OCDex

2020

PUBLIC PROCUREMENT ANALYTICS

A COMPILATION of CONCEPTS, METHODS, and USE-CASES in the PHILIPPINES

1st EDITION

Hivos
people unlimited

LAYER _TECH

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Acknowledgment

This handbook is a compilation of methods, results, and learnings of Layertech Labs' Procurement Analytics team and partners in the Philippines from years 2018-2020.

We would like to acknowledge the following partners, contributors and reviewers:

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Preface

Fair, transparent, and efficient government procurement benefits the public. In this information age, where insight generation from big data has proven to be powerful, using the tools of Data Analytics can help ensure integrity and transparency in public procurement.

From years 2018 to 2020, Layertech has worked under the support and grant of Hivos' Open Contracting programme on improving government procurement data use and disclosure. Layertech worked with the Local Government Unit (LGU) Legazpi city, academic institutions such as Bicol University and Southern Luzon Technological College, individual business owners and business organizations such as the Albay Chamber of Commerce and Industry, and Civil Society Organizations (CSO) such as Gayon Bicol LGBTQI organization and their regional network.

This compilation was produced to share experiences and methodologies of Layertech and partners, in mining government procurement data to answer advocacy-related questions of CSOs; to generate business insights; to help suppliers and procuring entities identify bottlenecks and inefficiencies in various procurement stages; and, to uncover trends and red flags in the procurement process.

Target readers of this handbook are assumed to have basic working competency in mathematics, statistics, and basic data manipulation. Working knowledge in coding such as in R and Python, would allow the reader to better appreciate the use-cases and replicate them.

Please NOTE that this handbook focuses on the data sources, filtering, and modelling methods used. Links to the papers (published AND manuscripts) are provided at the end of every use-case, and it is encouraged that the reader visit the links to view the full papers and studies. Some of the papers featured in this handbook may be updated, supplemented, and improved in the future.

A digital copy of this handbook is made available on the website: www.OCDEX.tech and www.LAYERTECHLAB.com.

Table of Contents

Introduction

The Handbook

This handbook provides sample cases and their corresponding Procurement Analytics methodologies. Part I of this handbook discusses introductory tools and concepts of open contracting, the procurement process, and a survey of documents, datasets, and tools used in the use cases in part II.

Part II discusses the actual case studies and their results. References are provided at the end of each case.

Part III of this handbook lists down references, related links, and resources for further reading. Some of the information contained in this handbook are highly dependent on specialized knowledge. However, effort to simplify explanations were undertaken by the contributors and editors.

Learning Objectives

This handbook can be used as a self-paced or group resource. Readers will explore how to:

- collect and process procurement datasets for decision support;
- observe basic techniques of procurement analytics in real-life Head Start examples;
- identify and articulate trends and patterns in data gathered over time;
- provide information from a variety of different backgrounds and levels of prior experience;
- create a "value-added" framework that presents strategies, concepts, procedures, methods and techniques in the context of real-life examples;
- appreciate that learning takes time and competence take practice.

Delimitations

This handbook does not attempt to address all possible procedures or methods of analytics or imply that it is limited to the contents of this handbook. Readers are urged to view this handbook as a beginning resource; to supplement their knowledge on applied procurement analytics procedures and methods over time as part of their on-going personal or professional development. In addition, procedures and methods introduced does not provide assurance on winning bids, bidding strategies are beyond the scope of this handbook. Finally, this handbook is not meant to replace domestic policies and procedures.

PROCUREMENT ANALYTICS, CONCEPTS, AND TOOLS
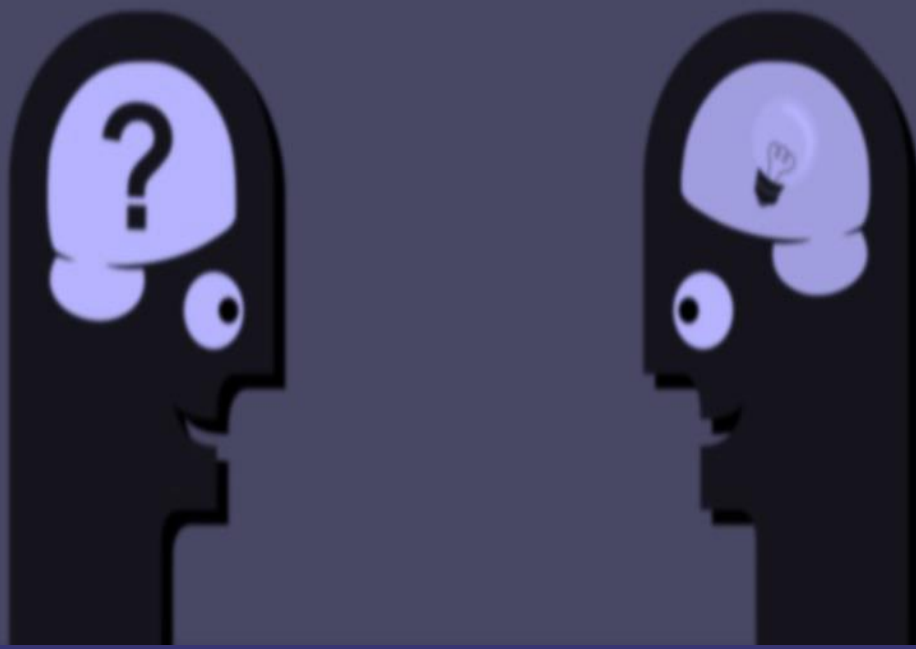
OPEN CONTRACTING

Each year, trillions of dollars are spent by governments procuring goods and services from private suppliers and individuals. A significant percentage of that fund is lost either by inefficiency, or corruption, or both.

An essential principle of Open Contracting is transparency through the publication and disclosure of information related to public tenders and contracts. This way, fairness of the procurement process may be constantly monitored by stakeholders, and hold governments accountable for how they spend public funds.

Open Contracting is all about following the money across the entire chain of public contracts to ensure fairness and accountability in the process.

OPEN GOVERNMENT DATA

Open data is a framework of data disclosure, such that it can be freely used, modified, and re-distributed, not subject to copyright, or similar restrictions.[1] According to definition[2], when we say a dataset is in "Open Data format", it means that the dataset is:
- ✓ Published in the Public Domain
- ✓ Downloadable online without charge
- ✓ Machine Readable
- ✓ No monetary or any similar restrictions on its use
- ✓ Can be processed with at least one open-source software tool

Open government data (OGD) is open data that is produced by authorized government institutions. Procurement datasets published in open data format is an example of OGD. In open contracting, processing OGD allows stakeholders to inspect, in detail, the entire chain of public procurement from planning, to tendering and award, and onto delivery and implementation.

OPEN CONTRACTING DATA STANDARD (OCDS)

OCDS is a data standard in JavaScript Object Notation (JSON) designed to facilitate publication and analysis of data and documents related to all stages of a contracting process. OCDS was developed by Open Contracting Partnership (OCP)[3] for a structured presentation of contracting data, to reflect the complete contracting cycle in a single, universal format. OCDS is an example of OGD.

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[1] Open Data Handbook. https://opendatahandbook.org/guide/en/what-is-open-data/
[2] Open Knowledge Foundation's Definition of "Open" works. https://opendefinition.org/od/2.1/en/
[3] OCP – http://www.open-contracting.org

OCDS describes in details the procedure of releasing contracting data and offers a framework for governments to continuously collect and publish their information. Using the standard, users and partners around the world can publish reusable, shareable, machine readable data, to join those data with their own ones and analyze or share them.

Figure 1 shows the high-level structure and information contained in OCDS format, and Table 1 shows the corresponding mapping of the OCDS information requirements to Philippine procurement documents.

01 - PLANNING
•Budgets, Project plans, Procurement Plans, Market Studies, Public Hearing Information

02 - TENDER
•Tender notices, Specifications, Line items, Values, Enquiries

03 - AWARD
•Award details, Bidder information, Bid evaluation, Values

04 - CONTRACT
•Final contract details, Signed contract, Amendments, Values

IMPLEMENTATION
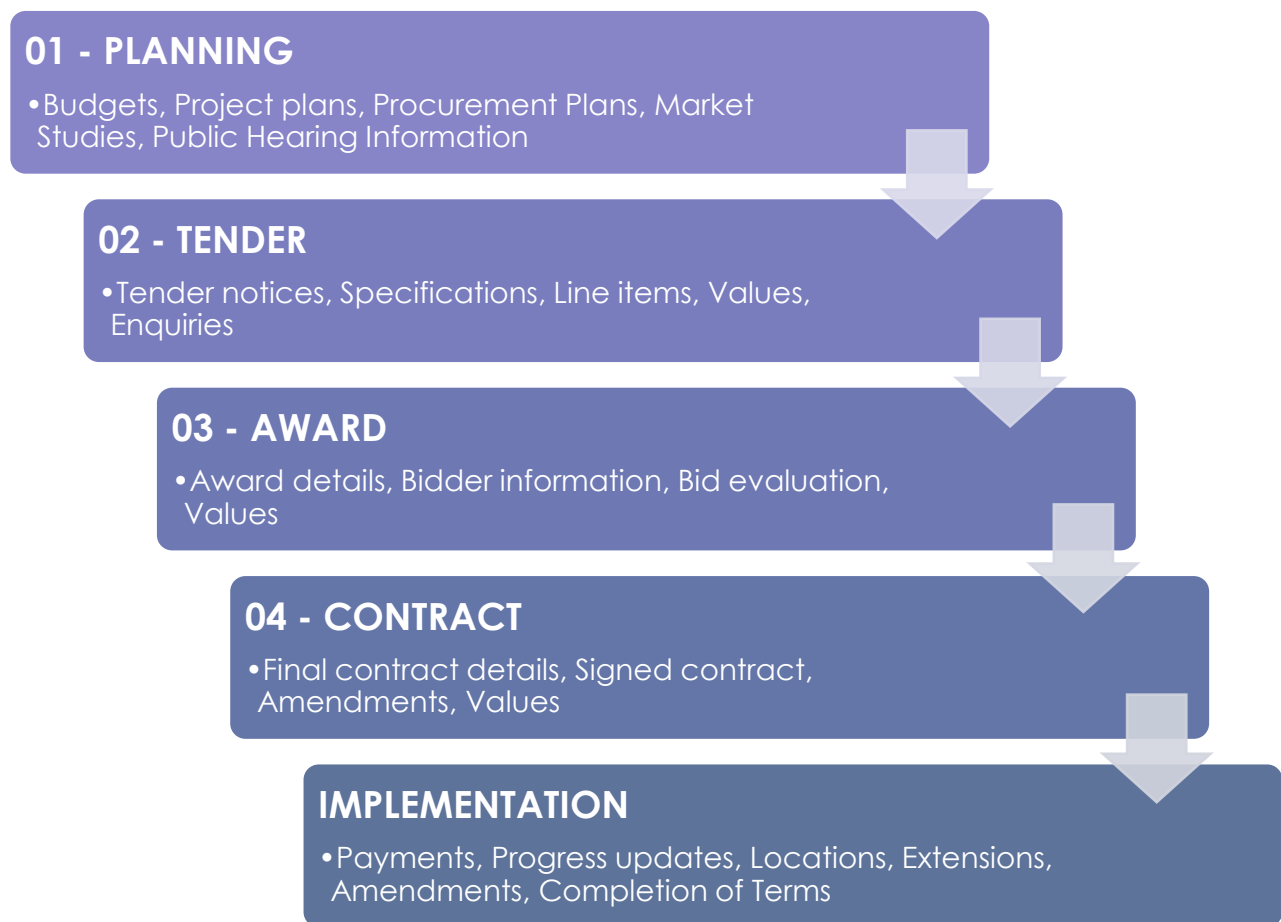•Payments, Progress updates, Locations, Extensions, Amendments, Completion of Terms

Figure 1: OCDS High Level Data Structure

Where to Get OCDS-prescribed information in Philippine procurement documents?

OCDS BASIC	OCDS INTERMEDIATE	OCDS ADVANCED
PLANNING STAGE		
Budget, Approved Annual Procurement Plan (APP), Approved Supplemental Annual Procurement Plan	Market Research, Market Analysis, Market Study, Environmental Impact Statement, Annual Statement of Indebtedness, payments and Balances (SIPB) (SDS), Bidding Document for Design and Build Scheme, Project Procurement Management Plans (PPMPs), Medium Term Public Investment Program (MTPIP), Regional Development Investment Plan (RDIP), Muti-Year Obligational Authority (MYOA), Needs analysis or Historical data, Feasibility Study, Technical Specifications, Scope of Work, Detailed Engineering, Program of work, Terms of Reference	
BIDDING STAGE		
Invitation to Bid (IB), Request for Expression of interest, Bid Documents, Technical Specifications, Scope of Work, Program of work, Terms of Reference, Detailed Engineering Document	Bid Documents, Bid Document: Form of Contract and General and Special Conditions of Contract, Supplemental Bulletin, List of Pre-selected suppliers or Consultants	Technical Envelope of Submitted Bid (List of Registered Suppliers, List of Registered Contractors, List of Licensed Contractors, List of Special Licenses Issued, List of Temporary Licenses Issued, List of Extended Government Registration Certificates Issued, PCAB License, DTI name registration papers, Sec Registration Papers) Omnibus Sworn Statement, Consolidated File of Blacklisted Suppliers, Contractors and consultants, Drawings, Envelope 1 and 2 of Submitted Bids as indicated in Instruction to Bidders, Letter of Withdrawal of Bid

AWARDING STAGE		
Notice of Award (NOA)	Abstract of Bids as calculated, Post Qualification Summary Report, BAC Resolution recommending the award	Technical and Financial Bid of winning bidder, Bid Results, request for reconsideration, BAC resolution resolving the protest, Bid Documents, Technical Envelope of Submitted Bid
CONTRACTING STAGE		
Notice to Proceed	Contract Agreement, Notice to Terminate, Bid Document: Completion Schedule or Delivery Schedule	Contract Agreement, Bid Security, performance security, Sub-contractor agreement
IMPLEMENTATION STAGE		
Certificate of Completion, Certificate of acceptance, Inspection and Acceptance Report	Project Implementation report, CPES Report, Annual Audit Report	

Table 1: OCDS Mapping to Philippine Documents

What are the Benefits of Using OCDS formatted Datasets?

