Project Details

Project Motivation

Government Electronic Business (GeBIZ) is Singapore Government's one-stop e-procurement portal, created to facilitate transparency in procurement requirements, procedure, and evaluation. Purchases can either be centralised (ministries and government agencies will then purchase off service-wide contracts) or decentralised. GeBIZ encompasses the public sector's request for quotations and tenders within the procurement procedure, except where emergency procurement procedures apply:

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

Summary of Procurement Procedure, source: GeBIZ

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 categorise the products or services from the raw text provided by GeBIZ, thereby generating powerful insights on government procurements. This treasure trove has not been widely explored or utilized (at least publicly) and through a R Shiny application, we seek to explore meaningful insights that can aide anyone looking into government procurements, be it the government agencies themselves, the suppliers keen on participating in government tenders, or even a member of the general public with an interest to see one facet of how tax dollars are spent.

Problems

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 and deep dive into the areas including but not limited to:

1. Categorizing the records from its current raw text form; identify goods or services which are required by the government. This is crucial to enable practical use of the dataset by any user group.
    a. Examine and forecast time-series trends in procurement spend; is there any truth in the hypothesis that organizations tend to spend more liberally at the end of budgeting period?
    b. Is there any difference in GeBIZ procurement during the Covid period (identified as April 2020 to March 2022 by the Auditor-General's Office), when emergency procurement procedures were utilized?
2. The dataset from GeBIZ is limited in scope; expand the scope beyond the seven variables
    a. Enrich the dataset by labeling the Ministry which each Government Agency belongs to
    b. Enrich the dataset with additional information on the supplier (i.e. primary industry, paid-up capital)

3. Explore any bias in terms of frequency of using the same supplier that could highlight a need to investigate if this is with or without good reason.

Relevant Related Work

It seems that there is a business intelligence tool named GeBIZ Insight that existed but it is either entirely an internal tool or for some other reason cannot be publicly found anymore.

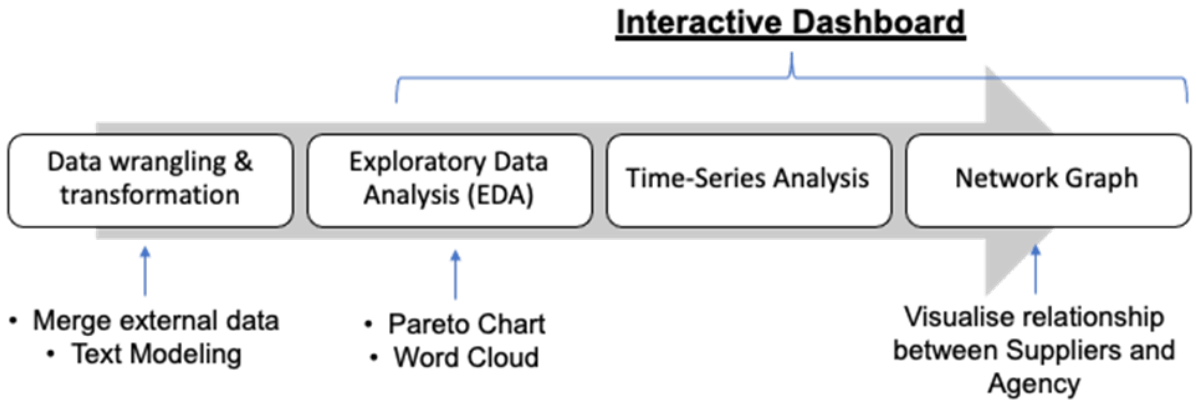
Other previous works include an earlier ISSS608 class project in 2018 which provided network visualization between ministry, agency and supplier. The visualization supported inter- and intra-agency opportunities for information sharing and bulk negotiation with suppliers. A potential challenge to previous use case may arise due to variances in product or service and project size.

To enrich ministerial / agency understanding of opportunities, this project will approach the dataset from the perspective of products and services. In addition, we look to enrich the procurement data with ACRA information on industry classification and paid-up capital. This will enable the public and corporate bidders to understand any other underlying relationship between the successful bidder and project type. It will also be interesting to see if the insights generated 5 years ago have changed since the world has drastically changed with the COVID pandemic and other global events.

