

Visualising the flow of amt (\$) awarded

► EXAMPLE OF FILTERED PLOT:

Select Type of Bid
ITQ - Mid

Select Category
Facilities Management for Schools & Parks

Select Ministry
All

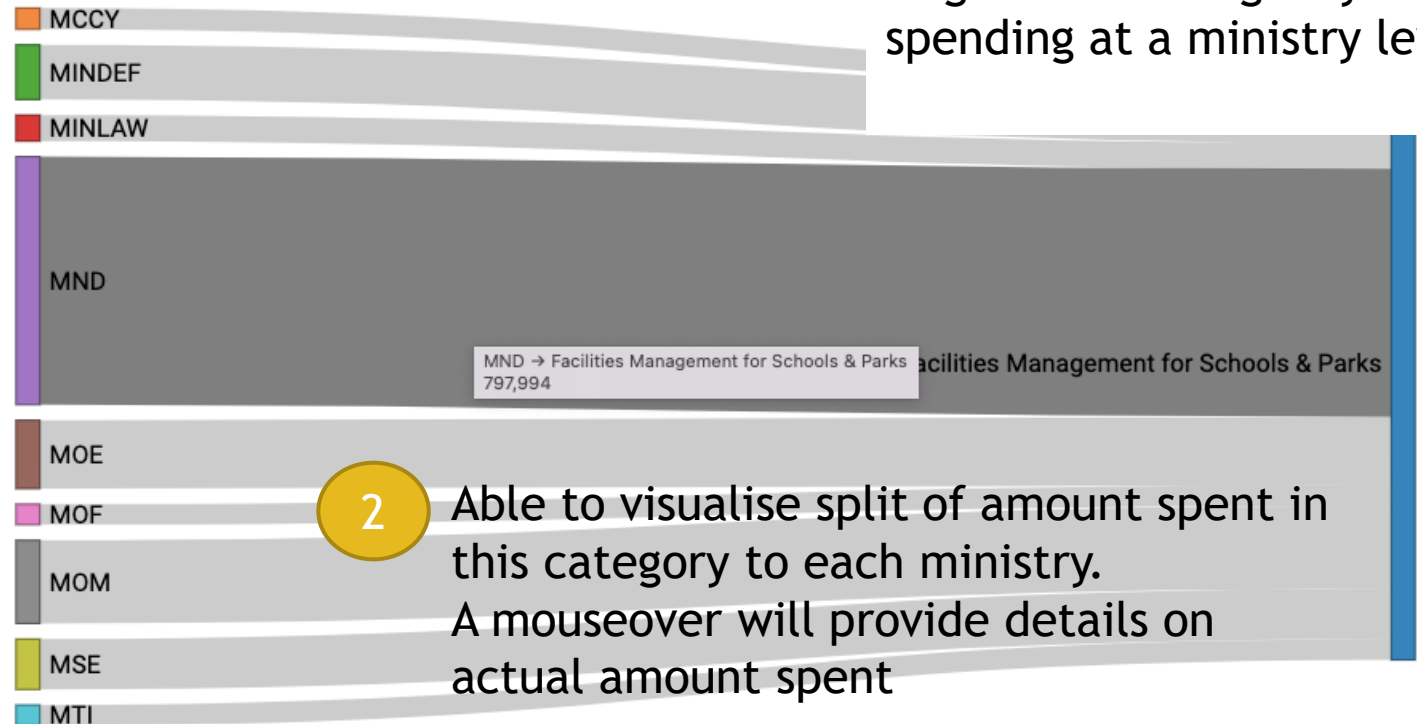
Select Date Range
2016-04-01 2021-03-30 2022-03-31

RESET FILTERS

3

DATE & BID TYPE -

Data is filtered by user inputs of date range and bid type at the backend



1

Ministry - Aggregated view of government agency spending at a ministry level

2

Able to visualise split of amount spent in this category to each ministry. A mouseover will provide details on actual amount spent

3. Procurement Spending Proportion & Top Product Categories



BidBetter - Leveraging Visual Insights for Smart Tender Bidding

TENDER DESCRIPTION

Select Date Period

2016-04-01

to

2022-03-31

Select Ministry

MINISTRY OF TRADE & INDUSTRY MINISTRY OF TRANSPORT
MINISTRY OF DEFENCE MINISTRY OF NATIONAL DEVELOPMENT

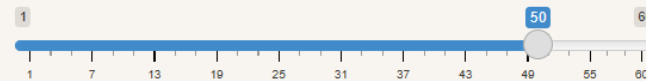
Select Agency

CIVIL AVIATION AUTHORITY OF SINGAPORE
NATIONAL COUNCIL OF SOCIAL SERVICE
HOUSING AND DEVELOPMENT BOARD NATIONAL PARKS BOARD
PUBLIC UTILITIES BOARD

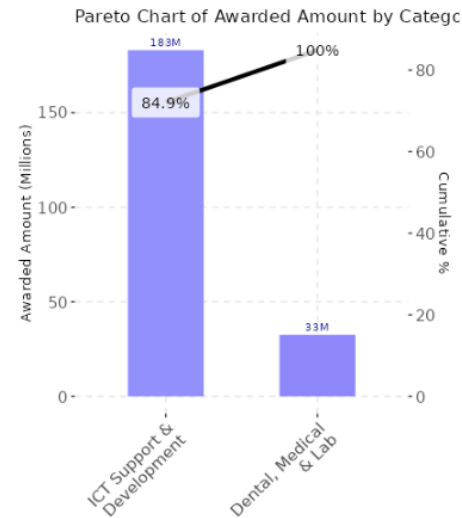
Select Category

Dental, Medical & Lab ICT Support & Development
Facilities Management for Schools & Parks
Services for National Service Audio-visual equipment and accessories

