



Procurement Management of the Resources Used During the First Quarter by Philippine Government Agencies as Response Measures to the COVID-19 Pandemic in the Bicol Region

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ABSTRACT

The purpose of this study is to analyze and evaluate how resources are managed to address the COVID-19 pandemic using the open government procurement data. In this paper, the team pre-processed procurement datasets from the official Philippine Government E-Procurement System (PhilGEPS) repository from January to March 2021 and April to June 2021. The study focuses entirely on Covid-19 procurements and excludes non-Covid related procurements. The data and visualizations demonstrated the items procured during the first quarter of Covid-19 pandemic, transaction details of the procured items, Covid related procurements per month of 2021 and procured items per business category and area of delivery.

CASE INTRODUCTION

With the rampant spread of COVID-19, an infectious disease that is caused by SARS-CoV-2, a large number of people are becoming infected worldwide, including in the Philippines and the Bicol Region. And in this time of the pandemic, the availability of life-saving goods and services like testing kits and other medical supplies is essential in the fight against COVID-19. As a result, it is critical to assist the health response, including the purchase, allocation, and administration of necessary health facilities and products, while also ensuring that the consumption of such restricted resources is managed properly. In this regard, the study was carried out to analyze available data from Philippines Government E-Procurement System (PhilGEPS) to assess how these resources are managed.

The study focuses mainly to determine and analyze the procurement transactions of the different Philippines Government Agencies as response measures during the COVID-19 pandemic occurrence in Region V.

WHY COVID-19

COVID-19 has been around for almost two years now and affected many aspects of our day to day lives. As of November 6, 2021, the Philippines recorded more than 2.8 million confirmed cases of COVID-19 with more than 43,800 deaths.

SCOPE AND DELIMITATION

The dataset obtained from the PhilGEPS portal is assumed to be official and correct in this study. Inaccuracies introduced by the PhilGEPS dataset itself will not be taken into account.

METHODOLOGY

Data Source

Our data is obtained from the Philippine Government Electronic Procurement System (PhilGEPS). PhilGEPS is a "single, centralized electronic platform that acts as the primary and definitive source of government procurement information" (Philgeps, 2018). Since agencies are required to use the system in the conduct of procurement information, it helps to collect the best data suitable for our topic.

DATA PREPARATION

Data scraping

Data was scraped from the PhilGeps website in the Bid Notice and Award Details for the year 2021, which covers the months of January to March, and April to June. The total number of datasets obtained for procurement data was 567, 206. However, focusing solely on COVID -19 procurements and deleting non-COVID-related procurements resulted in only 2,142 datasets.

Data Processing

We import the datasets into R, as well as install and load R packages. The readr package includes functions for importing and reading rectangular data into R data frames, such as comma-separated values (CSV). We will also need these following packages: Plotly package for the data visualization, dplyr for data transformation, lubridate for date manipulation, and data.table package an extension of data.frame.

```
library(readr)
library(plotly)
library(dplyr)
library(lubridate)
library(data.table)
```

The dplyr package contains a set of tools for manipulating datasets. The two datasets were combined into one data frame using the rbind function, producing 567,206 datasets.

```
dataa <- read_csv("Bid Notice and Award Details Jan-Mar 2021.csv")
datab <- read_csv("Bid Notice and Award Details Apr-Jun 2021.csv")
datal <- rbind(dataa, datab) %>% distinct()  # Merge the 2 <u>dataset</u> and remove duplicates
```

This also includes filtering PhilGeps procurement data to see if it's COVID - related based on notice titles, item names, and descriptions. Filtering involves determining the fields that are relevant to the data analysis, such as the area of delivery.

```
# Cleaning the data (To remove all procurements that is not from BICOL Region)
data3 <- filter(data2, Area.of.Delivery=="Camarines Sur" |
    Area.of.Delivery=="Albay" |
    Area.of.Delivery=="Sorsogon" |
    Area.of.Delivery=="Masbate" |
    Area.of.Delivery=="Camarines Norte" |
    Area.of.Delivery=="Camarines Norte" |
    Area.of.Delivery=="Catanduanes") %>%
```

Data Visualization

Each significant finding was visualized by organizing data into an easier-to-understand form and making the appropriate conclusions from the results.