Data Description

Data will be drawn mainly from data.gov.sg and supplemented by GeBiz portal and Singapore Government Directory. We will extract the open tenders put out by government agencies from years Jan 2017 to March 2022. The main dataset will consist of 7 columns such as tender description, awarded date, awarded amount, supplier and agency information. We will also be extracting 'ACRA Information on Corporate Entities' from data.gov.sg to supplement supplier's information on industry classification (Primary SSIC code & description) and paid-up capital.

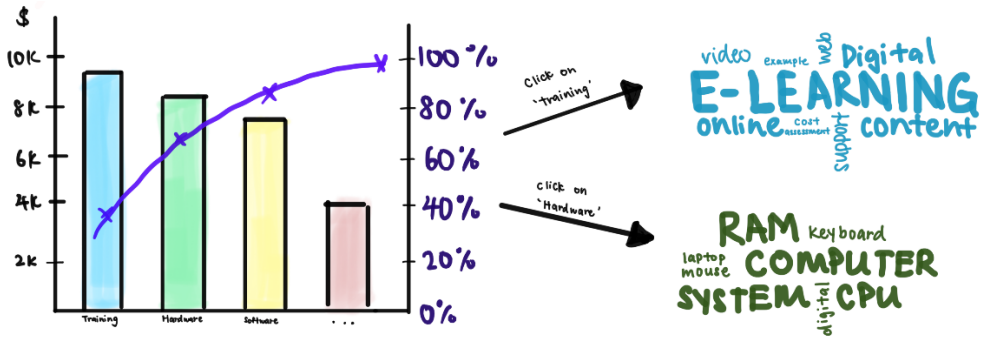
Data Preparation & Story Board



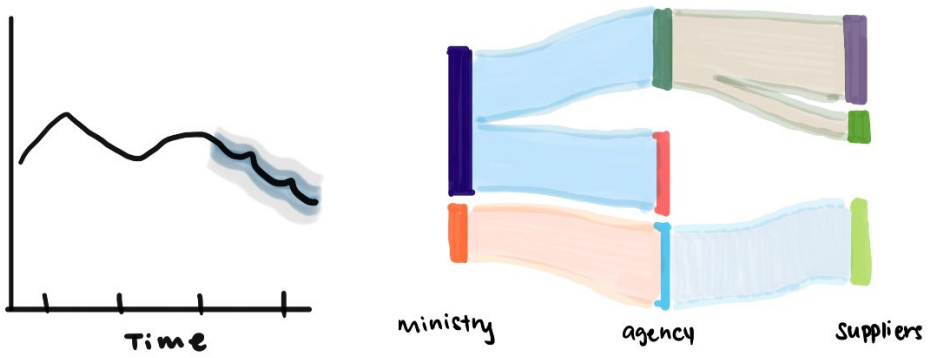
1. Data wrangling and Transformation
    a. Merge data from GeBiZ and ACRA into Government Procurement dataset
    b. Use topic modeling to analyze procurement text and determine cluster words relevant to products or services

2. Exploratory Data Analysis (EDA)
    a. Pareto Charts to visualize total amount awarded on each category

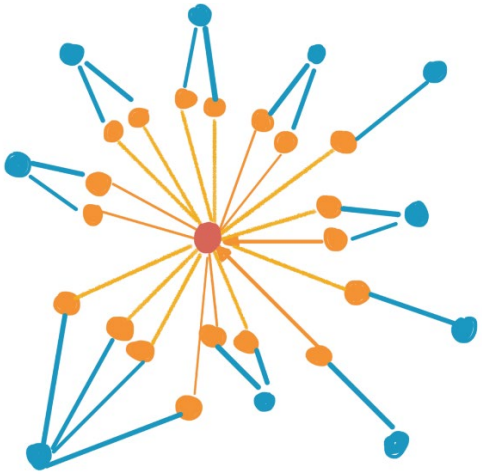
b. Interactive wordcloud to identify related key words to each category



3. Time-Series Analysis
    a. Time-series analysis to explore the relationship between calendar year period and volume/value of awarded contracts
    b. Predictive forecast of procurement spending by product / service
    c. Sankey diagram to show flow of spending from ministry to supplier, by procurement category