- ✓ Makes analysis of contracting metadata more convenient and efficient;
- ✓ Renders data interoperable, and assures better link among multiple systems;
- ✓ A great tool in fighting corruption as it enables transparent data presentation and exchange;
- ✓ OCDS serves as a structured guide for procurement data collection.

IMPORTANCE OF E-GPS in PUBLIC PROCUREMENT and ANALYTICS

The World Bank e-Procurement Toolkit[4] defines e-GPS as:

"The collaborative use of information and communications technologies by government agencies, the bidding community, regulatory and oversight agencies, other supporting service providers, and civil society in conducting ethical procurement activities in the government procurement process cycle for the procurement of goods, works, and services and the management of contracts, thereby ensuring good governance and value for money in public procurement and contributing to the socioeconomic development of a country"

In performing analytics, an important first step is to identify data sources and define a systematic method for extracting the data it houses. In public procurement, E-GPS is a candidate for sourcing official procurement data.

Implementation of the Open Contracting Data Standard in e-GPS can streamline procurement analytics. By including the OCDS in e-GPS by design, or upgrading an existing system to account for OCDS, an e-GPS will become more transparent and also facilitate business intelligence, analysis, data sharing, and monitoring that will assist policy makers and procurement practitioners in improving value for money, integrity, fairness and performance of public contracts. Figure 2 outlines the benefits of implementing an OCDS module in e-GPS.
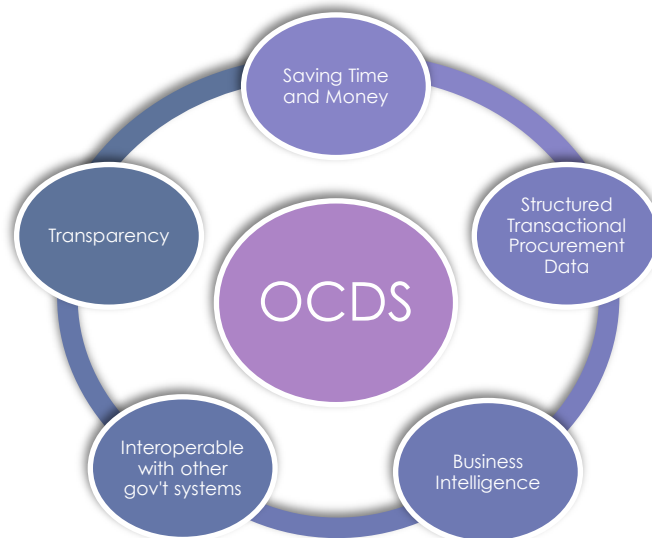
Figure 2: Benefits of using OCDS in eGPS[5]

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[4] World Bank e-Procurement Toolkit Accelerating E-procurement Solutions http://www.eprocurementtoolkit.org/
[5] Image and definitions referenced from Open Contracting Partnership portal

The 2016 implementing rules and regulations of the Republic Act 9184, also known as Government Procurement Reform Act (GPRA) designates the Philippine Government E-Procurement System (PhilGEPS) as the country's official E-GPS.[6] PhilGEPS is the sole, definitive, source of Philippine procurement data, making it a key information source for Procurement Analytics.

In the PhilGEPS' Open Data portal, procurement information is uploaded in quarterly increments, in Excel (.xlsx) format.[7]

The PHILGEPS DATA COLUMNS

The Philippine procurement datasets posted in PhilGEPS has a total of **40 data columns**, each row/observation corresponds to one line item. The default column headers are outlined in Table 2.

PHILGEPS COLUMNS

DEFAULT COLUMN TITLE	DEFINITION/DETAILS
Organization Name	Name of the procuring entity/office/agency
Reference ID	Tender reference ID. Unique per tender
Solicitation No.	Documentary identifier
Notice Title	Title of the tender published in the tender notice
Publish Date	Date of publication of the tender notice to PhilGEPS
Classification	Procurement Classification. Either under Goods, Civil Works, or Services

Notice Type	Invitation to Bid or Request for Quotation
Business Category	Business Category for Item/Service to be procured
Funding Source	Where the funds to procure the item/service will come from
Funding Instrument	Legal basis for use of funds
Procurement Mode	Mode of procurement. Either Public bidding, Negotiated Procurement, Direct Contracting, or Shopping
Trade Agreement	Guiding rules and regulations for the procurement.
Approved Budget of the Contract	Maximum allowed budget for the contract (numerical)

6 Implementing Rules and Regulations of GPRA Law. https://www.gppb.gov.ph/laws/laws/RevisedIRR.RA9184.pdf
7 Last accessed: August 3, 2020.

Area of Delivery	Geographical Area where the items/services will be delivered	Award Type	Type of award document issued (Award notice)
Contract Duration	Duration of contract (numerical)	UNSPSC Code	UNSPSC code for the line item[8]
		UNSPSC Description	UNSPSC description for the line item
Calendar Type	Type of calendar for duration (either days, months, etc.)	Awardee Corporate Title	Name of the awardee company/supplier
Line Item No	Identification number for line items in a tender. Line item is unique per tender.	Contract Amount	Amount of contract awarded to the winner
Item Name	Name of the line item	Contract No	Contract identification number.
Item Desc	Description of the line item	Publish Date (Award)	Date the award was published in PhilGEPS
Quantity	Quantity of the line item	Award Date	Date of award, as shown in award document
UOM	Unit of measure for the quantity column.		
Item Budget	budget allotted for the line item (numerical)	Notice to Proceed Date	Date of issuance of Notice to Proceed document
PreBid Date	Date of Pre-bid	Contract Effectivity Date	Date when the contract will start to take effect
Closing Date	Date of closing the bidding	Contract End Date	Date when the contract will end
Notice Status	Status whether tender is closed, awarded, or cancelled	Reason for Award	Reason for giving the award to the winning bidder (ex. Lowest calculated responsive bid, etc.)
Award No.	Award identifier		
Award Title	Title of award document	Award Status	Status of award (Posted, updated, etc.)

Table 2: Default PhilGEPS Columns (last accessed: August 3, 2020)

MAPPING PHILGEPS TO OCDS DATA FORMAT

PhilGEPS datasets are not uploaded in OCDS format[9]. However, it is possible to convert the excel files in the portal to JSON/OCDS. Layertech and partners in Legazpi City mapped the PhilGEPS dataset to OCDS-fields, as shown in Figure 3. The conversion schematic was used as a general guide for partner researchers and developers to create localized tools that automatically convert PhilGEPS data into OCDS formatted JSON files.

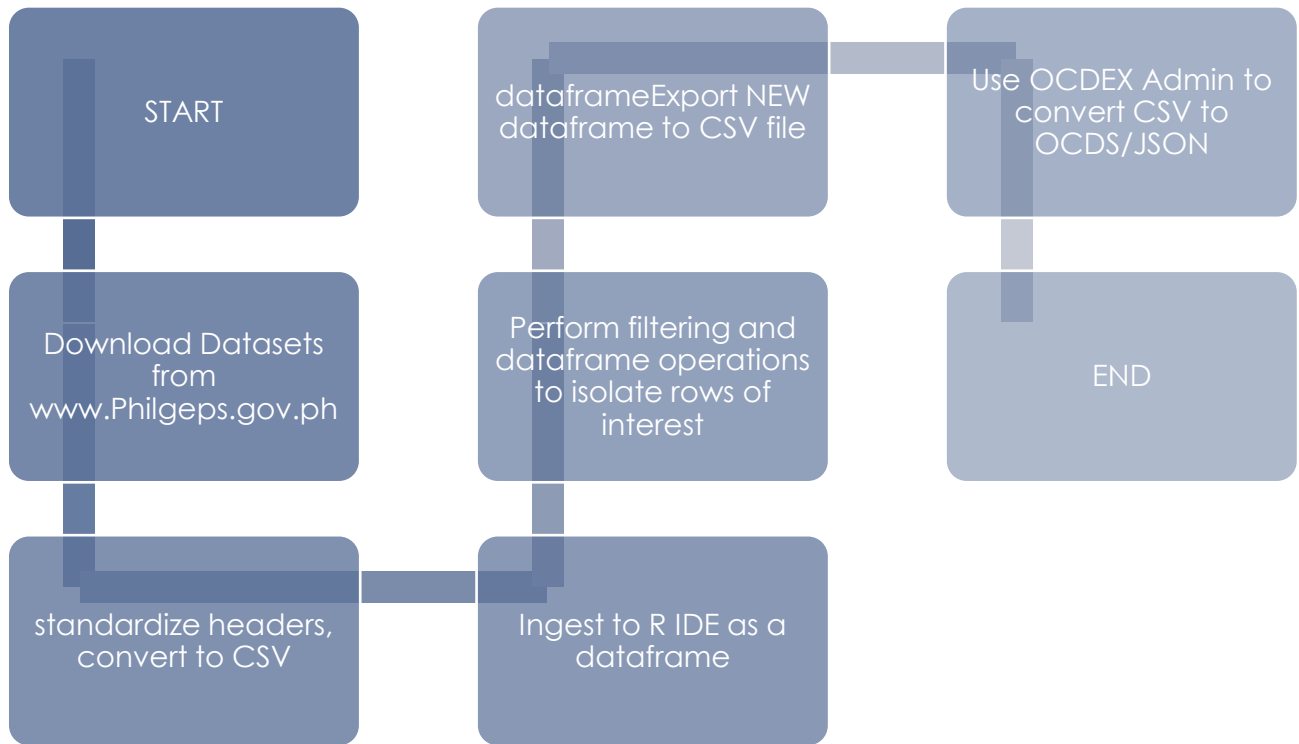[8] United Nations Standard Products and Services Code   [9] As of August 3, 2020

Figure 3: General Schematic of PhilGEPS to OCDS/JSON Conversion

HOW TO FILTER PHILGEPS DATA WITH R AND R STUDIO?

PRE-REQUISITE: R and an R IDE (R Studio, for example) must be installed in the computer. The official installers can be download ded from the following links:

R - https://cran.stat.upd.edu.ph
R Studio - https://www.rstudio.com

STEP 1 – Go to www.PHILGEPS.GOV.PH and go to the "Open Data" Section and download the Excel file of interest in the "Standard Reports" section.

STEP 2 – The files are in XLSX format. Export the files to CSV. Make sure that the rows do not have blanks on the top. The top row will automatically become the 'header' once it is ingested in R Studio. So, make sure the top row is the row that contains the column labels.

STEP 3 – Ingest the CSV file in RStudio as a dataframe.

STEP 4 – Now that the file is ingested as a dataframe in R, it is now possible to perform basic operations on the dataset. For example, filter the name of the agency of interest.

```
DATA_FRAME_NAME_NEW<-subset(DATA_FRAME_NAME, ColumnName=="ParameterHere")
```

example:

```
JUL_SEP_2018_sub <- subset(JUL_SEP_2018, Organization.Name=="DEPARTMENT OF HEALTH - REGIONAL OFFICE V")
```

The resulting dataframe from the example above contains only the data from Department of Health Regional Office 5.   Do note that the strings are case sensitive. Because there are duplicate names of agencies with different spellings, it is best practice to list all unique agency names before doing a filtering.

Once filtered, it is possible to remove columns, count occurrences, join two or more dataframes, and more.

STEP 5 – Once satisfied with the final dataframe, save the resulting filtered dataframe as a CSV file through the following commands:

```
write.csv(DATA_FRAME_NAME, file="PREFERRED_FILE_NAME.csv"
```

This is because, there is a big chance that someone else who isn't familiar with R needs the same dataset produced by the filtering.

STEP 6 – Finally, share the cleaned datasets in the OCDEX repository using an ADMIN account.

EXPORTING OCDS FILES FROM OCDEX

CSV files ingested in OCDEX portal can be exported and downloaded as OCDS/JSON files

PROCUREMENT PROCESS

The procurement process can be modelled as a business process, with identified actors, a systematic flow, compliance monitoring requirements, data generation, event triggers and conditions. By studying the process, it is possible to measure its compliance (to country laws), its efficiency, identify bottlenecks.