RESULTS AND VISUALIZATION

We included the following items/procurement rows related to COVID:

From the PhilGEPS dataset, we selected all rows wherein the procuring entity is related to COVID. We only take rows from 2021, resulting in a total of 567,206 items in the record, 120,123 of them recorded as successfully awarded. Among these, we have 2207 items related to COVID, 793 are recorded as successfully awarded, and 133 of them are located in Bicol.





Among the 133 line items, 74 line items were procured through Negotiated Procurement, 48 on Shopping, and 11 on Public Bidding. Breaking down the 74 Negotiated Procurement, there are 22 that were successfully awarded, and 52 that were closed. What are these failed negotiated procurement? 51 of them are goods, with only 1 civil works.

As for 48 Shopping Procurement, only 4 were successfully awarded and a total of 44 were closed/canceled. Lastly, for the 11 public bidding procurements, 2 are currently active and a total of 9 were deemed unsuccessful.



Figure 2: All Negotiated Procurement Items: Awarded VS Failed

Notice Status Goods Civil Works



Figure 3: Classification for the line items that have not been awarded



Figure 4: All Failed Line Items by Business Category

Figure 4 shows the breakdown of these 105 failed line items by Business Category. We see that the majority of the failed bidding line items belong to Hardware and Construction Supplies, closely followed by General Merchandise, and then Medical Supplies and Laboratory Instrument, Laboratory Supplies, Catering Services, and so on.

Items Procured During the First Quarter by Government Agencies as Response Measures to COVID-19 Pandemic

The items procured in terms of the business category by various government agencies as represented by the four (4) organization types are shown in Figure 5.



Figure 5: Items Procured Along with Organization Type and Business Category

Results revealed that the hospital's top procurement priorities during the first quarter of 2021 as prevention and response for Covid-19 were hardware and construction supplies, general merchandise such as other supplies, printing, information materials, and the like. Medical supplies and laboratory instruments were found to be the next top-most procured items by the various government agencies mainly by LGUs. Closely followed by catering services which were found to be the only one procured by all government agencies. It is good to note that hospitals took the lead in taking their initiative for the prevention of the spread of the virus.



Figure 6. The Procured Item Business Category and Its Area of Delivery

In Figure 6, findings showed that Albay had made the greatest number of procured items on almost all business categories particularly on hardware and construction supplies, and general merchandise during the first quarter of 2021. Camarines Sur also had a big count of purchases on medical supplies and laboratory instruments, general merchandise, and so with the other item categories. Next to it were Camarines Norte with communication equipment & parts and accessories, and catering services respectively.

Transaction Details of the Procured Items



Figure 7. The Funding Source and Instrument and Procurement Mode

Majority of the funding instruments of the procured items as reflected in Figure 7 are found on General Appropriations Act (GAA) whereas the Government of the Philippines (GOP) is its major funding source, and shopping as its major procurement mode followed by negotiated procurement.



Figure 8: Area of Delivery by Frequency & Area of Delivery by Contract Amount (Awarded)

Most frequent delivery area goes to Albay, with a total contract amount of P10.63M, followed by Camarines Sur, with only a total of P15,408. Next is Camarines Norte, whereas second in terms of amount totalling to P643,550. Camarines Sur has a greater number of procurements but has the least contract amount compared to Camarines Norte, the reason for this is because out of the 22 procurements in Camarines Sur, only one was awarded.

Business Category By Amount



Figure 9: Business Category along with the Approved Budget

What business category do they spend the most money on?

As to the budget utilization for Covid related procurements, they spent most on construction projects amounting to P4.69M, followed by grocery items which is found to be one of the most procured items by the LGUs to address the need of the displaced families and individuals with an approved budget amounting to P2.77M, and the least amount spent is on Janitorial Supplies totalling to only P15,409.



Figure 10. The Award Type and Reason for Award

As part of the procurement process, based on the procurement details on the first quarter of this year, most of the Award Type granted was on Award Notice as presented which was evidently shown in Figure 10. Notably, the Lowest Calculated and Responsive Bidder (LCRB) and the Responsive Quote were the top main reasons for giving the award to the concerned suppliers as shown also in the Figure. For the Award Notice of Negotiated Procurement, prevention and control activity to Covid-19 pandemic was the top reason for the award, closely followed by SCRB and the declaration of a state of calamity due to the Covid-19 pandemic.

CONCLUSION

The study concluded that, despite the fact that local governments had made the most procurement of medical supplies and laboratory equipment during the first quarter of 2021, the various government agencies had made only minor procurement of covid-related items in preparation for the pandemic. In addition, the findings also indicate that the most procured items were on construction projects.