Maximum Word Frequency



RESET FILTERS



	Ministry	Agency	Tender Description	Awarded Amount	Category
1	MINISTRY OF TRANSPORT	CIVIL AVIATION AUTHORITY OF SINGAPORE	PROVISION OF INFRA-RED THERMOGRAPHIC SCANNING SERVICES	129060	Dental, Medical & Lab
2	MINISTRY OF TRANSPORT	CIVIL AVIATION AUTHORITY OF SINGAPORE	PROVISION OF ON-SITE PERSONNEL FOR APPLICATION DEVELOPMENT AND MAINTENANCE SERVICES	378000	ICT Support & Development
3	MINISTRY OF TRANSPORT	CIVIL AVIATION AUTHORITY OF SINGAPORE	PROVISION OF MICROSOFT WINDOWS SERVER OS LICENCES FOR VIRTUAL MACHINES IN THE VIRTUAL SERVER FARMS	656640	ICT Support & Development
4	MINISTRY OF TRANSPORT	CIVIL AVIATION AUTHORITY OF SINGAPORE	REPLACEMENT OF X-RAY MACHINES AND PROVISION OF SECURITY SCREENING EQUIPMENT FOR CAAS PREMISES	175553	Dental, Medical & Lab

Showing 1 to 4 of 128 entries

[Previous](#)

1

2

3

4

;

2

Next

3. Procurement Spending Proportion & Top Product Categories – User Interface

Choose the following filters to update plot based on input:

1 Select Date Period
2016-01-04 to 2022-12-01

2 Select Ministry
MINISTRY OF TRADE & INDUSTRY MINISTRY OF TRANSPORT
MINISTRY OF DEFENCE MINISTRY OF NATIONAL DEVELOPMENT

3 Select Agency
CIVIL AVIATION AUTHORITY OF SINGAPORE
NATIONAL COUNCIL OF SOCIAL SERVICE
HOUSING AND DEVELOPMENT BOARD NATIONAL PARKS BOARD
PUBLIC UTILITIES BOARD

4 Select Category
Dental, Medical & Lab ICT Support & Development
Facilities Management for Schools & Parks Services for National Service
Audio-visual equipment and accessories

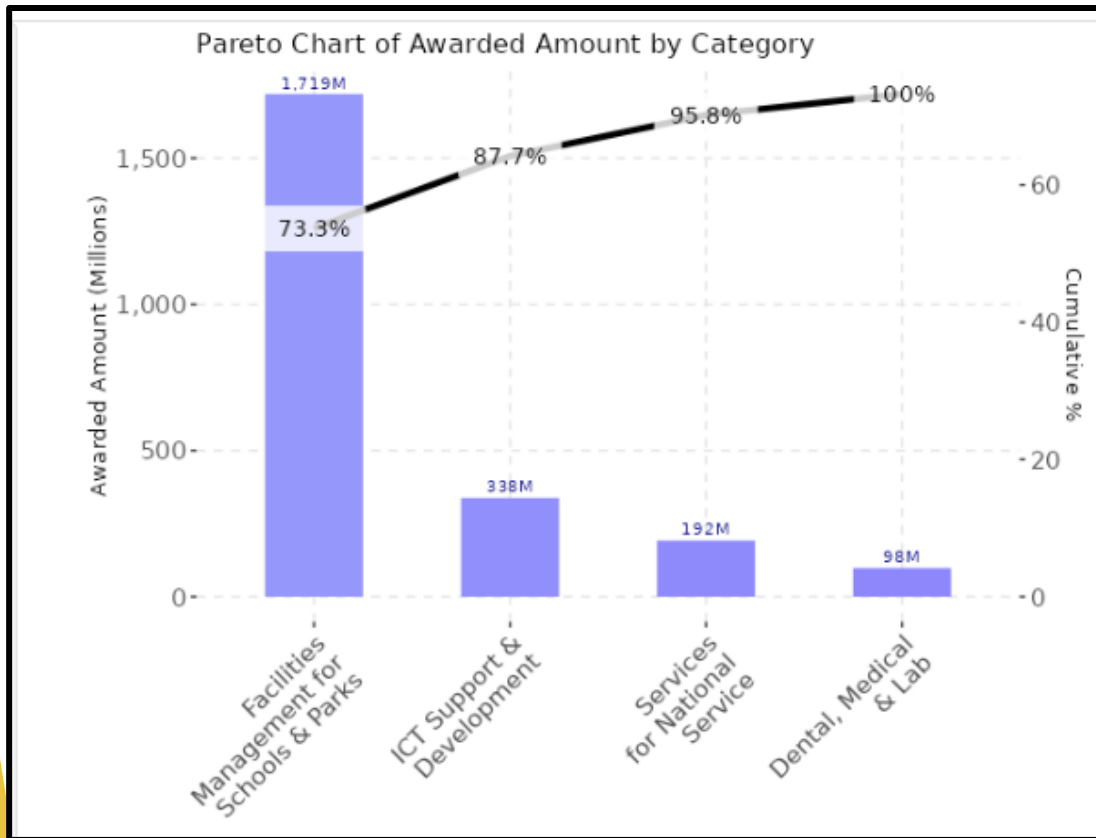
5 Maximum Word Frequency
1 50 60
1 7 13 19 25 31 37 43 49 55 60