The public procurement process aims to award contracts to the most qualified contractors/suppliers given the terms laid out by the procuring entity. The procurement cycle starts with identifying the procuring entiy's needs and available resources, and ends with successful service delivery by the winning contractor. It is an end-to-end transaction, making sure that the need is sufficiently addressed given the available budget.

Identify Needs and Budget (PLANNING)

Monitor Implementation and Feedback

Bidding, Evaluation and Selection

Qualification check of winning bidder and awarding pf contract

Contract Implementation / Supply Delivery

Contract signing
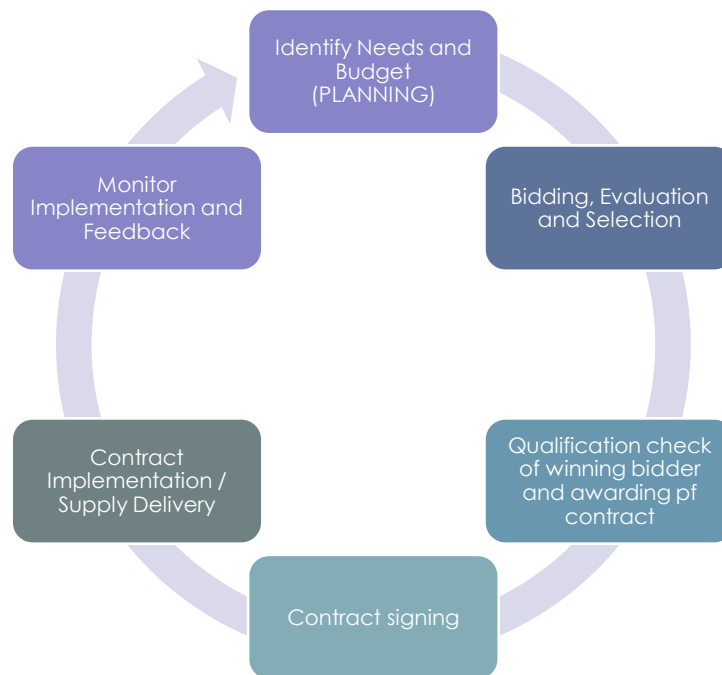
Figure 4: Procurement Cycle

Legal Framework

Public procurement is governed by a legal framework that defines the process and its actors. The legal framework differs from country to country. In the Philippines, the legal framework for public procurement is Republic Act 9184, also known as Government Procurement Reform Act and its Implementing Rules and Regulations.

Key Actors in the Public Procurement Process

Government Agencies

These are the actors and agencies outside of the procuring entity, mandated by the law to operationalize, create policies, and assess compliance of procurement process to the legal framework.

In the Philippines, examples of these agencies are:

AGENCY	MANDATE
Government Procurement Policy Board (GPPB)	An independent, inter-agency body with private representation, tasked to formulate and amend public procurement policies, build capacity of government procurement actors, and conduct annual assessment of the current rules' effectiveness. [10]
Philippine Government E-Procuremnet System (PhilGEPS)	The country's sole, official, e-procurement system that houses and manages all government procurement data entered into the online system.
Commission on Audit (COA)	Principal duties of the commission include examination of government expenditures, promulgation of accounting and auditing rules on use of government funds, submit annual reports on the financial condition of the government, and recommend measures to improve efficiency and effectiveness of government operations.[11]

End User
The end user is the specific office or section within the procuring entity that directly utilizes the goods/services procured. In the case of infrastructure, the end user is the office or section that directly uses or manages the built infrastructure.

Bids and Awards Committee
In the Philippine procurement law, the Bids and Awards Committee (BAC) is the body within the procuring entity responsible for assessing the qualification of bidders and selecting the most qualified and responsive bidder within the given budget limit.

Approving Bodies
A winning bid, once selected by BAC, will have to be reviewed and approved by the Head of the Procuring Entity (HoPE). In some cases however, there is a need for the approval of the legislative body of the procuring entity (e.g. the City/Municipal Council in the cases of Local Government Units) in the form of a resolution granting the HoPE authority to enter into contract with a selected contractor.

Public
Ultimately, the beneficiaries and recipients of government services are the public. The public's role in the procurement process is the assessment of the quality of service delivery,

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[10] Official GPPB Website. https://www.gppb.gov.ph/about-gppb.php
[11] COA official Website. https://www.coa.gov.ph/index.php/2013-06-19-13-06-03/principal-duties

feedback and reporting to the procurement entity to improve the next iterations of the process.

Similarities and Differences between Public and Private Sector Procurement[12]

Public and Private sector procurement processes are very similar, but there are key differences that the researcher/analyst must take note of. Both procurement processes aims to acquire goods and services with the best possible efficiency and value-for-money. However, the main difference is that the goal of public procurement is conducted to support government services in order to provide public services, while private sector procurement is meant to support the principal business objective, which is to generate profit. This does not mean that the private sector does not seek social benefits, its just not the business' primary goal.

Another key difference is source of funding. Public procurement uses public funds while private sector uses funds of the company owners and/or shareholders.

Finally, public sector procurement is required to comply with government procurement law while private sector is required to comply with commercial rules and regulations and company policy. Therefore, the monitoring of process compliance also differs between the two. Public procurement is subject to public scrutiny while private procurement is usually open only to key actors within the company or in some cases, external auditors.

	PUBLIC PROCUREMENT	PRIVATE PROCUREMENT
Legal Framework	Government procurement law	Corproate Laws (external) and Company policy (internal)
Principal Objectives	Public service delivery	Support business process to generate profit
Funding	Public funds	Shareholder/Owner funds
Monitoring	Monitoring is done internally and externally. All procuring entities have inspectorate /monitoring teams.	Internal company monitoring

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[12] Chapter 1 Public Procurement: Principles, Categories and Methods
Procurement Classroom Series Vol #2 by Jorge A. Lynch T.
https://leanpub.com/procurement-principles-categories-and-methods/read

The following are fundamental principles as defined in article 9 of United Nations Convention Against Corruption (UNCAC)[13]

Transparency

Transparency involves publicity of procurement opportunities, disclosure of rules to be followed, public and visible undertaking of the procurement process, and provision of a system for monitoring to allow stakeholders to monitor the entire procurement process.

Competition

Competition means that bidders act independently, and compete for the opportunity by offering the most favorable terms. Competition leads to lower prices and improved quality of goods and service delivery.

Objective Criteria in Decision-Making

This refers to the elimination of biases and prejudices in crafting tenders and selecting suppliers.

Similarly, RA 9184 or Government Procurement Reform Act of the Philippines, highlights the following procurement principles:

- **Competitiveness/Competition**
- **Transparency**
- **Streamlining use of Public Procurement**
- **Public Monitoring**
- **Accountability**

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[13] United Nations Guidebook on Anti-Corruption in Public Procurement and Management of Finances (2013)

UNAC suggestions to ensure above principles are upheld in procurement

Public Distribution of Information

Contract opportunities must be publicly distributed to maximize competition and value for money.

Publication of Conditions for Participation

Procedures and award conditions must be published, to ensure that companies submit bids that match the procurement entity's needs. This also allows verification whether conditions for award are in line with the procurement laws, rules and regulation, thereby allowing timely challenge in case the law has not been followed.

Use of Objective and Predetermined Criteria for Decision-Making

Criteria for contract award must be thoroughly specified ahead of time, allowing bidders to assess their chances of winning the bid.

Effective Systems of Domestic Review

Having a system of review, including a system of appeal, ensuring legal recourse and remedies in the event that rules of the procurement procedures are not followed.

Responsibilities of Public Officials

Have ethics rules and regulations for public officilas, procurement officers and personnel, and assess their compliance, training, and capacity to follow these rules.

RECOMMENDED TIMELINE IN PHILIPPINE PROCUREMENT

The 2016 Implementing Rules and Regulations of the GPRA law sets minimum, maximum, and recommended days for every procurement stage, depending on procurement classification. Procurement line items are generally classified into either Infrastructure, Goods and Services, and Consulting Services.

Definition from the RA9184:

Infrastructure
"construction, improvement, rehabilitation, demolition, repair, restoration, or maintenance of roads and bridges, railways, airports, seaports, communication facilities, civil works components of information technology projects, irrigation, flood control and drainage, water supply, sanitation, sewerage and solid waste management systems, shore protection, energy/power and electrification

facilities, national buildings, school buildings, and other related construction projects of the government."

Goods

"all items, supplies, materials, and general support services, except consulting services and infrastructure projects, which may be needed in the transaction of public businesses or in the pursuit of any government undertaking, project or activity, whether in nature of equipment, furniture, stationery, materials for construction, or personal property of any kind, including non-personal or contractual services, such as repair and maintenance of equipment or furniture, as well as trucking, hauling, janitorial, security, and related or analogous services, as well as procurement of materials and supplies provided by the procuring entity for such services."
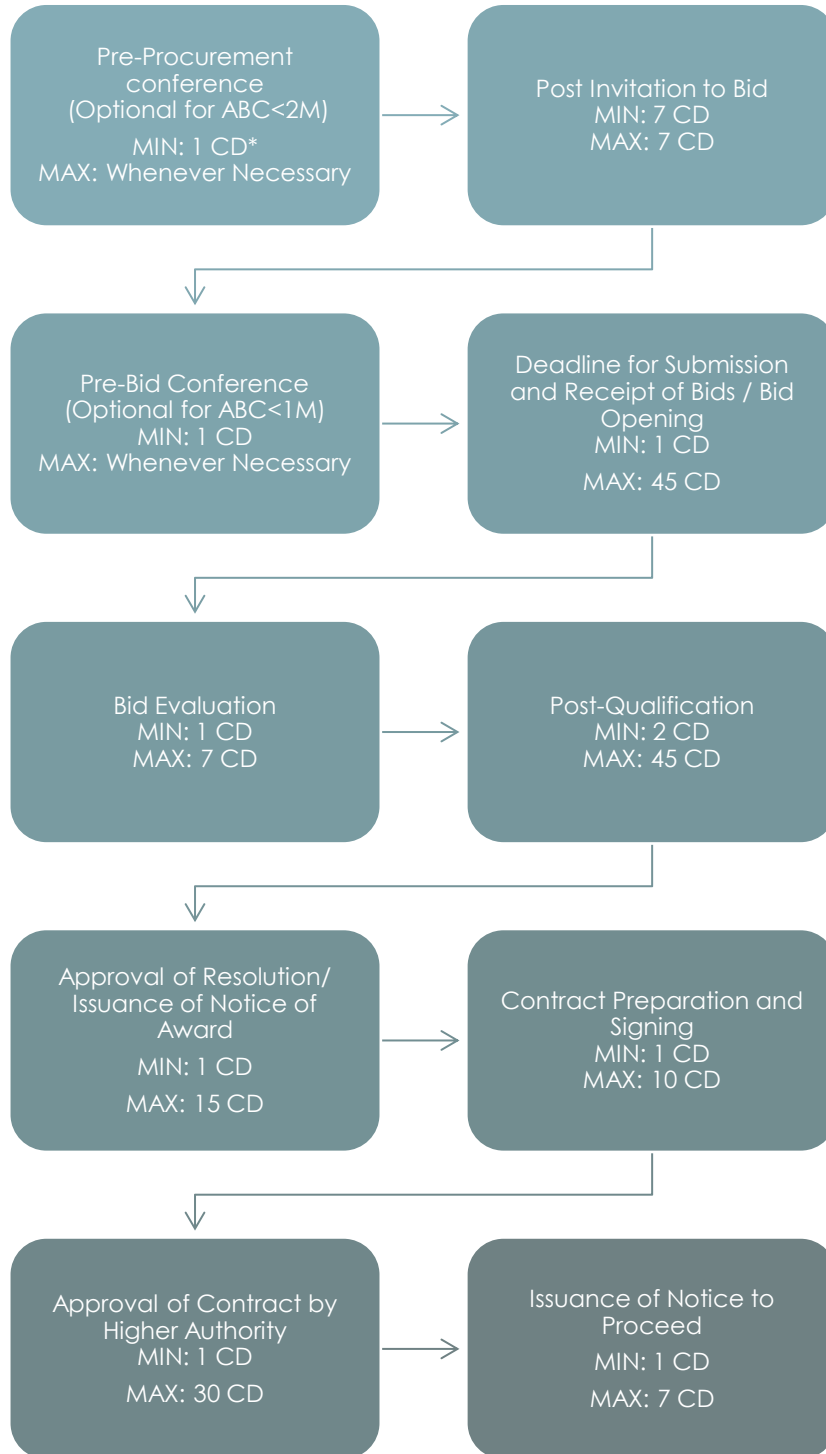
Consulting Services

"services for Infrastructure Projects and other types of projects or activities of the Government requiring adequate external or technical and professional expertise that are beyond the capability or capacity of the government to undertake such as but not limited to: advisory and review services; pre-investment or feasibility studies, design, construction supervision, management and related services, and other technical services or special studies."