RECOMMENDATION

By accessing the open government procurement data, the goal of this study is to analyze and evaluate how resources are managed to address the COVID-19 pandemic. Thus, the following recommendations are hereby presented:

- 1. Since the government manages emergency public procurement, COVID-19 procurement strategies must be quickly updated to form a global, digital, and data-driven plan. This will play a major role in how COVID-19 is contained and how many lives can be saved.
- 2. Amidst the COVID-19 crisis, it is significant to be transparent and accountable. The researchers recommend publishing the procurement data in public to be able to detect the fraud and to know the services that are performed among the citizens and government. Additionally, this study suggests having public access to data in the online platform, specifically on the DOH-ROV website, where the citizens are able to gather data and witness the transactional data events.

REFERENCES

- PhilGeps Bid Notices and Award Notices Datasets: https://notices.philgeps.gov.ph/opendataSRD.html
- The Philippine Government Precautionary Measures Through Procurement of COVID-19 Related Items: <u>https://www.ocdex.tech/the-philippine-government-precautionary-measures-through-procurement</u> <u>-of-covid-19-related-items/?fbclid=IwAR2j6PYYHGv7CMqfU-ksB4zKrUM4Gb-wPhJrNQdLg6</u> <u>qtxDT2fNb_XYO-NcA</u>
- Procurement Business Intelligence: Identifying Time Compliance, Bottlenecks, In Philippine Procurement Stages: https://docs.google.com/viewerng/viewer?url=https%3A%2F%2Fwww.ocdex.tech%2Fwp-conten t%2Fuploads%2F2020%2F01%2FCOMPLIANCE-CHECK-USING-PROCUREMENT-DATA-S TATE-UNIVERSITY-1.1.pdf&hl=en&fbclid=IwAR2DGraqFSs3VOe5Mf9x9jdnLKYvnGahAdc EnYeydgVusZYeSUKtqkrs-80
- Procurement Management of the Resources Used on Testing COVID-19 Cases in the Bicol Regional Diagnostic and Reference Laboratory (BRDRL): <u>https://www.ocdex.tech/procurement-management-of-the-resources-used-on-testing-covid-19-cas</u> <u>es-in-the-bicol-regional-diagnostic-and-reference-laboratory-brdrl/</u>

APPENDIX

Data Preparation.R

library(readr) library (plotly) library(ggplot2) library(dplyr) library(lubridate) library(reshape2) setwd("~/Desktop/Case Study 1") dataa <- read csv("Bid Notice and Award Details Jan-Mar 2021.csv") datab <- read csv("Bid Notice and Award Details Apr-Jun 2021.csv")</pre> data1 <- rbind(dataa, datab) %>% distinct() # Merge the 2 dataset and remove duplicates data1awarded <- filter(data1, Notice.Status == "Awarded")</pre> d1 <data1[grep("COVID|COVID-19|ANTI-COVID|Covid|covid|covid-19|Covid-19|anti-c ovid|Anti-covid|Anti-Covid|, data1\$Notice.Title),] # Find the Covid Related Procurements and <d2 data1[grep("COVID|COVID-19|ANTI-COVID|Covid|covid|covid-19|Covid-19|anti-c ovid|Anti-covid|Anti-Covid", data1\$Item.Name),] # move to new data frame d3 < data1[grep("COVID|COVID-19|ANTI-COVID|Covid|covid|covid-19|Covid-19|anti-c ovid|Anti-covid|Anti-Covid", data1\$Item.Desc),] d4 <- rbind(d1, d2, d3) # Merge dataframes data2 <- distinct(d4)</pre> # Remove duplicates

data2awarded <- filter(data2, Notice.Status == "Awarded") # Dataframe for awarded procurements only (All Region)

Cleaning the data (To remove all procurements that is not from BICOL Region) data3 <- filter(data2, Area.of.Delivery=="Camarines Sur" | Area.of.Delivery=="Albay" | Area.of.Delivery=="Sorsogon" | Area.of.Delivery=="Masbate" | Area.of.Delivery=="Camarines Norte" | Area.of.Delivery=="Camarines Norte" | Area.of.Delivery=="Catanduanes") %>%

select (Organization.Name, Reference.ID, Notice.Title:Procurement.Mode,

Area.of.Delivery, Approved.Budget.of.the.Contract, Item.Name, Item.Desc,

Notice.Status:Award.Type, Contract.Amount, Reason.for.Award, -Award.No.)