6 Reset Filters

1. Select the range of date for the output
2. Select the Ministry/Ministries (you may choose to select multiple)
3. Select the Agency/Agencies (you may choose to select multiple)
4. Select the category/categories (you may choose to select multiple)
5. Select the range for maximum word frequency, it will adjust the output in the wordcloud
6. Click on this to reset all filters

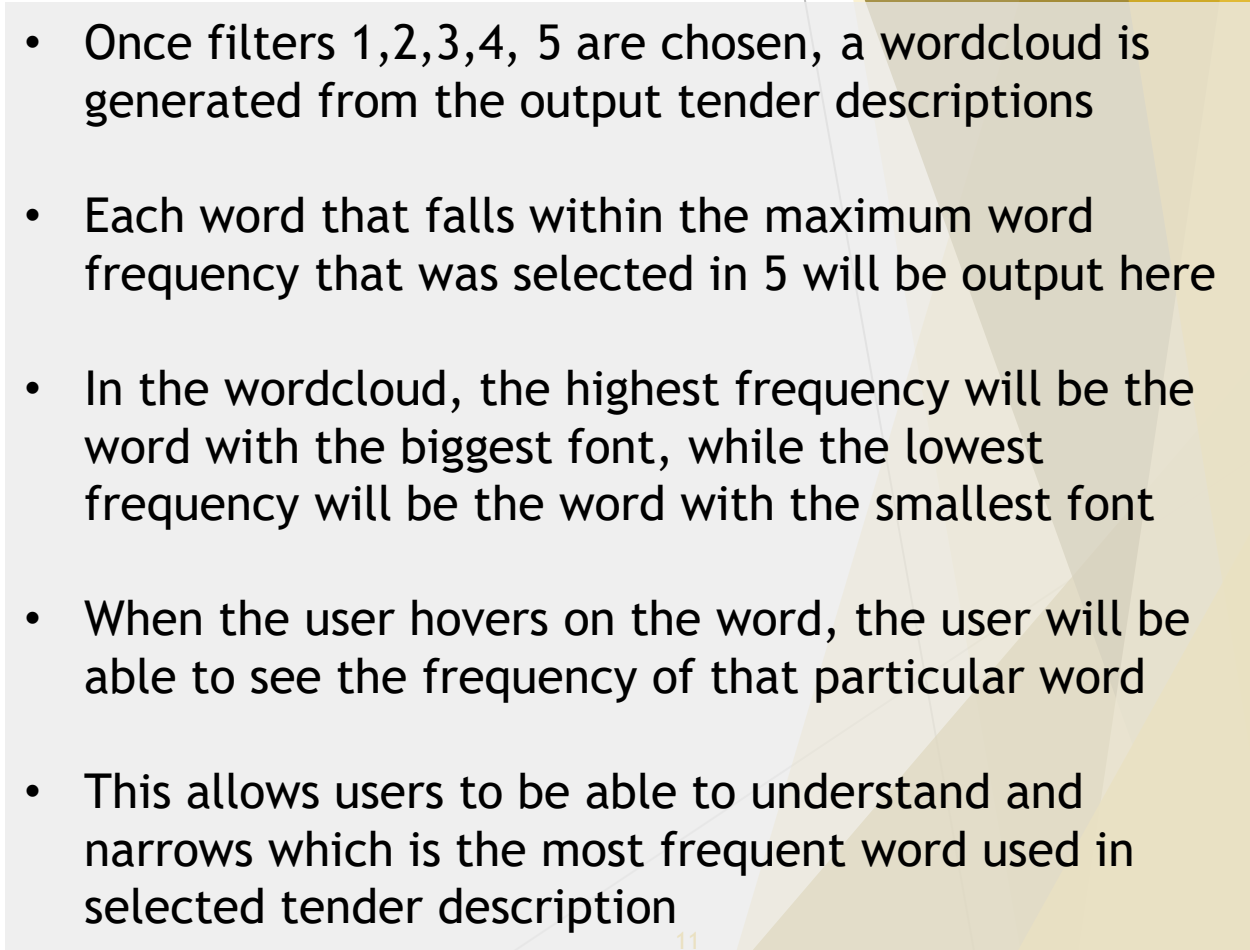
3. Procurement Spending Proportion & Top Product Categories

3.1 Pareto Chart - Reactive Visualization (1/3)



- Once filters 1,2,3,4 are chosen, a Pareto chart is shown
- On the top of the bar chart, user can also see the exact amount spent in each category
- On the line chart, user can tell the Cumulative % for each category
 - For instance, in this screenshot, we see that 'Facilities Management for Schools & Parks' takes up 73.3% of the total spending across categories selected
- The Pareto chart shows the top spending category for the selected inputs
 - For instance, in this screenshot, we see that 'Facilities Management for Schools & Parks' are the highest followed by 'ICT Support & Development' and so on.

3.2 WordCloud - Reactive Visualization (2/3)



3. Procurement Spending Proportion & Top Product Categories

3.3 Tender Table - Reactive Visualization (3/3)

	Ministry	Agency	Tender Description	Awarded Amount	Category
1	MINISTRY OF TRANSPORT	CIVIL AVIATION AUTHORITY OF SINGAPORE	PROVISION OF CONSULTANCY SERVICES TO DESIGN A PASSENGER CENTRALISED DATA MANAGEMENT SYSTEM	390000	ICT Support & Development
2	MINISTRY OF DEFENCE	DEFENCE SCIENCE AND TECHNOLOGY AGENCY	PROVISION OF TRAINING AND COMPETITION FOR THE CYBER DEFENDERS DISCOVERY CAMP (CDDC)	938000	Consultancy services
3	MINISTRY OF NATIONAL DEVELOPMENT	HOUSING AND DEVELOPMENT BOARD	TERM CONTRACT FOR THE SUPPLY OF SECURITY SERVICES TO CONNECTION ONE FOR A PERIOD OF TWENTY FOUR (24) MONTHS	1180000	Facilities Management for Schools & Parks
4	MINISTRY OF TRADE & INDUSTRY	JURONG TOWN CORPORATION	PROPOSED ERECTION OF A 4-STOREY MULTI-USER BUSINESS PARK DEVELOPMENT WITH CAFE AND OFFICE ON PART LOT 01759N MK 09 AT CLEANTECH LOOP (WESTERN WATER CATCHMENT PLANNING AREA)	9700000	Construction & upgrading for MRT lines & buildings