Below are visual timelines for the procurement of Goods and Services, Infrastructure Projects, and Consulting Services:
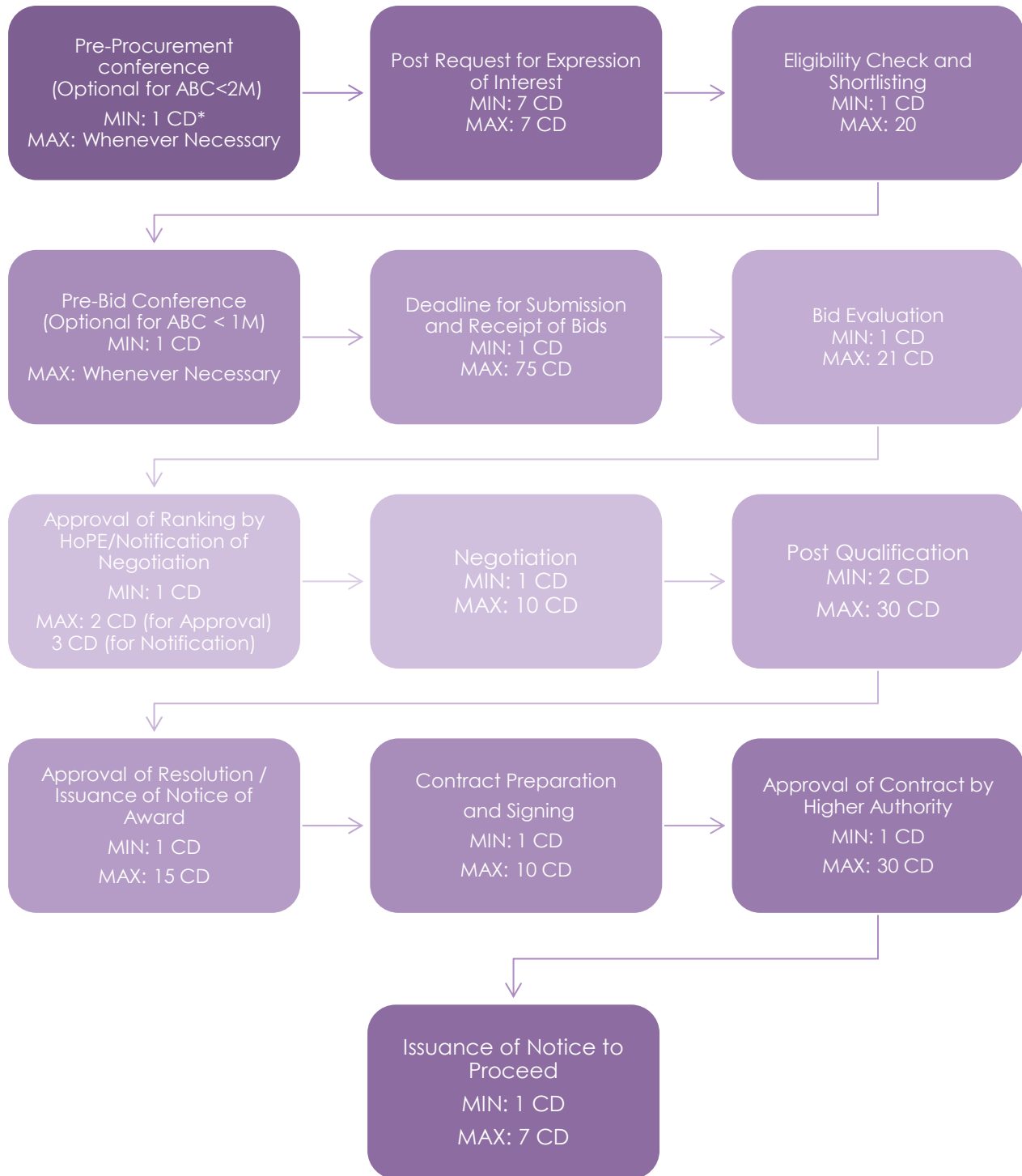
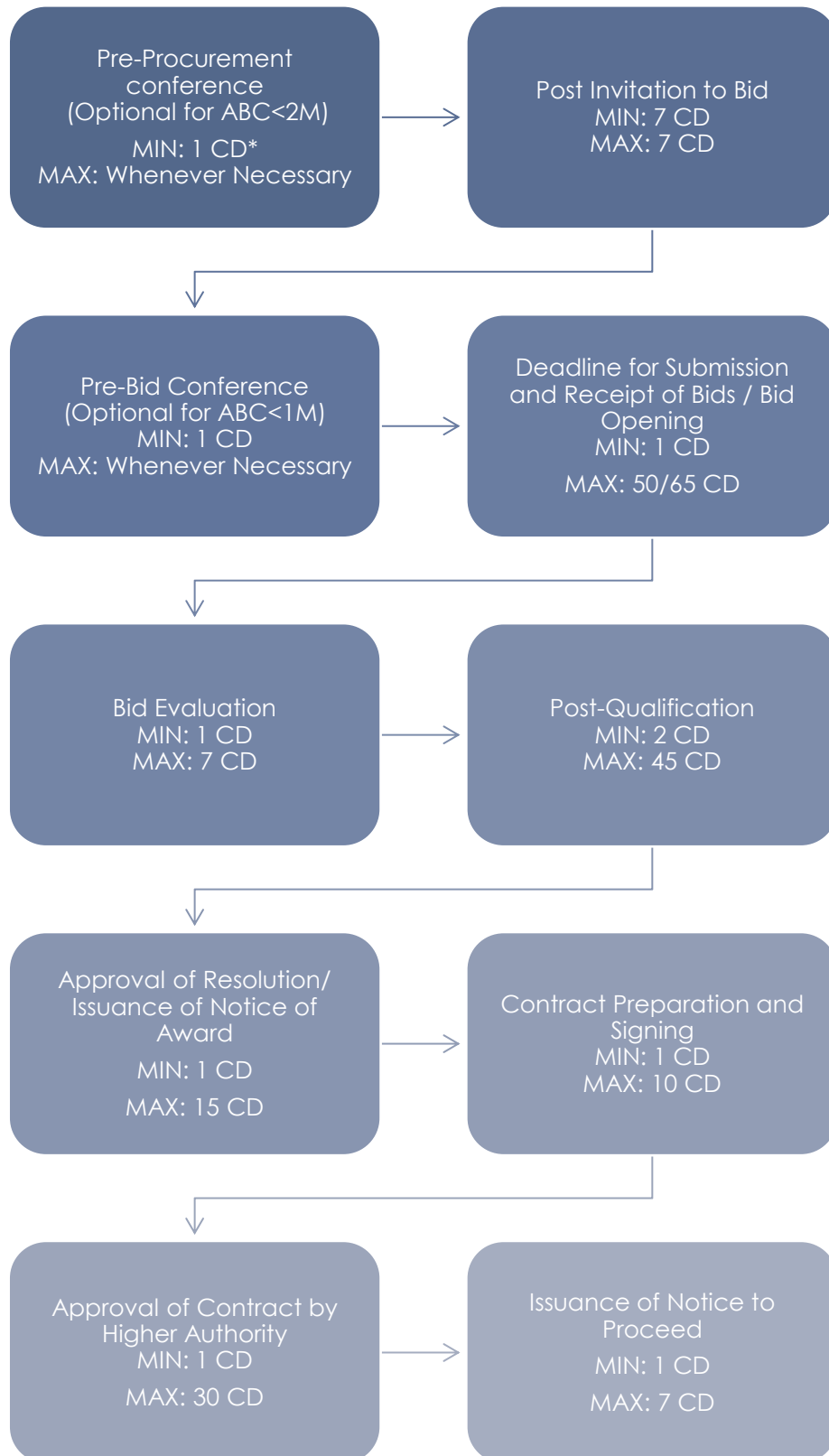**Prescribed Procurement Timeline for Goods and Services**

*CD = calendar day/s

Pre-Procurement conference
(Optional for ABC<2M)
MIN: 1 CD*
MAX: Whenever Necessary

→

Post Invitation to Bid
MIN: 7 CD
MAX: 7 CD

Pre-Bid Conference
(Optional for ABC<1M)
MIN: 1 CD
MAX: Whenever Necessary

→

Deadline for Submission and Receipt of Bids / Bid Opening
MIN: 1 CD
MAX: 45 CD

Bid Evaluation
MIN: 1 CD
MAX: 7 CD

→

Post-Qualification
MIN: 2 CD
MAX: 45 CD

Approval of Resolution/ Issuance of Notice of Award
MIN: 1 CD
MAX: 15 CD

→

Contract Preparation and Signing
MIN: 1 CD
MAX: 10 CD

Approval of Contract by Higher Authority
MIN: 1 CD
MAX: 30 CD

→

Issuance of Notice to Proceed
MIN: 1 CD
MAX: 7 CD

Prescribed Procurement Timeline for Consulting Services

*CD = calendar day/s

Pre-Procurement conference (Optional for ABC<2M) MIN: 1 CD* MAX: Whenever Necessary	**Post Request for Expression of Interest** MIN: 7 CD MAX: 7 CD	**Eligibility Check and Shortlisting** MIN: 1 CD MAX: 20
Pre-Bid Conference (Optional for ABC < 1M) MIN: 1 CD MAX: Whenever Necessary	**Deadline for Submission and Receipt of Bids** MIN: 1 CD MAX: 75 CD	**Bid Evaluation** MIN: 1 CD MAX: 21 CD
Approval of Ranking by HoPE/Notification of Negotiation MIN: 1 CD MAX: 2 CD (for Approval) 3 CD (for Notification)	**Negotiation** MIN: 1 CD MAX: 10 CD	**Post Qualification** MIN: 2 CD MAX: 30 CD
Approval of Resolution / Issuance of Notice of Award MIN: 1 CD MAX: 15 CD	**Contract Preparation and Signing** MIN: 1 CD MAX: 10 CD	**Approval of Contract by Higher Authority** MIN: 1 CD MAX: 30 CD
	Issuance of Notice to Proceed MIN: 1 CD MAX: 7 CD	

Prescribed Procurement Timeline for Infrastructure Projects

*CD = calendar day/s

Pre-Procurement conference (Optional for ABC<2M) MIN: 1 CD* MAX: Whenever Necessary	**Post Invitation to Bid** MIN: 7 CD MAX: 7 CD
Pre-Bid Conference (Optional for ABC<1M) MIN: 1 CD MAX: Whenever Necessary	**Deadline for Submission and Receipt of Bids / Bid Opening** MIN: 1 CD MAX: 50/65 CD
Bid Evaluation MIN: 1 CD MAX: 7 CD	**Post-Qualification** MIN: 2 CD MAX: 45 CD
Approval of Resolution/ Issuance of Notice of Award MIN: 1 CD MAX: 15 CD	**Contract Preparation and Signing** MIN: 1 CD MAX: 10 CD
Approval of Contract by Higher Authority MIN: 1 CD MAX: 30 CD	**Issuance of Notice to Proceed** MIN: 1 CD MAX: 7 CD

PROCUREMENT ANALYTICS

Procurement Analytics use quantitative methods to derive actionable insights and outcomes from data. It involves the capture and use of data to support fact-based decision making. It reports typically on what has happened in the past and creates estimates, using the predictive analytics based on historical data to guess what will happen in the future.

Effective harvesting and analysis of procurement data can streamline public procurement markets, reduce waste and graft, and give citizens confidence that their governments are spending tax money wisely.

Where to Get Procurement Data?

Official Government Data Repositories (Online)

External Data Repositories

Request for Documents

Expert Interviews and Focus Group Discussions

Philippine Government E-Procurement System (PhilGEPS)
Official Philippine Government Procurement Datasets
LINK: **https://www.philgeps.gov.ph/**

Electronic Freedom of Information Portal (e-FOI)
Various Government Data, reseased by Request
LINK: **https://www.foi.gov.ph/**

Procuring entities post procurement information in their respective official websites. You may check the website of the procuring entity you are interested in.

You may also check reputable websites such as official university repositories/open data portal.

OCDex Public Procurement Analytics Portal
Procurement Analytics resource center, maintained by volunteer researchers and analysts
LINK**: www.OCDEX.tech**

If the data you are looking for is not available online, you may use the EFOI portal to make a request OR, you can go to the office of the procuring entity and submit a letter of request for data.

To supplement your data collection, you may request for expert interviews with stakeholders.

Data Quality Assessment:
Is my Procurement Dataset Ready for Analysis?

Accuracy

A basic requirement for analysis is having an accurate dataset. This means that the dataset being analyzed is truthful, and representative of the actual events that happens in the procurement process. One way of ensuring accuracy is evaluating the source of the dataset. Ensure that the source of data is legitimate and trustworthy. It is good practice to note where the data was downloaded, the time and date of access and revision. It also helps to know the method of collection, noting the assumptions that the data collector/publisher based the collection on.

A list of suggested procurement data repositories for the Philippines is found on part III of this handbook.

Completeness

Dataset distribution and completeness is essential in analytics. If a dataset has significant missing data especially on columns of interest, the insights drawn from it may be skewed. Therefore, understanding the nature of missing data and conducting pre-processing on the dataset is important. By rule of thumb, suggested imputation for missing data are as follows:

MISSING DATA	IMPUTATION METHOD
Under 10%	Any method can be applied, complete case method is least preferred
10% to 20%	for MCAR[14]: All available data, hot deck case substitution, regression method For MAR[15]: Model-based imputation
Over 20%	For MCAR: Regression method For MAR: Model-based imputation

Table 3: Rule of Thumb for Imputation[16]

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[14] Missing Completely at Random
[15] Missing at Random
[16] Multivariate Data Analysis Textbook

Consistency

The measurement of the variables in the dataset must be consistent. If a field is measured in centimeters, all values under that column must be in centimeters. Otherwise, aggregating the column leads to skewed results. Another common consistency problem in Philippine government datasets is the DateTime column values. Some values are labelled mm/dd/yyyy, while others are dd/mm/yyyy. In such cases, the dataset must first be pre-processed, ensuring that all values in the column follow the same format.[17]

Timeliness and Relevance

It is important that the dataset contains values that are relevant to the research question or the analysis objective. Timely data produces timely and relevant insights, allowing stakeholders and decision makers to quickly act on the possible concerns raised by the analysis.