data3awarded <- filter(data3, Notice.Status == "Awarded") # Dataframe for awarded procurements only (Bicol Region)

#write.csv(data3, "data3.csv")

Figure 1-3.R

- # Figure 1-3
- # Clean Data

```
fig123 <- data3
```

fig123\$Procurement.Mode[fig123\$Procurement.Mode =="Negotiated Procurement"
- Community Participation (Sec. 53.12)"] <- "Negotiated Procurement"</pre>

fig123\$Procurement.Mode[fig123\$Procurement.Mode =="Negotiated Procurement
- Emergency Cases (Sec. 53.2)"] <- "Negotiated Procurement"</pre>

fig123\$Procurement.Mode[fig123\$Procurement.Mode =="Negotiated Procurement
- NGO Participation (Sec. 53.11)"] <- "Negotiated Procurement"</pre>

fig123\$Procurement.Mode[fig123\$Procurement.Mode =="Negotiated Procurement
- Small Value Procurement (Sec. 53.9)"] <- "Negotiated Procurement"</pre>

fig123\$Procurement.Mode[fig123\$Procurement.Mode =="Shopping Ordinary/Regular Office Supplies & Equipment (Sec. 52.1.b)"] <- "Shopping"</pre>

fig123\$Classification[fig123\$Classification == "Goods - General Support
Services"] <- "Goods"</pre>

Group by Procurement.Mode, Notice.Status, Classification

cfig123 <- count(fig123, Procurement.Mode, Notice.Status, Classification)

Function for sunburst plotting

cfig123 <- as.sunburstDF(cfig123, value column = "n", add root = TRUE)

Plot

plot ly(data = cfig123, ids = ~ids, labels= ~labels,

parents = ~parents, values= ~values,

type='sunburst', branchvalues = 'total')

Cant explain this function as I only found this on the internet and modified it

Basically this is a function based on library(data.table) to prepare the data, accepting two different data.frame input formats.

```
as.sunburstDF <- function(DF, value_column = NULL, add_root = FALSE){
    require(data.table)</pre>
```

colNamesDF <- names(DF)</pre>

```
if(is.data.table(DF)) {
       DT <- copy(DF)
    } else {
        DT <- data.table(DF, stringsAsFactors = FALSE)</pre>
    }
    if(add root){
        DT[, root := "Total"]
    }
    colNamesDT <- names(DT)</pre>
    hierarchy columns <- setdiff(colNamesDT, value column)</pre>
        DT[, (hierarchy columns) := lapply(.SD, as.factor), .SDcols =
hierarchy columns]
    if(is.null(value column) && add root){
        setcolorder(DT, c("root", colNamesDF))
    } else if(!is.null(value column) && !add root) {
        setnames(DT, value column, "values", skip absent=TRUE)
        setcolorder(DT, c(setdiff(colNamesDF, value column), "values"))
    } else if(!is.null(value_column) && add_root) {
        setnames(DT, value_column, "values", skip_absent=TRUE)
             setcolorder(DT, c("root", setdiff(colNamesDF, value column),
"values"))
    }
   hierarchyList <- list()</pre>
```

for(i in seq_along(hierarchy_columns)){

```
current columns <- colNamesDT[1:i]</pre>
```

```
if(is.null(value_column)){
    currentDT <- unique(DT[, ..current_columns][, values := .N, by
= current_columns], by = current_columns)
    } else {
        currentDT <- DT[, lapply(.SD, sum, na.rm = TRUE),
by=current_columns, .SDcols = "values"]
    }
    setnames(currentDT, length(current_columns), "labels")
    hierarchyList[[i]] <- currentDT
}
hierarchyDT <- rbindlist(hierarchyList, use.names = TRUE, fill = TRUE)</pre>
```

parent_columns <- setdiff(names(hierarchyDT), c("labels", "values", value_column))

```
hierarchyDT[, parents := apply(.SD, 1,
function(x){fifelse(all(is.na(x)), yes = NA_character_, no =
paste(x[!is.na(x)], sep = ":", collapse = " - "))}), .SDcols =
parent_columns]
```

```
hierarchyDT[, ids := apply(.SD, 1, function(x){paste(x[!is.na(x)],
collapse = " - ")}), .SDcols = c("parents", "labels")]
hierarchyDT[, c(parent_columns) := NULL]
return(hierarchyDT)
```

```
}
```