Showing 1 to 4 of 2,087 entries

Previous 1 2 3 4 5 ... 522 Next

- Once filters 1,2,3,4, 5 are chosen, a table of all the output tenders will be generated
- In this table, the individual ministry, agency, tender description, awarded amount and category will be shown

4. Ministry & Supplier Relationship

1 Select Ministry
MINISTRY OF FINANCE

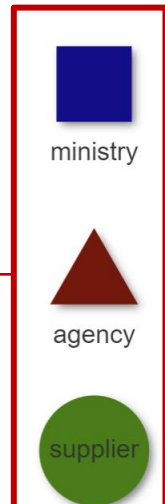
2 Select Year
2016

Reset Filters

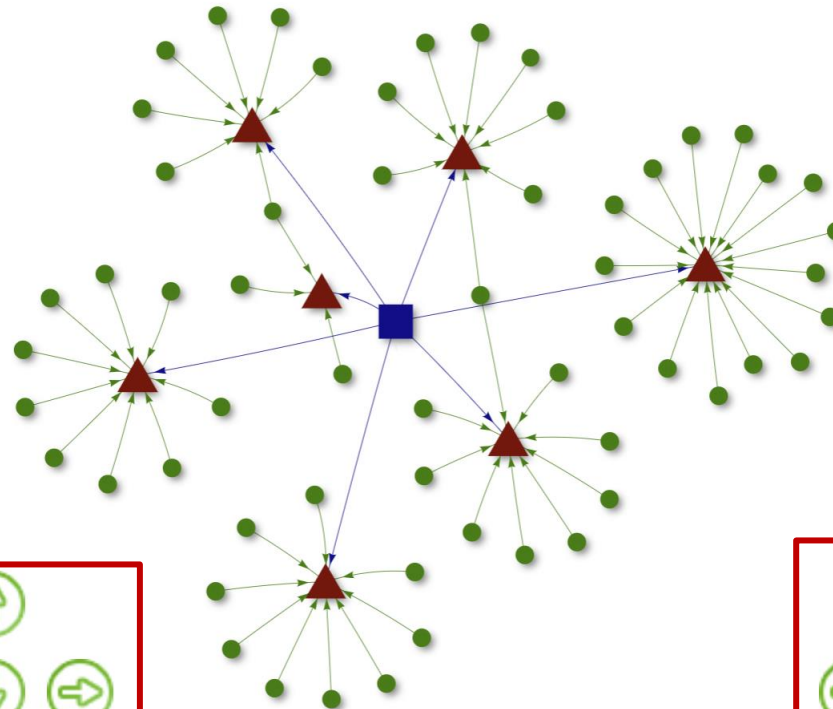
Choose the following filters to update network graph based on input:

1. Select the Ministry (single option only)
2. Select the Year (single option only)

Legend for the nodes' shape and colour



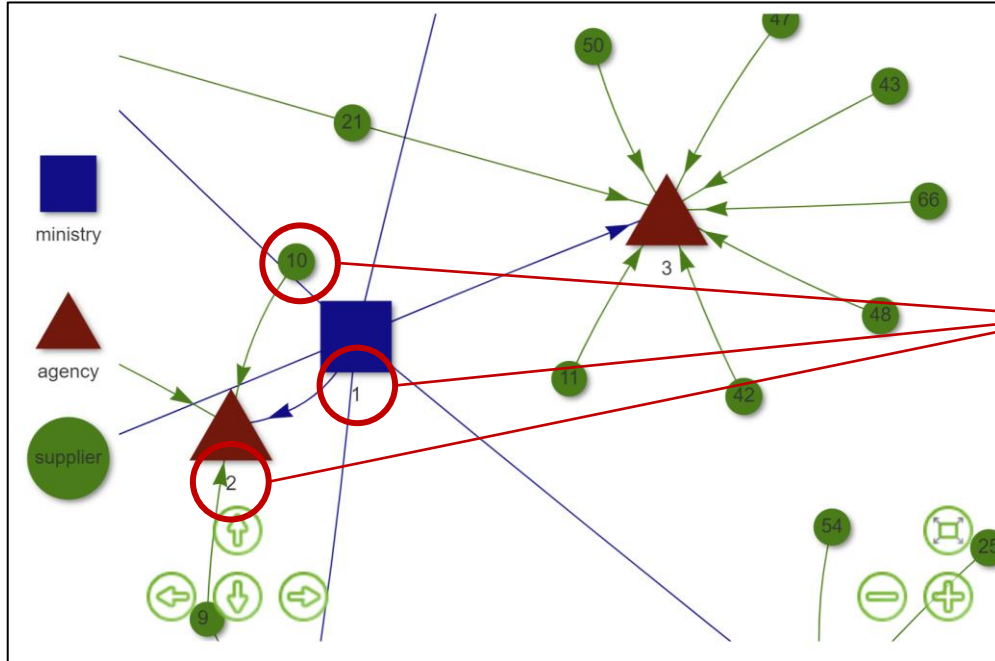
To move around each part of the graph, especially after zoom in