ANALYTICS TOOLS TO EXPLORE

This list contains the tools and platforms used by the researchers in this compilation to pre-process and process procurement datasets.

Microsoft Excel (https://www.microsoft.com/en/microsoft-365/excel)

Excel is a proprietary spreadsheet program, developed by Microsoft. The software is primarily used by researchers in procurement analytics, because PhilGEPS datasets are under this software's file format (.xlsx). Opening the file under Excel can give the user a good, general look of how the dataset looks like.

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[17] A common tool used by the researchers featured in this handbook is the R Package: Lubridate. https://lubridate.tidyverse.org/

Excel can be helpful in basic pre-processing procurement data and generating graphs, but only for a small number of rows (maximum of 50 to 100 rows). Any more than that can be difficult to manage on Excel alone. Excel can convert XLSX files to CSV and other spreadsheet file formats.

Figure 4: Screenshot of the PhilGEPS dataset on Excel

R Studio (https://rstudio.com/)

R studio is a free and open-sourced statistical software environment for R. Using R, researchers were able to ingest PhilGEPS datasets into Data Frames and perform filtering, basic operations, imputation, and aggregation. For the use cases featured in part II of this handbook, the primary software used for pre-processing and processing procurement data is R and R Studio.
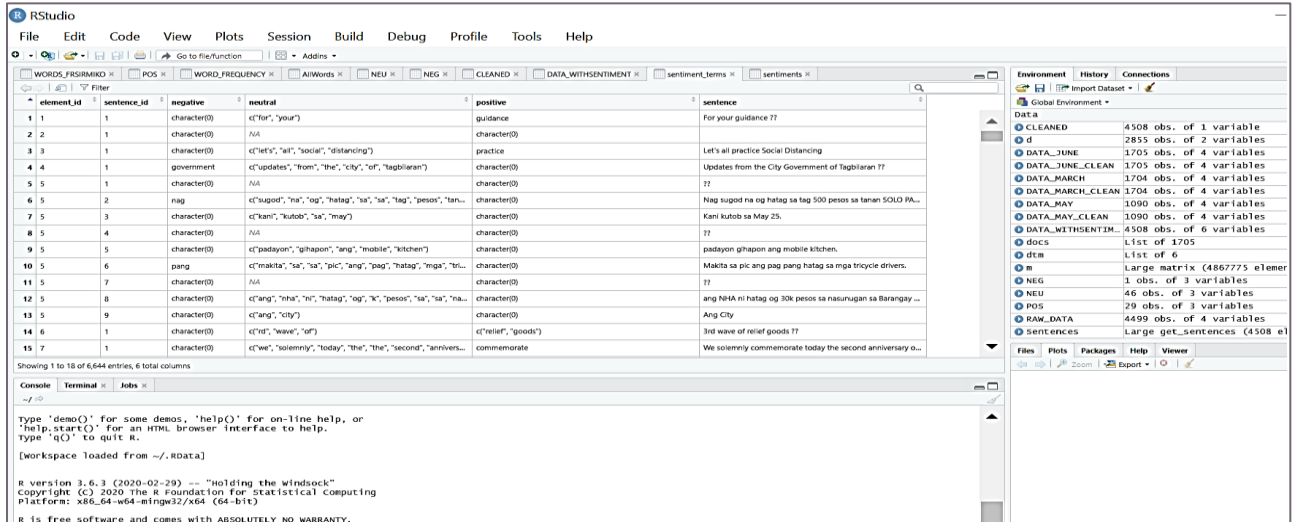
Figure 5: Screenshot of the R Studio interface

R studio has a wide variety of downloadable packages which can be used to pre-process the dataset, build models, and generate visualizations. A screenshot of the R Studio interface is shown above.

Tableau (https://www.tableau.com/)

Tableau is an analytics platform with an easy and intuitive interface. Tableau both has a paid and public version. In using public version, however, you will need to save your work by logging into your Tableau online account. A screenshot of the Tableau Public interface is shown below.
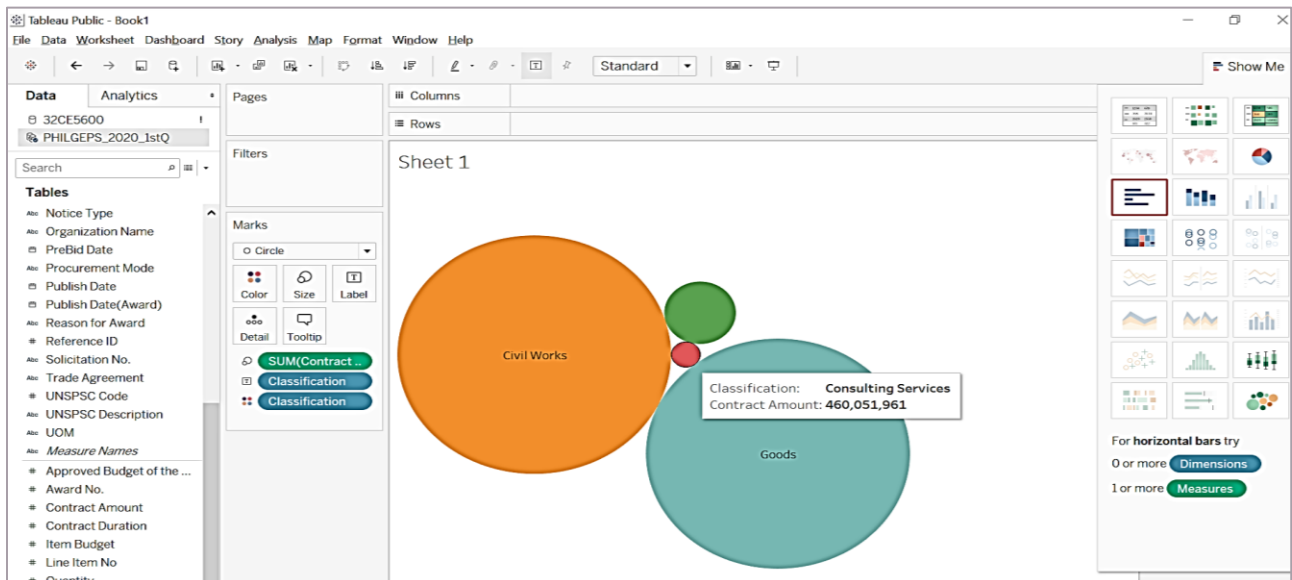

Figure 6: Screenshot of the Tafbleau Public interface

Tableau Prep Builder allows users to clean and shape datasets using a visual interface. Then, Tableau Desktop (or Public) is used to visualize pre-processed dataset in the same visual, drag-and-drop interface.

OCDex (https://www.ocdex.tech/)

OCDex is an online repository of machine-readable procurement datasets, visualization and data conversion tools developed by Layertech Labs and partners. Users can download pre-processed datasets in the portal, under the public domain. The portal also houses references, guides, and use-cases developed by the team to help researchers analyze Philippine procurement data.
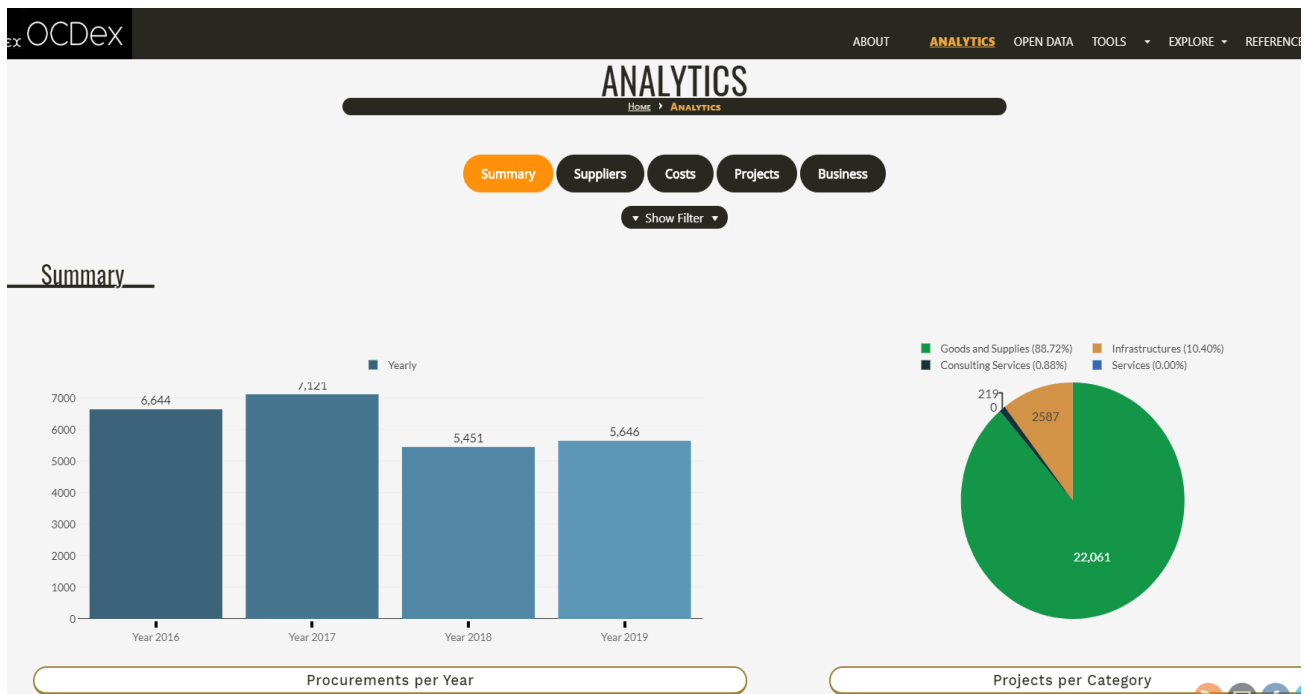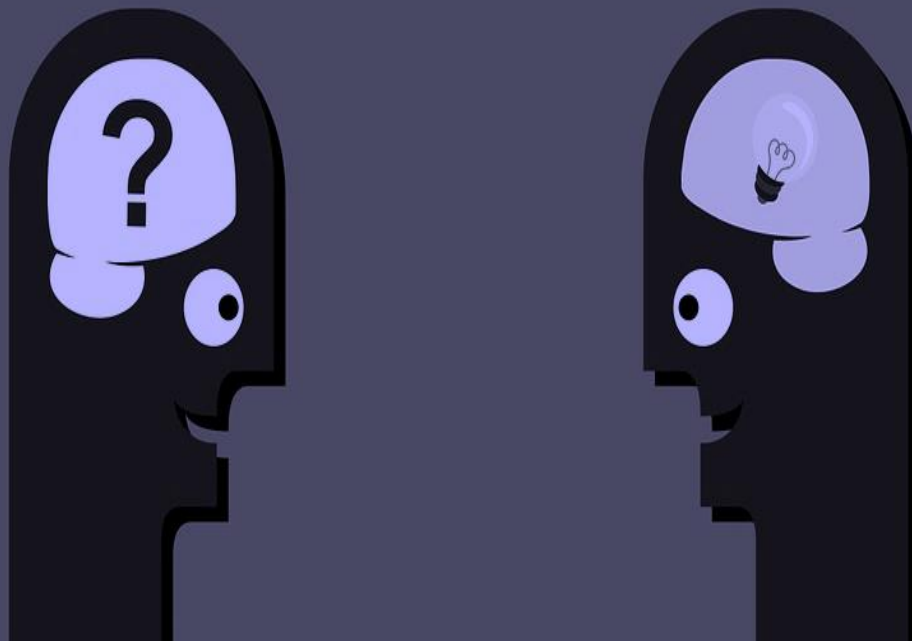

Figure 7: Screenshot of the Tableau Public interface

USE-CASES and METHODOLOGIES

USE CASES

There are many definitions of a use case. For example, Ivar Jacobson defines a use case as "description of a set of sequences of actions and variants that a system performs that yield an observable result of value to an actor." (Jacobson, et. al., 1999, p.41). In this handbook we will simply define use case as a requirements-gathering technique of all the ways an end-user wants to use a system.