Figure 1.R

Figure 1
Projects per Procurement Method

fig1 <- data3

```
# Narrowing down the mode of procurement for easy grouping
figl$Procurement.Mode[figl$Procurement.Mode =="Negotiated Procurement -
Community Participation (Sec. 53.12)"] <- "Negotiated Procurement"
figl$Procurement.Mode[figl$Procurement.Mode =="Negotiated Procurement -
Emergency Cases (Sec. 53.2)"] <- "Negotiated Procurement"
figl$Procurement.Mode[figl$Procurement.Mode =="Negotiated Procurement -
NGO Participation (Sec. 53.11)"] <- "Negotiated Procurement"
figl$Procurement.Mode[figl$Procurement.Mode =="Negotiated Procurement -
Small Value Procurement (Sec. 53.9)"] <- "Negotiated Procurement"
figl$Procurement.Mode[figl$Procurement.Mode =="Shopping - Ordinary/Regular
Office Supplies & Equipment (Sec. 52.1.b)"] <- "Shopping"</pre>
```

fig1 <- count(fig1, Procurement.Mode) ## Group by Procurement Mode</pre>

Plot

pfig1

Figure 2.R

```
# Figure 2
# Awarded VS Failed
fig2 <- count(data3, Notice.Status) # Group By Notice Status
# Plot
pfig2 <- plot_ly(fig2, labels = ~Notice.Status, values = ~n, type = 'pie',
        texttemplate= "%{label}: %{value:}", hole = 0.3) %>%
layout(title = 'All Line Items: Awarded VS Failed',
        legend = list(orientation = 'v',
```

pfig2

Figure 3.R

Figure 3

Classification for the line items that have not been awarded

```
fig3$Classification[fig3$Classification == "Goods - General Support
Services"] <- "Goods" # Rename</pre>
```

cfig3 <- count(fig3, Notice.Status, Classification) # Group By Classification

Plot

```
pfig3 <- plot_ly(cfig3, labels = ~Classification, values = ~n, type =
'pie',</pre>
```

texttemplate= "%{value:}", hole = 0.4) %>%

```
layout(legend = list(orientation = 'v',
```

```
title=list(text='<b>Notice Status</b>')))
```

pfig3

Figure 4.R

- # Figure 4
- # Failed Items by Business Category

```
# Select only the Failed procurements
fig4 <- filter(data3, Notice.Status == "Cancelled" |</pre>
            Notice.Status == "Closed") %>%
    select(Business.Category, Notice.Status)
cfig4 <- count(fig4, Business.Category) # Group By Business Category
cfig4$ID <- seq.int(nrow(cfig4)) # Create a sequence number and put in a
new column
# Function for animation plotting
accumulate by <- function(dat, var) {</pre>
    var <- lazyeval::f eval(var, dat)</pre>
    lvls <- plotly:::getLevels(var)</pre>
    dats <- lapply(seq along(lvls), function(x) {</pre>
        cbind(dat[var %in% lvls[seq(1, x)], ], frame = lvls[[x]])
    })
    dplyr::bind rows(dats)
}
# Plot
df <- cfig4 %>% accumulate by(~ID)
pfig4 <- df %>% plot ly(
    x = ~Business.Category,
    y = ~n,
    frame = ~frame,
    type = 'scatter',
    mode = 'lines+markers',
    fill = 'tozeroy',
    fillcolor='rgba(114, 186, 59, 0.5)',
    line = list(color = 'rgb(114, 186, 59)'),
    marker = list(color = 'rgb(114, 186, 59)', size = 3)
```

```
)
pfig4 <- pfig4 %>% layout(
   title = "Failed Line Items by Business Category",
    yaxis = list(
       title = "",
        range = c(0, 60),
        zeroline = F
    ),
    xaxis = list(
        title = "",
        range = c(0, 31),
        zeroline = F_{,}
       showgrid = F
    )
) %>% animation_opts(
    frame = 100,
   transition = 0,
   redraw = FALSE
) %>% animation slider(
   hide = T
) %>% animation_button(
    x = 1, xanchor = "right", y = 0,
   yanchor = "bottom"
)
```

```
pfig4
```

Figure 5.R

Figure 5

Items Procured Along Organization Type and Business Category

fig5 <- data3 %>% select(Organization.Name, Business.Category)

cfig5 <- fig5 %>% count(Organization.Name, Business.Category) # Group By
Organization.Name and Business.Category