Zoom in to see node indexes



4. Ministry & Supplier Relationship

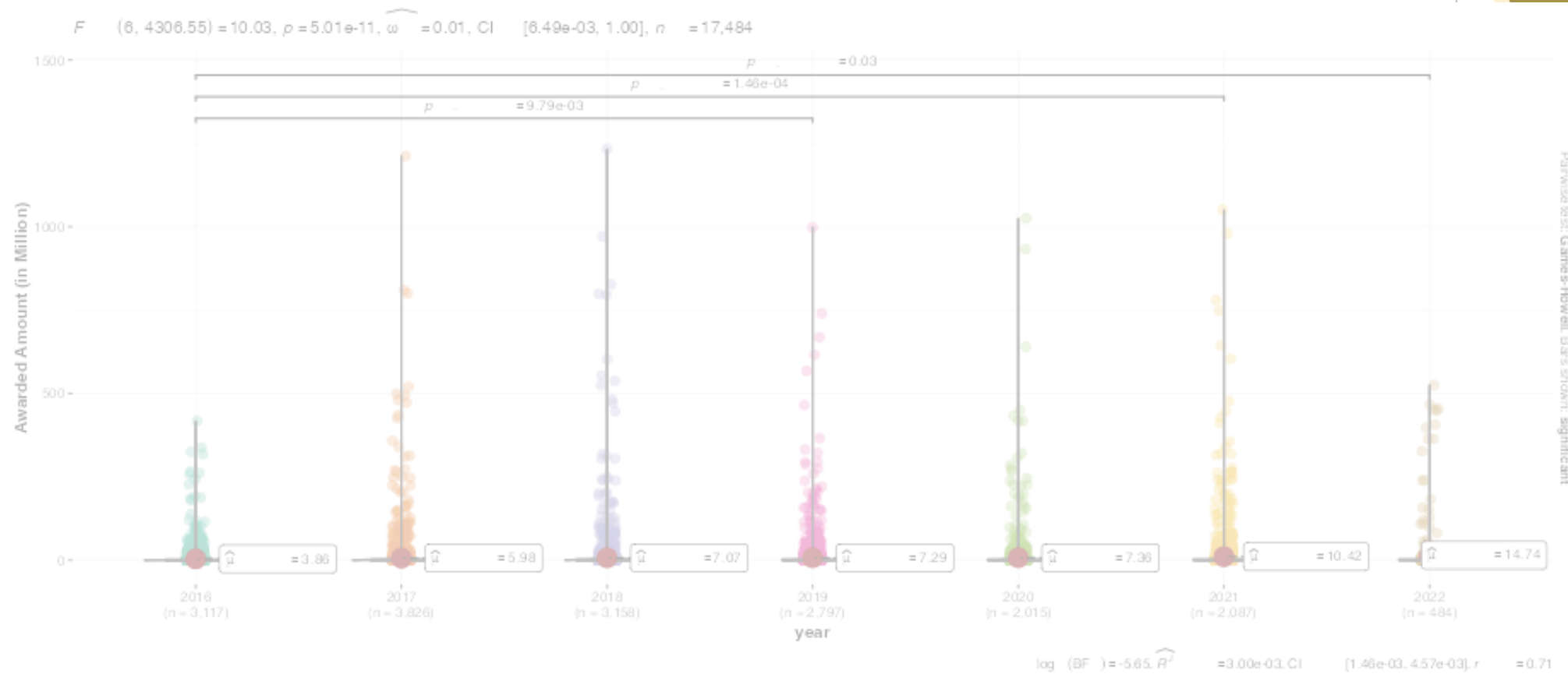


Refer to table for
corresponding
Ministry, Agency,
or Supplier name

index	namelist
1	MINISTRY OF FINANCE
2	ACCOUNTING AND CORPORATE REGULATORY AUTHORITY
3	INLAND REVENUE AUTHORITY OF SINGAPORE
4	MINISTRY OF FINANCE - SINGAPORE CUSTOMS
5	MINISTRY OF FINANCE - VITAL
6	MINISTRY OF FINANCE- ACCOUNTANT-GENERAL'S DEPARTMENT
7	MINISTRY OF FINANCE- MINISTRY HEADQUARTER
8	PRODUCTIVITY FUND ADMINISTRATION BOARD
9	TOTE BOARD
10	BDO CONSULTANTS PTE. LTD.
11	SIMPLE SOLUTION SYSTEMS PTE. LTD.
12	TECH MAHINDRA LIMITED (SINGAPORE BRANCH)
13	DELTEQ PTE LTD

5. Pairwise Comparison of means using ANOVA

► VIEW OF VIOLIN PLOT & PAIRWISE COMPARISON:

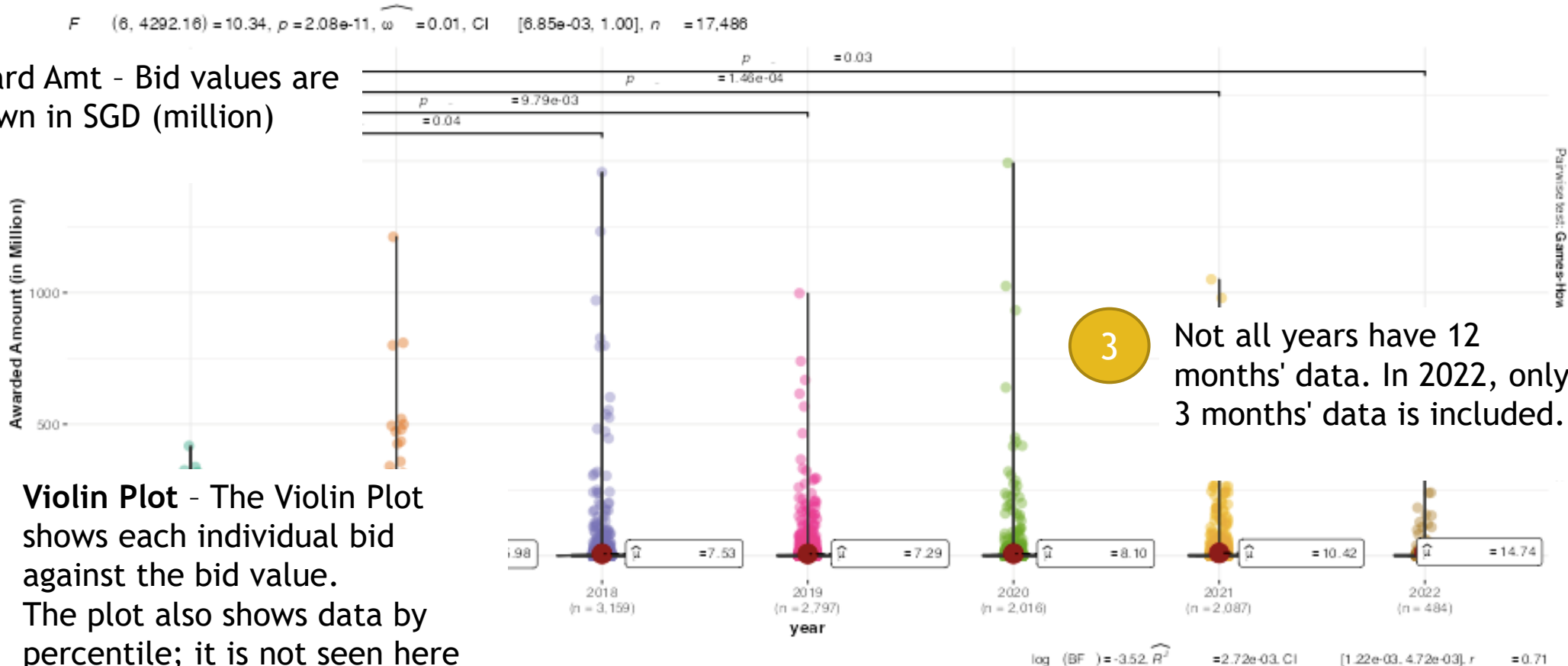


5. Pairwise Comparison of means using ANOVA

VIEW OF VIOLIN PLOT & PAIRWISE COMPARISON (WITHOUT FILTER):

2

Award Amt - Bid values are shown in SGD (million)



3

Not all years have 12 months' data. In 2022, only 3 months' data is included.

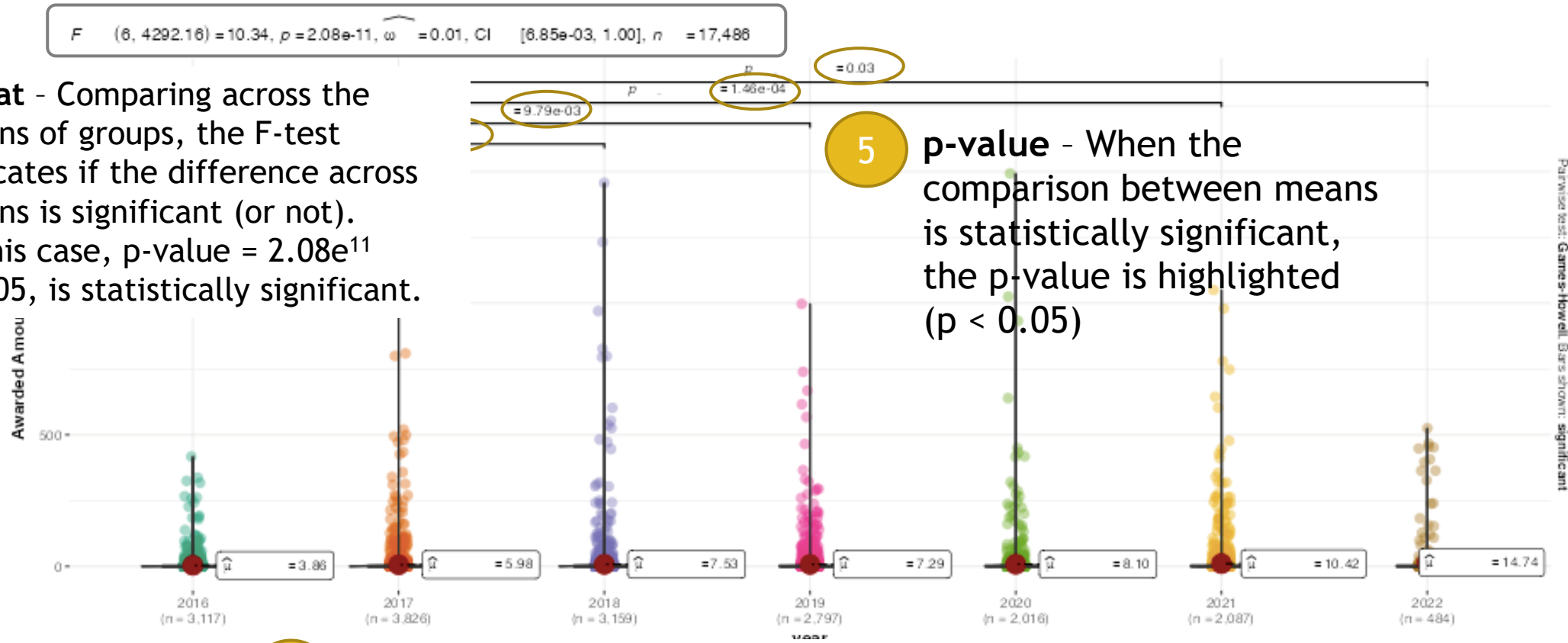
1

Violin Plot - The Violin Plot shows each individual bid against the bid value. The plot also shows data by percentile; it is not seen here due to multiple outlier points