In this section, we will introduce use-cases of Philippine procurement data, and how its analysis answered questions and addressed key information needs of various stakeholders for decision support.
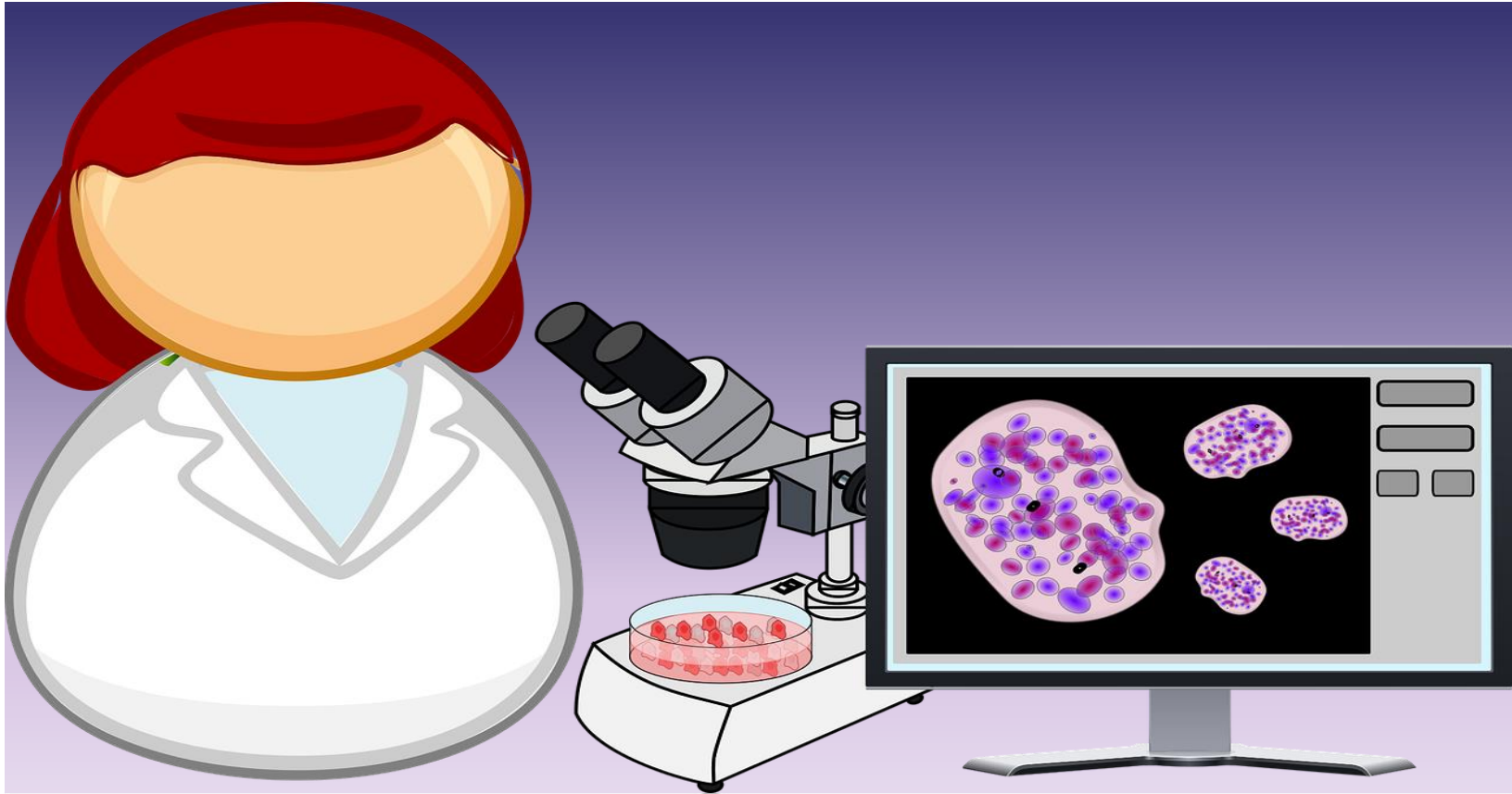
INSPECTING HIV/AIDS-RELATED PROCUREMENT

The role of Civil Society Organizations (CSOs) in the awareness and prevention of HIV/AIDS is critical in ensuring effective and inclusive programmes. Most CSOs working on HIV/AIDS awareness and prevention advocacy needs to constantly coordinate with the local health authorities both in conducting activities and in acquiring related items and supplies. Timely and effective coordination, and ensuring availability of supplies is required for an effective campaign against HIV/AIDS.

In this study, the researchers engaged a Civil Society Organization, GAYON LGBTQI, who is working on HIV/AIDS prevention and awareness in Bicol Region. The researchers used collected, processed, and visualized official government procurement data, in order to answer the key information requirements of the CSO.

FULL PAPER AVAILABLE

Why HIV/AIDS?

From 2009, the number of persons increased by two (2) newly diagnosed with HIV per day and 32 in 2018. One thousand seventy-two (1072) new HIV antibody seropositive individuals were reported to the HIV/AIDS and ART Registry of the Philippines in October 2018, with 16% having clinical manifestations of advanced HIV Infection at the time of diagnosis. In 2018, majority of those with HIV-related reported cases belonged to 28 years old age-group and 29% cases are among the youth aged 15-24 years old. Notably, 57% of the mode of transmission among children and adolescents from January 1984 to October 2018 is from males having sex with males only, followed by 21% of males having sex with both males and females.

Figure 8: Modes of transmission among children and adolescents, Jan 1984-Oct 2018, taken from DOH HIV/AIDS& ART Registry
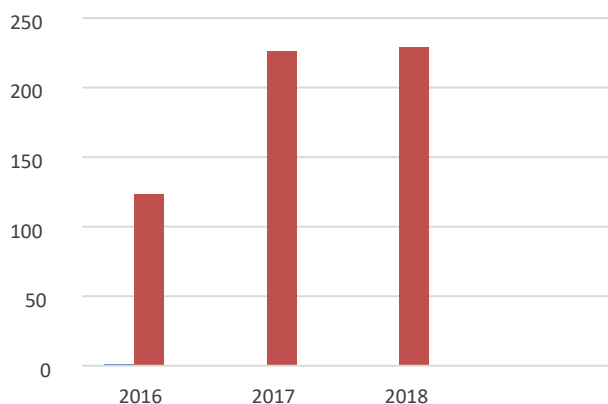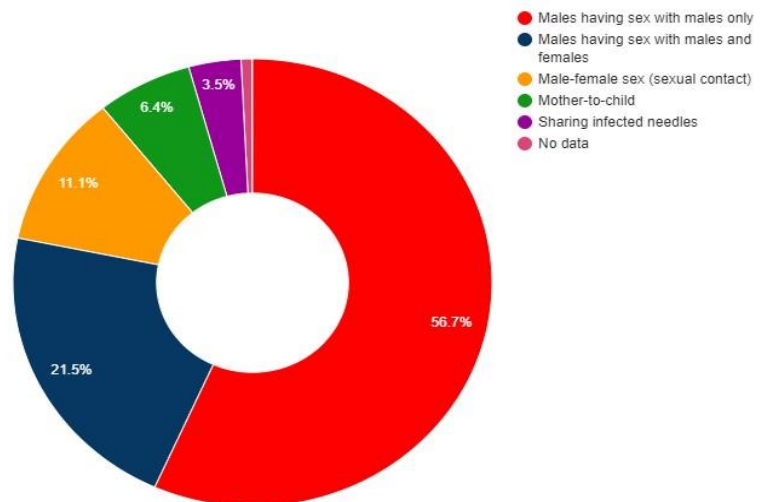
Figure 9: Recorded Cases of HIV in Bicol Region

Similarly, an increasing trend of HIV cases in Bicol Region is observed from 2016 to 2017, with Camarines Sur having the highest case count of 80 cases, followed by Albay with 71 cases. With the situation at hand, DOH and CSOs are taking actions to prevent the spread of HIV by providing free and confidential counseling, referral to treatment hubs, awareness trainings, and community-based screenings.

## CIVIL SOCIETY ORGANIZATIONS AND GROUND-BASED ACTIVITIES

Gayon, as an organization, has the following mission:

1. To promote **better policies or ordinances that will protec the rights of LGBTs**

2. To promote **prevention awareness on STI/HIV/AIDS**

3. To promote **acceptance o LGBTs through education**

4. To strengthen the organization by **broadening the membership base,** and

5. To mobilize resources to **finance and support LGBT activities**

CSO participation is strongly linked to reducing inequalities, poverty alleviation, and more effective implementation of activities in the ground due to the n CSOs like Gayon Bicol work with the Department of Health in their HIV/AIDS Advocacy. They request for test kits which they use for community-based screening and HIV/STI/AIDS Information Education Campaigns. They also frequently receive training from the government agency, many are about HIV/AIDS and Reproductive Health.

Information Requirements:

- How many HIV Testing kits, condoms, lubricants, etc. is the agency procuring?

- How long does the procurement process normally take?

- Budgetary requirements inclusions and exclusions of the agency (for crafting proposals)

- Ensuring quality of trainings conducted (e.g. conducive training location, etc.)
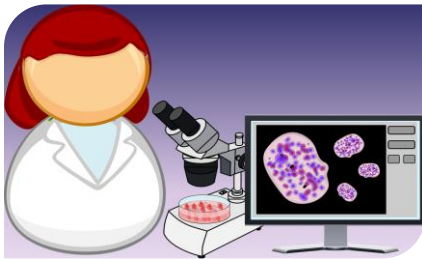
Web Scraping using R

Procurement data of DOH 5 from 2016-2018 was collected through Philippine Government Electronic Procurement System (PhilGEPS) website.
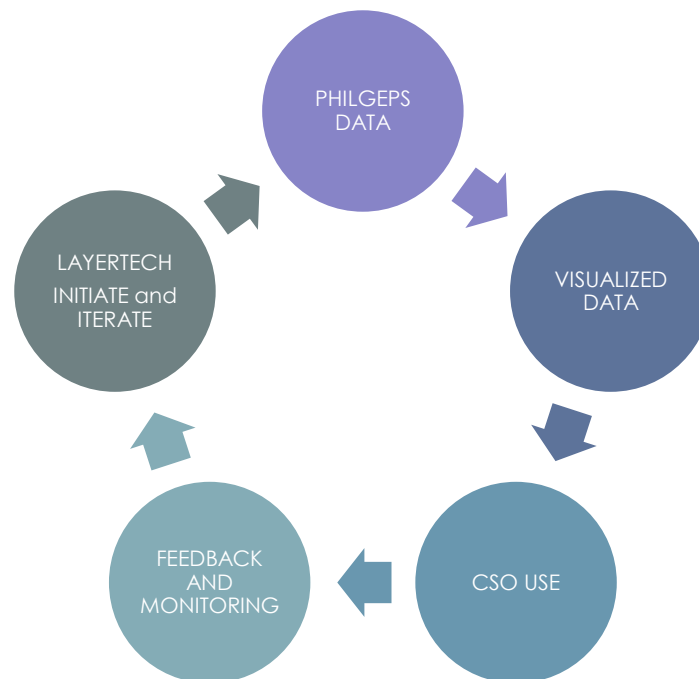
Figure 10: Web Scraping using R Overview

Using R Language, data filtering was conducted on all HIV-related PhilgGEPS data sets from 2016-2018 using keywords HIV and AIDS in all 40 columns, and then checked and filtered for duplicate rows. The number of raw data collected were 4671 line items.

To ensure the reliability of data, procurement documents were reviewed from the official website of the DOH RO5 and validated it through the electronic Freedom of Information (eFOI) portal.

Data Filtering

The PhilGeps datasets collected is in machine-readable format consisting of 40 columns, but with inconsistent value formats, agency names, and contains missing data of over 10%.
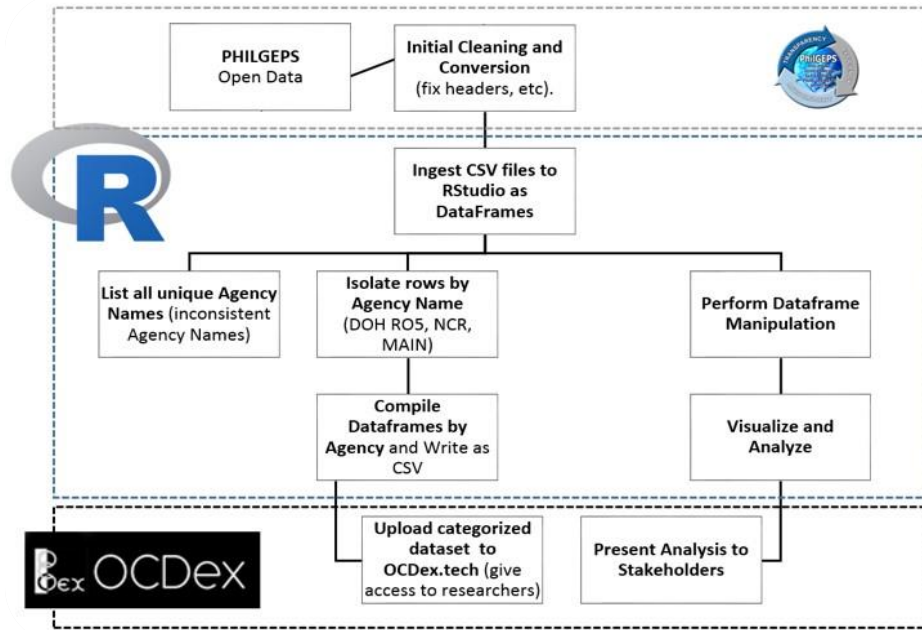
Figure 11: PhilGeps Data Filtering Process

The .csv files were ingested to R Studio as data frames, cleaned, imputed, and filtered by listing all the unique agency names and standardized for uniformity. Only rows with DOH Region 5 as the procuring entity were selected for processing. The newly-cleaned data frames were compiled by agency and converted into .csv file and afterwards uploaded the categorized data sets to OCDex.tech to provide open data to future researchers.