Categorize Organization Name by Organization Type

school <- cfig5[grep("SCHOOL|UNIVERSITY|COLLEGE", cfig5\$Organization.Name),] lgu <- cfig5[grep("CITY|MUNICIPALITY|PROVINCE|GOVERNMENT", cfig5\$Organization.Name),] offices <- cfig5[grep("DEPARTMENT", cfig5\$Organization.Name),] hospital <- cfig5[grep("HOSPITAL", cfig5\$Organization.Name),]</pre>

Rename all the categorized org name to its org type school\$Organization.Name <- "School" lgu\$Organization.Name <- "LGU" offices\$Organization.Name <- "Office" hospital\$Organization.Name <- "Hospital"</pre>

cfig5 <- rbind(school, lgu, offices, hospital) # Merge the categorized data

Plot

config(displayModeBar = FALSE)%>%

layout(title = 'Items Procured Along Organization Type and Business
Category',

```
xaxis = list(title = 'Business Category'),
yaxis = list(title = ''),
barmode = 'stack',
```

legend = list(title=list(text='Organization Type')))

fig5plot

Figure 6.R

Figure 6

The Procured Item Business Category and Its Area of Delivery

fig6 <- data3 %>% select(Business.Category, Area.of.Delivery)

```
cfig6 <- fig6 %>% count(Business.Category, Area.of.Delivery) # Group by
Business.Category and Area.of.Delivery
```

Plot

fig6plot

Figure 7.R

Figure 7

The Funding Source and Instrument and Procurement Mode

fig7 <- count(data3, Funding.Instrument, Funding.Source, Procurement.Mode)
Groub by</pre>

Data cleaning

```
fig7$Procurement.Mode[fig7$Procurement.Mode =="Negotiated Procurement -
Community Participation (Sec. 53.12)"] <- "Negotiated Procurement"
fig7$Procurement.Mode[fig7$Procurement.Mode =="Negotiated Procurement -
Emergency Cases (Sec. 53.2)"] <- "Negotiated Procurement"
fig7$Procurement.Mode[fig7$Procurement.Mode =="Negotiated Procurement -
NGO Participation (Sec. 53.11)"] <- "Negotiated Procurement"
fig7$Procurement.Mode[fig7$Procurement.Mode =="Negotiated Procurement -
Small Value Procurement (Sec. 53.9)"] <- "Negotiated Procurement"
fig7$Procurement.Mode[fig7$Procurement.Mode =="Negotiated Procurement -
Small Value Procurement (Sec. 53.9)"] <- "Negotiated Procurement"
fig7$Procurement.Mode[fig7$Procurement.Mode =="Shopping - Ordinary/Regular
Office Supplies & Equipment (Sec. 52.1.b)"] <- "Shopping"</pre>
```

```
fig7 <- as.sunburstDF(fig7, value_column = "n", add_root = TRUE) #
Function for sunburst plot</pre>
```

Plot

```
plot_ly(data = fig7, ids = ~ids, labels= ~labels,
    parents = ~parents, values= ~values,
    type='sunburst', branchvalues = 'total',
    insidetextorientation='horizontal')
```

Figure 8.R

```
# Figure 8a
```

AoD Frequency

fig8a <- count(data3, Area.of.Delivery, Notice.Status) # Group by</pre>

Plot A

xaxis = list(title = 'Area of Delivery'), yaxis = list(title = 'Frequency'), legend = list(title=list(text='Notice Status:'), orientation = 'h'))

Figure 8b

Contract Amount awarded in every province of Bicol Region

fig8b <- data3 %>% select(Notice.Status, Area.of.Delivery, Contract.Amount) # Group by

fig8b\$Contract.Amount <- gsub(",", "", fig8b\$Contract.Amount) # Remove
comma</pre>

fig8b\$Contract.Amount <- as.numeric(fig8b\$Contract.Amount) # Convert to
numeric data type</pre>

Group by area of delivery and Find total contract amount

fig8bTotal <- aggregate(cbind(Contract.Amount)~Area.of.Delivery,</pre>

data=fig8b,FUN=sum)

fig8bTotal\$CA <- format(fig8bTotal\$Contract.Amount, big.mark=",", scientific=FALSE) # Put comma again to their original place