5. Pairwise Comparison of means using ANOVA

VIEW OF VIOLIN PLOT & PAIRWISE COMPARISON (WITHOUT FILTER):

6 F-stat - Comparing across the means of groups, the F-test indicates if the difference across means is significant (or not). In this case, $p\text{-value} = 2.08e^{-11} < 0.05$, is statistically significant.



4 Year(s) - This app provides inferential statistics comparing means of 2 years and across the selected year(s)

5 p-value - When the comparison between means is statistically significant, the p-value is highlighted ($p < 0.05$)

5. Pairwise Comparison of means with Violin Plot

► USER INPUT:

- 1 **Select Category**
- 2 **Select Ministry**
- 3 **Select Type of Bid**
- 4 **Select Bid Value**
- 5 **Select Year (Optional)**

Narrow the scope to one of 13 product categories (for more details, refer to Slide 4)

Narrow the scope of analysis by Ministry (data will include all agencies reporting to the Ministry)

ITQ - Invitation to quote (SGD 6-90K)
Tender - High value bids above SGD 90K

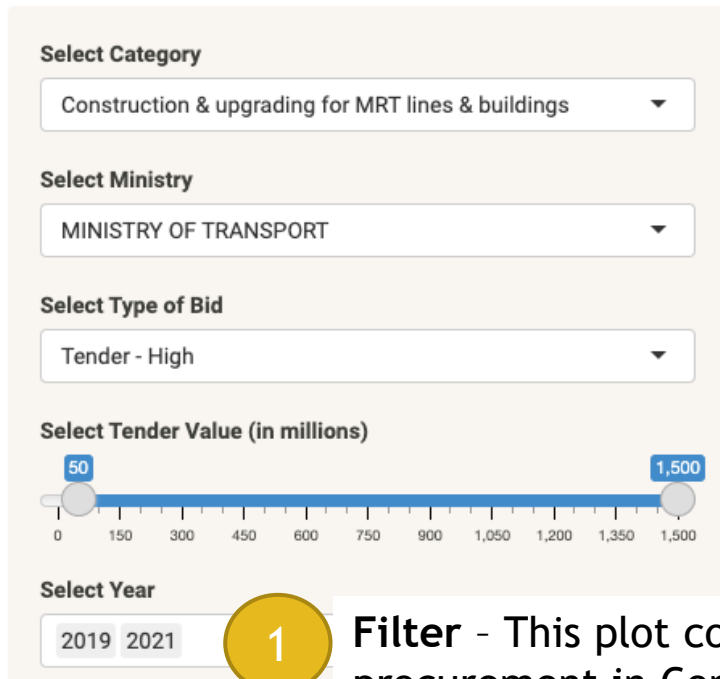
This filter is provided to exclude outliers 50 mil SGD and above from the dataset. The Violin Plot differs from earlier tables as it does not aggregate data.

Select the year(s) to include in the one-way ANOVA comparison

5. Pairwise Comparison of means using ANOVA

► EXAMPLE 1

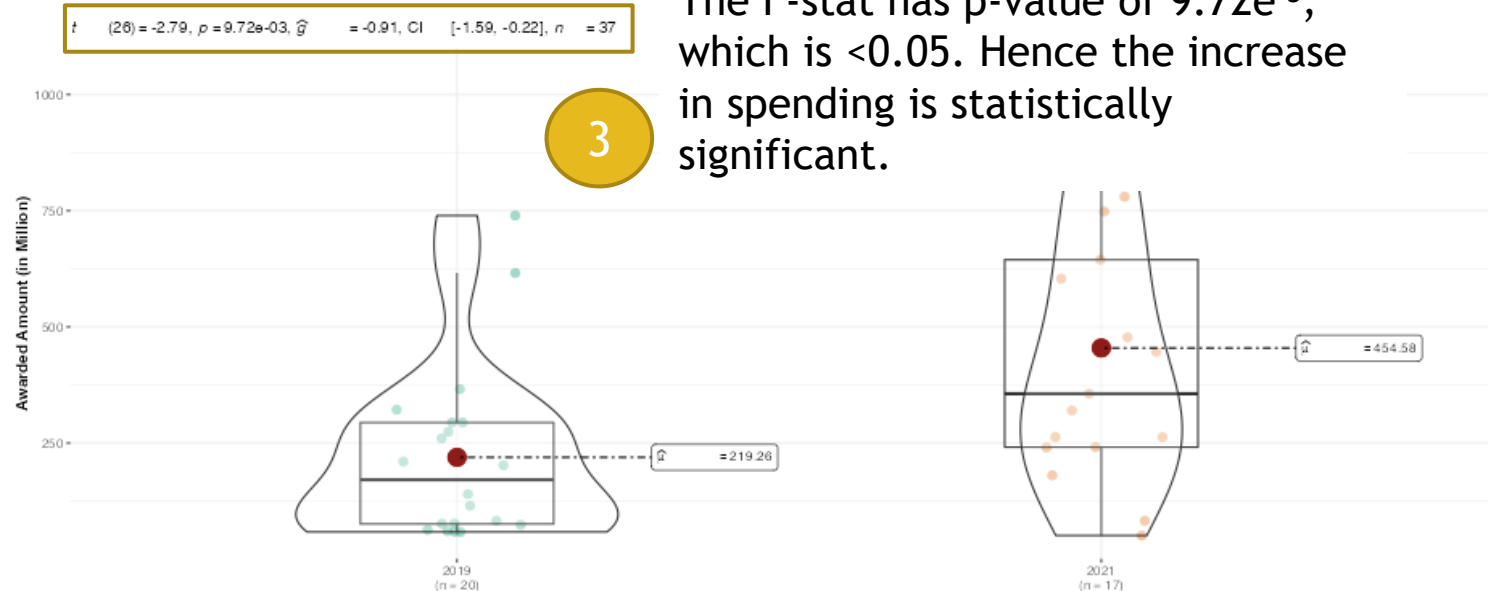
VIEW OF VIOLIN PLOT & PAIRWISE COMPARISON (AFTER FILTER)