As to data sets, above shows that only rows from years 2016 to 2018 were processed, resulting to a total of 4671 line items. From the collected datasets, it was observed that out of 4671 line items, only 2013 line items were successfully awarded. Of the 4671 line items, only 38 items are related to HIV/AIDS, 22 of which were recorded as successfully awarded.

Number of ROWS we extracted!
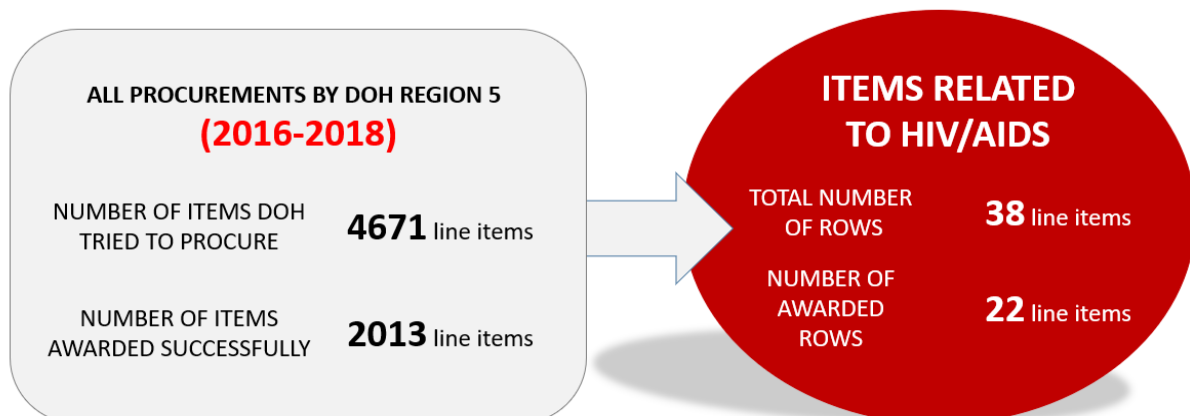
Every "ROW" in the dataset represents "ONE LINE ITEM" (not projects!)
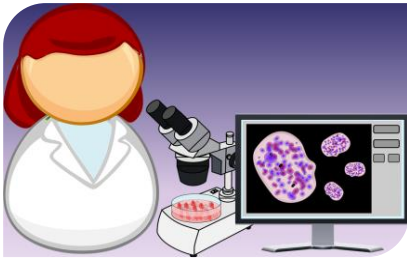
How Many test Kits are they Procuring?

YEAR	DATE OF PURCHASE	yNAME	QTY (unit = test)	UNIT COST	TOTAL COST	SUPPLIER	SENT BY DOH MAIN	TOTAL
2016	March 28 2016	HIV Ag-Ab EIA/CLIA, with compatible machine service provision for the duration of the tests	14,400	90.25	1,299,600	J & JK Medical Equipment Trading Services	16890	45,690
	March 28 2016	HIV Ag-Ab EIA/CLIA, with compatible machine service provision for the duration of the tests	14,400	237	3,412,800	J & JK Medical Equipment Trading Services		
2017	May 26, 2017	HIV Ag-Ab EIA/CMIA	24,000	80.95	1,942,800	J & JK Medical Equipment Trading Services	26310	50,310
2018	March 5, 2018	HIV Ag-Ab EIA/CLIA 100s	24,000	81.49	1,955,760	J & JK Medical Equipment Trading Services	5340	29,340

Table 4: No. of Test Kits Purchased by DOH

Data shows that DOH region 5 receives HIV Ag-Ab EIA/CMIA test kits from DOH Main. The agency received a total of 48,540 individual test kits from DOH Main from 2016 to 2018, the breakdown shown below. In parallel, DOH region 5 procured a total of 76,800 worth of individual test kits from two suppliers. Document requested revealed that for 2016, there is no delivery of test kits from DOH Main, but only 563 units were used on the same year, with surplus of 877 units. Of the five recorded procurements, three were procured through public bidding while the other two were procured via 'alternative mode' and Repeat order.
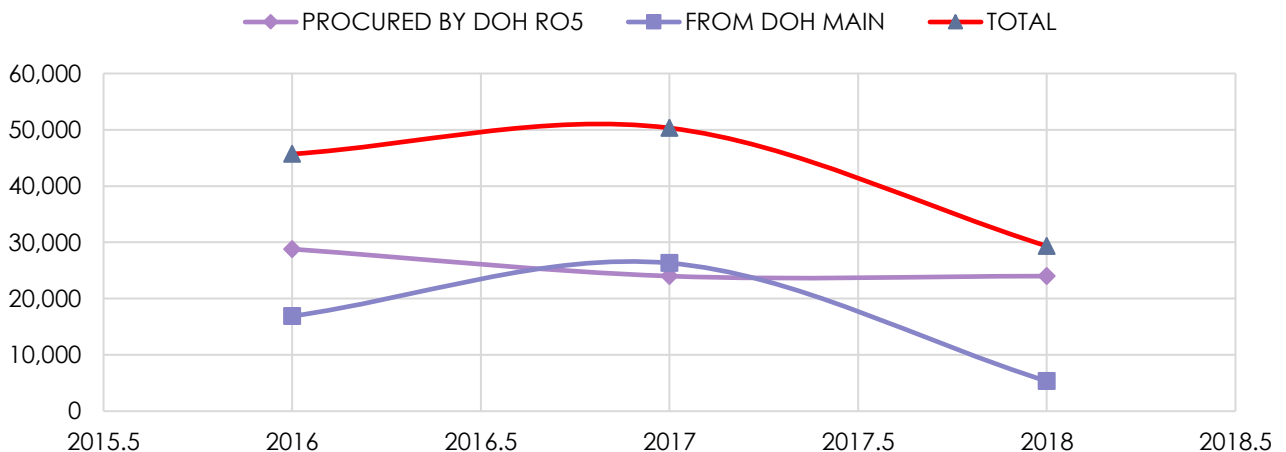

Figure 12: HIV Test Kits Availabiliy in DOH Region V

What and How Much is the Agency Spending on HIV-related procurement?

ALL DOH Region 5 PROCUREMENTS		HIV ROWS	
CATERING SERVICES	358, 860.14 PHP	CATERING SERVICES	91,920.00 PHP
GENERAL MERCHANDISE	140,361.38 PHP	GENERAL MERCHANDISE	27,600.00 PHP
LABORATORY SUPPLIES and EQUIPMENT	445,947.04 PHP	LABORATORY SUPPLIES and EQUIPMENT	1,380,765.00 PHP
MEDICAL SUPPLIES and LABORATORY INSTRUMENT	105,194.46 PHP	MEDICAL SUPPLIES and LABORATORY INSTRUMENT	992,975.00 PHP
PRINTING SERVICES	53,371.42 PHP	PRINTING SERVICES	25,334.75 PHP
REPRODUCTION SERVICES	60,019.89 PHP	REPRODUCTION SERVICES	27,750.00 PHP

Table 5: Average Costs per Business Category

As shown in table above, PhilGEPS data revealed that laboratory supplie s and equipment (445,947.04 Php) obtained the highest average cost per line item based on the awarded procurements and this is in consonance with HIV transactions (1,380,765.00 Php). This was followed by catering services (358,860.14 Php) for DOH-5 procurements as a whole, while medical supplies and laboratory instruments (992,975.00 Php) for HIV cases in particular.

How Long is the Process?

Figure below shows the standard procurement process, as stated in the Philippine Government Law. The first step is to publish the list of items to be procured, followed by pre-bidding, closing of bid, and awarding of bid. Once awarded, the winning bid will undergo post-qualification, and then the award is published, before the winning contractor is given the notice to proceed document.
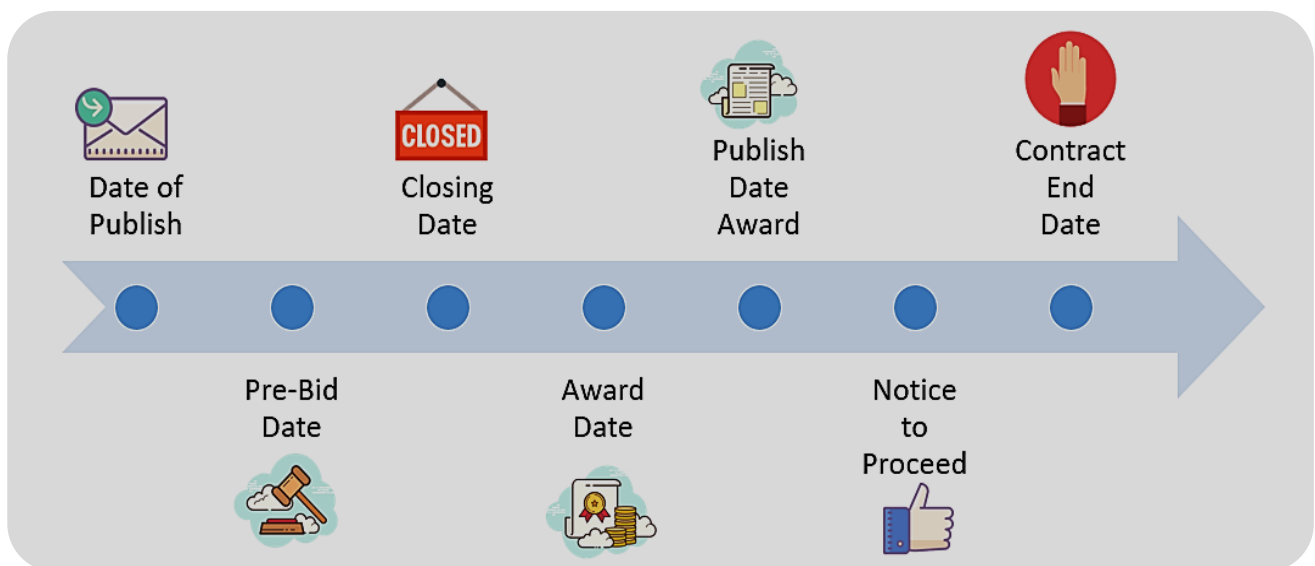

Figure 13: Standard Procurement Process, GPRA Law

Findings revealed in Figure 14 that the computed average procurement timeline consumes per process by DOH 5 were at least 7.43 days from date of publication to pre-bid process, 13.75 days from pre-bidding to its closing date, 53 days from the closing date to its award date, 51.95 days were also spent from the date of award to its publish date of award. Results however showed that the deferment of process occurs on the notice to proceed which raises questions on the process transparency and efficiency of the delivery of goods and services. The data shows that the Notice to Proceed is issued by an average of 27 days earlier than the publishing of the award in PhilGEPS.
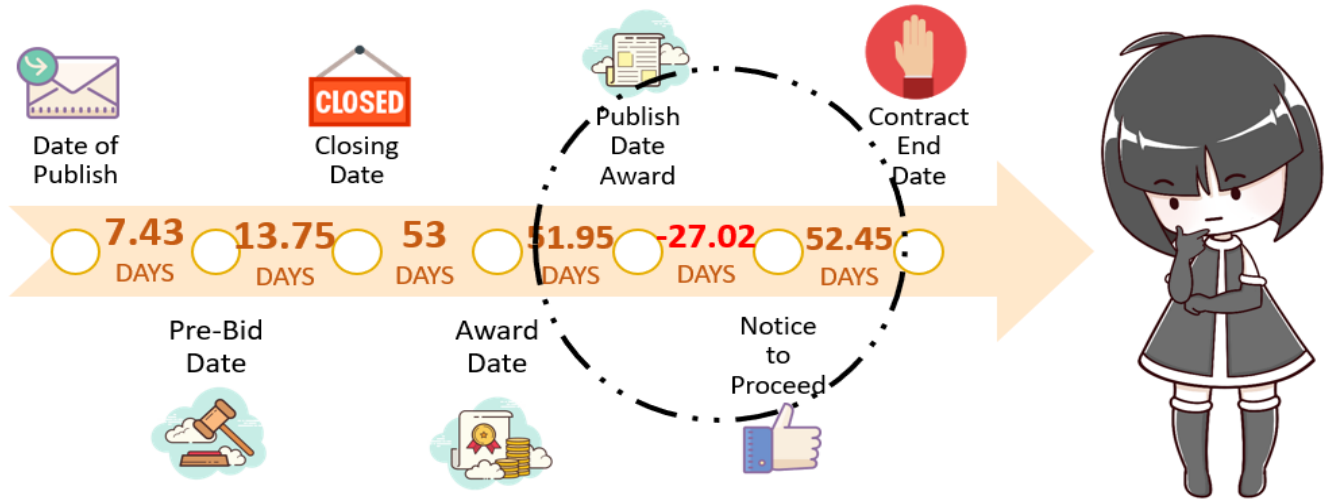
Figure 14: Computed Procurement Timeline for DOH 5