Plot B

```
pfig8b <- plot_ly(fig8bTotal, x = ~Area.of.Delivery, y = ~Contract.Amount,
type = 'bar',
    text = paste0('â,±',fig8bTotal$CA), textposition = 'outside',
    showlegend = F,
    marker = list(color = 'rgba(58, 71, 80, 0.6)',
    line = list(color = 'rgba(58, 71, 80, 1.0)',
    width = 3))) %>%
```

layout(title = 'Area of Delivery by Frequency & Area of Delivery by
Amount',

```
xaxis = list(title = 'Area of Delivery'),
yaxis = list(title = 'Contract Amount', tickprefix = "â,±"))
```

Subplot A and B

```
subplot(pfig8a, pfig8b, nrows = 2, shareX = T, shareY = T) %>%
config(displayModeBar = FALSE) %>%
layout(showlegend = T)
```

Figure 9.R

- # Figure 9
- # Business Category Spent Most

```
fig9 <- data3 %>% select(Business.Category, Contract.Amount) # Group by
```

```
fig9$Contract.Amount <- gsub(",", "", fig9$Contract.Amount) # Remove Comma</pre>
```

```
fig9$Contract.Amount <- as.numeric(fig9$Contract.Amount)  # Convert to
numeric</pre>
```

fig9Total <- aggregate(cbind(Contract.Amount)~Business.Category,</pre>

```
data=fig9,FUN=sum)
```

```
fig9Total$CA <- format(fig9Total$Contract.Amount, big.mark=",",
scientific=FALSE)
```

Plot

```
plot_ly(fig9Total, x = ~Business.Category, y = ~Contract.Amount, type =
'bar',
    text = paste0('â,±',fig9Total$CA), textposition = 'outside',
    marker = list(color = ~Contract.Amount)) %>%
    config(displayModeBar = FALSE) %>%
```

Figure 10.R

- # Figure 10
- # Data Cleaning

fig10 <- select(data3awarded, Award.Type, Reason.for.Award)</pre>

fig10\$Reason.for.Award[fig10\$Reason.for.Award=="to be use for the misting
machine during the conduct of daily spraying maintenance in CTC holding
area at Salugan, MHO, market area, LGU facilities, different offices and
other areas in the municipality in its prevention and control activity to
Covid-19 due to Covid-19 pandemic"] <- "Prevention and control activity to
Covid-19"</pre>

fig10\$Reason.for.Award[fig10\$Reason.for.Award=="due to Covid-19, to be use by MHO, municipal health emergency team and other concerned agencies/offices in its prevention and control activity to Covid-19"] <-"Prevention and control activity to Covid-19"

fig10\$Reason.for.Award[fig10\$Reason.for.Award=="SCRB, declaration of State
of Calamity, due to Covid-19"] <- "SCRB"</pre>

fig10\$Reason.for.Award[fig10\$Reason.for.Award=="SCRB, as per Municipal Resolution No. 120, S-2020 dated March 17, 2020 declaring under the state of Calamity"] <- "SCRB"</pre>

fig10\$Reason.for.Award[fig10\$Reason.for.Award=="declaration of state of calamity due to Covid-19 pandemic worldwide"] <- "Declaration of state of calamity
due to Covid-19 pandemic worldwide"

fig10\$Reason.for.Award[fig10\$Reason.for.Award=="declaration of state of calamity in the country due to Covid-19 Pandemic worldwide"] <-"Declaration of state of calamity
due to Covid-19 pandemic worldwide" fig10\$Reason.for.Award[fig10\$Reason.for.Award=="due to Covid19, to be for blood sampling of returning OFW and LSIs from other parts of the country and other countries"] <- "Prevention and control activity to Covid-19"</pre>

fig10\$Reason.for.Award[fig10\$Reason.for.Award=="said supplier is legally, technically and financially capable and has submitted the required documents."] <- "Said supplier is legally, technically and financially capable
and has submitted the required documents"

fig10\$Reason.for.Award[fig10\$Reason.for.Award=="lcrb"] <- "LCRB"</pre>

fig10\$Reason.for.Award[fig10\$Reason.for.Award=="LOWEST CALCULATED
RESPONSIVE BID"] <- "LCRB"</pre>
CALCULATED

fig10\$Reason.for.Award[fig10\$Reason.for.Award=="LOWEST DEALER/SUPPLIER"]
<- "Lowest dealer/supplier"</pre>

cfig10 <- count(fig10, Award.Type, Reason.for.Award) # Group by Award type</pre>

fig10 <- as.sunburstDF(cfig10, value_column = "n", add_root = TRUE) #
Sunburst function</pre>

Plot