4. Cluster Analysis
    a. Network Analysis of the different ministries/agencies vs suppliers to investigate their connectivity and any strong links or bias

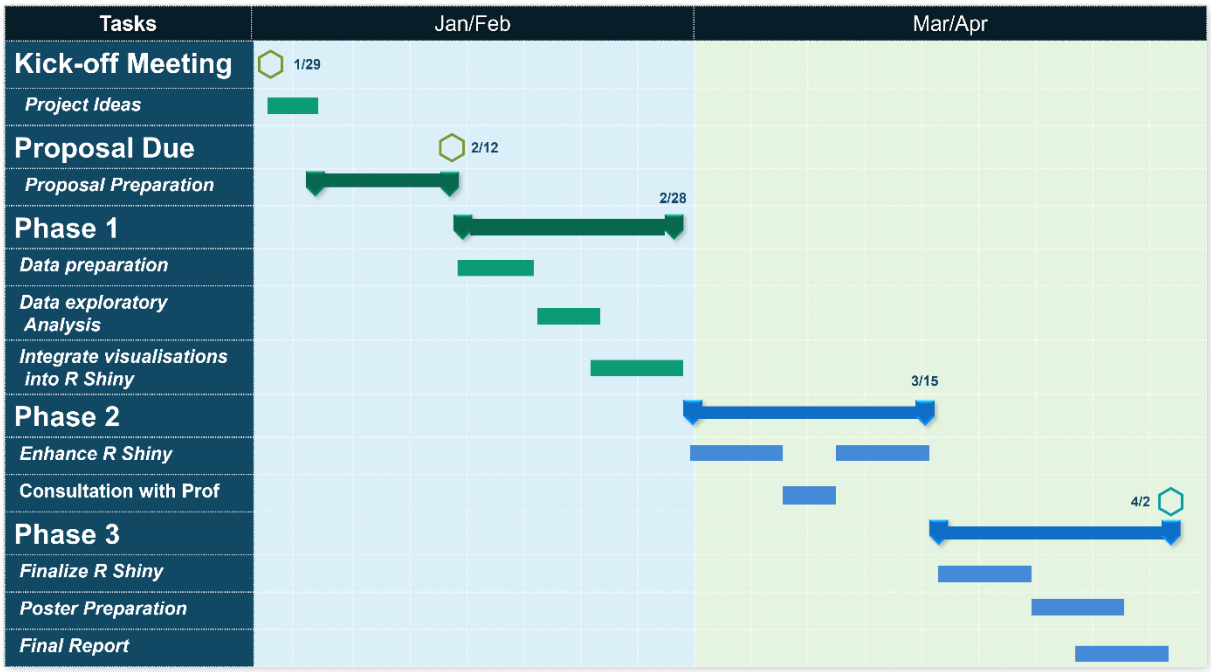


R Packages

The software used for this project is R, and the R packages that will be applied for the dashboard application are:

Packages	Purpose
Shiny and Shiny dashboard	To build interactive web application and visualisations
Spacyr	To tokenize and tag common product or services
Tidyverse	To tidy up and manipulate the data
Plotly	To create interactive graphs
ggplot2	To create static graphs
knitr	Dynamic report generation with R
ggstatsplot	To create graphics with details from statistical tests
visNetwork	To create network visualization
tm_map, wordcloud2	To create word cloud
crosstalk	To link different plots
LDAvis	To visualize and interpret topic models

Project Milestones



References

Auto, H. (2022, July 20). *Auditor-General's Office report: 8 key findings | The Straits Times*. www.straitstimes.com. https://www.straitstimes.com/singapore/eight-key-findings-in-agos-report

GeBIZ | Guide to Singapore Procurement. (n.d.). www.gebiz.gov.sg. https://www.gebiz.gov.sg/singapore-government-procurement-regime.html

Group17 Overview - Visual Analytics and Applications. (n.d.). Wiki.smu.edu.sg. Retrieved February 12, 2023, from https://wiki.smu.edu.sg/1718t3isss608/Group17_Overview

Government Procurement. (n.d.). MOF. Retrieved February 12, 2023, from https://www.mof.gov.sg/policies/government-procurement