1

Filter - This plot compares government procurement in Construction & upgrading for MRT lines & buildings

- 2021 (post-covid) and 2019 (pre-covid)
- Include only tender value above SGD50mil
- Filtered to procurement by Ministry of Transport (and its agencies)



3

F-stat

The F-stat has p-value of $9.72e^{-3}$, which is <0.05 . Hence the increase in spending is statistically significant.

2

Percentile plot

In this illustration, we are able to see the box plot indicating the percentile range.

The **red dot** indicate the mean, which is SGD 454.5 mil in 2021, and SGD 219.2 in 2019.

5. Pairwise Comparison of means using ANOVA

► EXAMPLE 2

VIEW OF VIOLIN PLOT & PAIRWISE COMPARISON (AFTER FILTER)

Select Category
Facilities Management for Schools & Parks

Select Ministry
All

Select Type of Bid
Tender - High

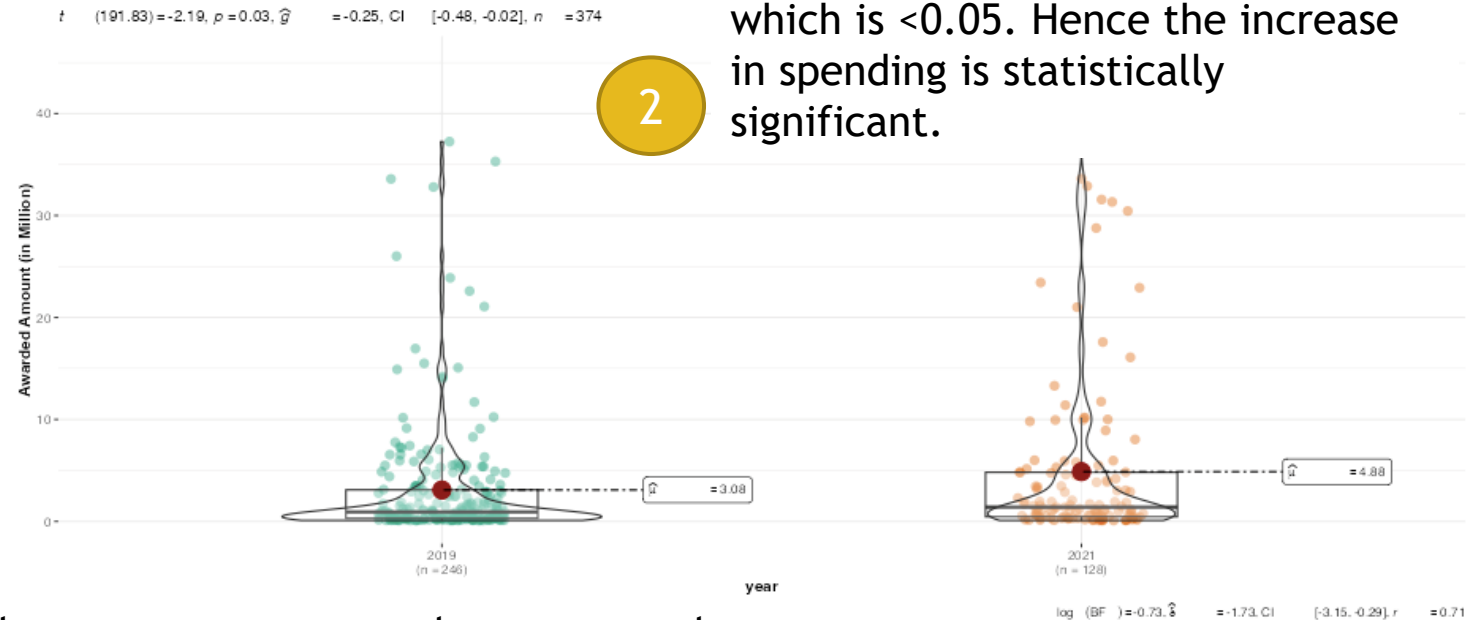
Select Tender Value (in millions)
0 - 50 1,500

Select Year
2019 2021

1

Filter - This plot compares government procurement in Facilities Management for Schools and Park

- 2021 (post-covid) and 2019 (pre-covid)
- Include only tender value between SGD 90K (High Value Tender) to SGD50mil (filtered outlier)
- All Ministries and Agencies are included in this analysis



F-stat

The F-stat has p-value of 0.03, which is <0.05 . Hence the increase in spending is statistically significant.

THANK YOU

Group 8

Chang Xin Xin Eda

Willie Lau Zhi Yong

Wang Kunrui (Olivia)