Almost similar findings were made on the computed procurement timeline for HIV/AIDS transactions. They only vary on the award date which took 41.9 days and longer period of 116.81 days on the publication of winning bidders as compare to other transactions. It is sad to note however that the notice to proceed issuance raises even bigger process integrity and transparency issues by being posted 110.07 days before Publish Date of Award.
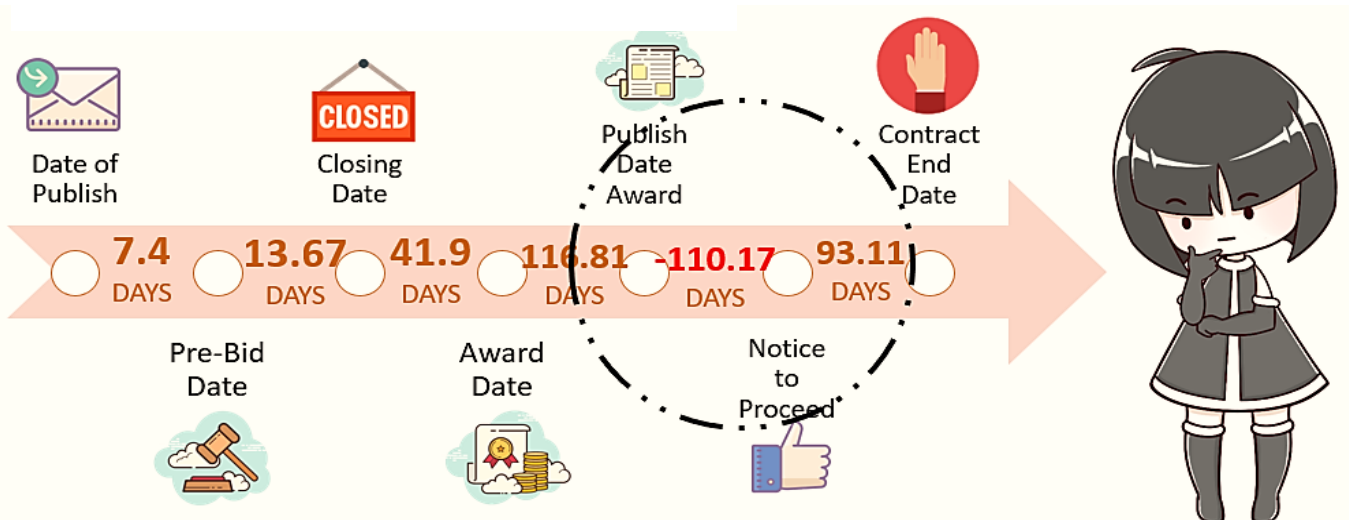
Figure 15: Computed Procurement Timeline for HIV/AIDS

On May 22, 2019, the final results were presented to the members of the LGBT community in Bicol region with hands-on demonstration of the OCDex portal and its features, including a crash course on Data Analysis and how to interpret graphs and tables. The participants exchanged stories, lessons, and practical uses of data in their campaign against HIV/AIDS, and how they can better work with the Department of Health region 5 to battle the increasing number of HIV/AIDS diagnosis in the region.

CONCLUSIONS & RECOMMENDATIONS

Results however showed that the deferment of process occurs on the issuance of Notice to Proceed which raises process transparency and integrity issues on delivery of goods and services on all procurement modes. However, this can also be interpreted as an issue with the Publishing of the Award on PhilGEPS, which can be further examined to correct this process aberration. To make the data and visualization tools freely accessible to the public, an automated OCDex platform was developed by Layertech Labs. The study recommends that online tools are important especially for cases on HIV/AIDS because of social stigma. It makes users more comfortable to browse HIV/AIDS-related documents in private; every government project from PhilGEPS dataset can be made available anytime, and can be reviewed in detail (e.g. see contract amount, contract period, etc.), anonymously and privately; delivery and procurement requisitions may be properly planned, helping CSOs to effectively schedule their advocacy activities; average award prices, savings, can be used as guides in crafting proposals, or in requesting for higher budget allocations to deliver the goods and trainings needed for their advocacy; potentially problematic stages in the procurement can be estimated and prepared for; by looking at the details, CSOs can monitor the value for money by ensuring the quality of service delivery commensurate to it; and, CSOs can formulate evidence-based requests, complaints and proposals to Department of Health and to other agencies, for that matter.

Information/Data sources used in this use-case:

Aggregated costs and timeline data – PhilGEPS dataset (ABC, unit costs, timestamps)

Test kits delivered to DOH-region 5 – Requested from DOH RO5 via EFOI portal

Test kits procured by DOH-region 5 – PhilGEPS dataset (ABC, status, item cost & description)

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BUSINESS INTELLIGENCE FOR BIDDERS

Business intelligence (BI) is the practice of systematically transforming raw data into useful information, which an organization can use to make informed decisions, monitor performance, and optimize resources. BI can unravel a clearer picture of what exactly is happening in a business process, narrow down potential bottlenecks, and serve as a guide in asking the right questions. BI can be used in public procurement. With BI for example, bidders can see exactly how much governments are spending, what exactly are their governments spending on, how long does the procurement process take, where are the bottlenecks in the process, and how projects and services are being acquired and delivered. Getting a hold of these trends and insights offers a strategic advantage to suppliers, contractors, locators, in planning for their bids, or in deciding whether to invest in a particular local government based on the procurement climate.

(map taken from google maps)

Albay is a province located in the Bicol Region, southeastern of Luzon Island of the Philippines. The Province is composed of 15 municipalities and 3 component cities, the capital being Legazpi city. The population of Albay[18] is 1,233,423 and a total land area of 2,554.06 sq. km.

The main industry in the entire province is agriculture, producing crops like coconut, rice, sugar, and abaca, as well as handicrafts making. Tourism is also a major focus by the local governments in the province[19]. In the recent years, Information Technology – Business Process Management services (IT-BPM) is also being explored by the city of Legazpi to provide more jobs for its constituents.

LOCAL GOVERNMENT UNITS (LGU) EXPLORED IN THIS REPORT:

Provincial Government of Albay	City Government of Legazpi	City Government of Ligao
City of Tabaco	Municipality of Bacacay	Municipality of Camalig
Municipality of Daraga	Municipality of Guinobatan	Municipality of Jovellar
Municipality of Libon	Municipality of Malilipot	Municipality of Malinao
Municipality of Manito	Municipality of Oas	Municipality of Pio Duran
Municipality of Polangui	Municipality of Rapu-Rapu	Municipality of Sto. Domingo
Municipality of Tiwi		

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[18] As of 2010 census Philippine Statistics Authority official website

[19] Information from Albay provincial government official website

The Questions

Interviews and focus group discussions with a number of contractors in Albay from 2017-2019 revealed the following **common questions** that potential bidders ask, in consideration whether to submit a bid to an open tender or not:

> 1. **What are the local governments buying?**
> 2. **How much are the local governments spending?**
> 3. **How long is the procurement process from posting of tender to contracting?**
> 4. **Who and how many are currently supplying the local governments?**
> 5. How many bidders participate in every tender?
> 6. How long do governments pay awarded suppliers after successful delivery?

Due to constraints in the availability of procurement data, the BI can only help answer the first four questions. The remaining two questions will be tackled in the recommendations section of this report.

Data Source and Processing

The Government Procurement Reform Act (GPRA) and its Implementing Rules and Regulations require procuring entities to post procurement information in PhilGEPS.

PhilGEPS continuously releases these procurement datasets in quarterly increments as excel files, downloadable for free in the PhilGEPS official open data portal.
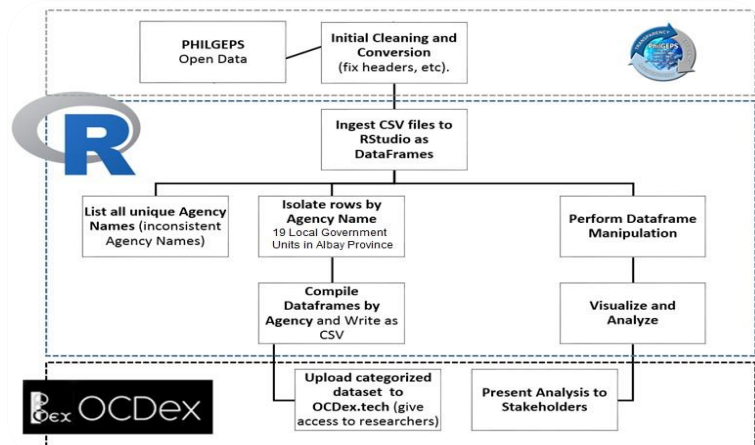
For this BI run, we use the datasets from the official PhilGEPS open data portal.

Please note that PhilGEPS dataset uploaded in the PhilGEPS open data portal is the **SOLE SOURCE of DATA** used in this report. While the dataset does not have consistent field formats and requires standardization, this study assumes that all data from PhilGEPS are ACCURATE.

Question #1:
What are the Local Governments in Albay Buying?

The datasets in the PhilGEPS portal are fragmented (quarterly), contains thousands of rows from procuring entities all over the Philippines. Furthermore, the dataset values have inconsistent procuring entity names, date and time formats. Before processing the data for BI, the datasets were pre-processed, standardized, to ensure "clean" datasets for processing, visualization, and analysis. As shown in the schematic diagram above, the first step is to isolate all rows related to the target procuring entities (in this report's case, 19 Local Government Units from Albay Province).

This report used data from Years 2016 to 2018.

The datasets are then 'cleaned' and visualized using R environment.
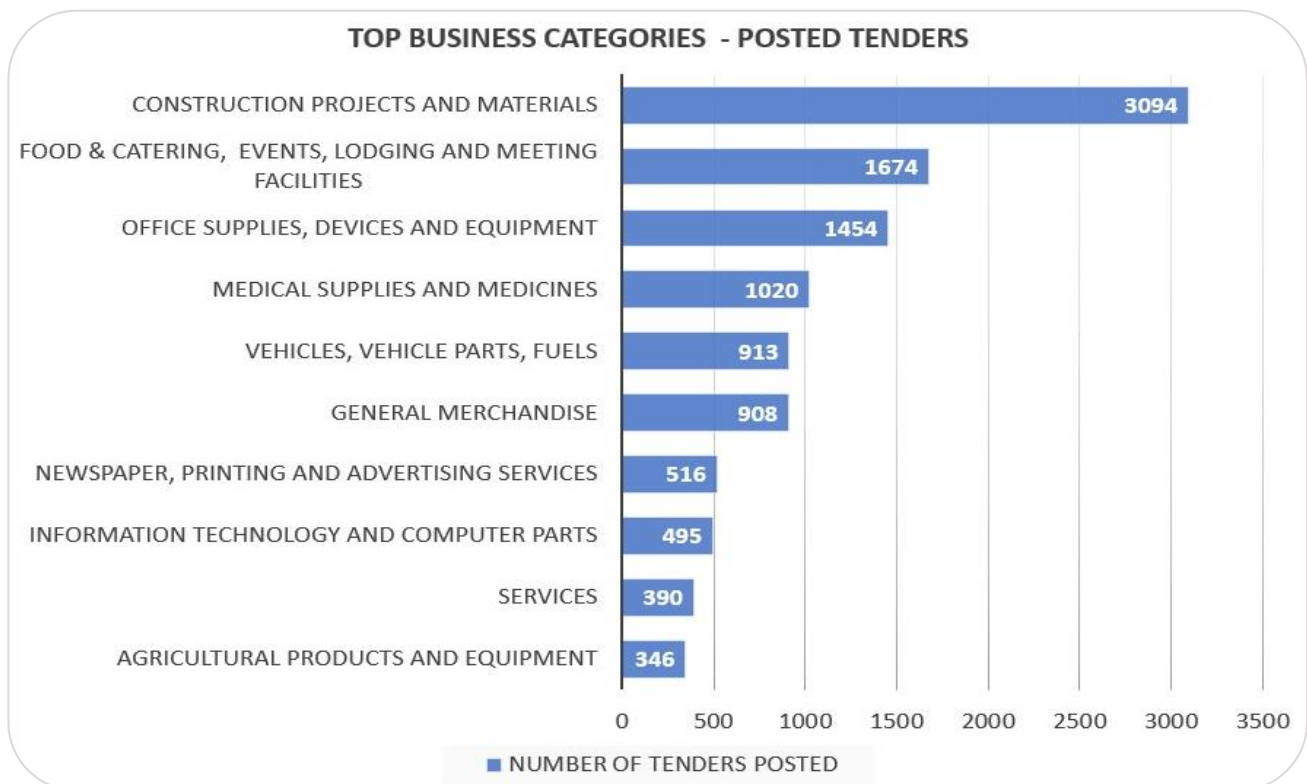

Figure 16: The Top Business Categories in Albay LGUs by Number of Tenders Posted from 2016-2018

The TOP 10 business categories according to the number of tenders posted by LGUs in Albay are shown in Figure 16. The most frequent purchase is under Construction Projects and Materials category, followed by Food and Catering, Office Supplies, Medical Supplies and Medicines, Vehicles, General Merchandise, Newspaper and Printing, IT, (general) Services, and Agricultural Products and Equipment.

While Figure 16 shows a general picture of the business categories of the entire Albay Province's purchases, it is helpful to see how each LGU in Albay Province contributes to these numbers. Figure 17 shows the breakdown of Figure 16 per LGU, while Figure 18 shows the percent contribution of each LGU to the top business categories in Albay Province.
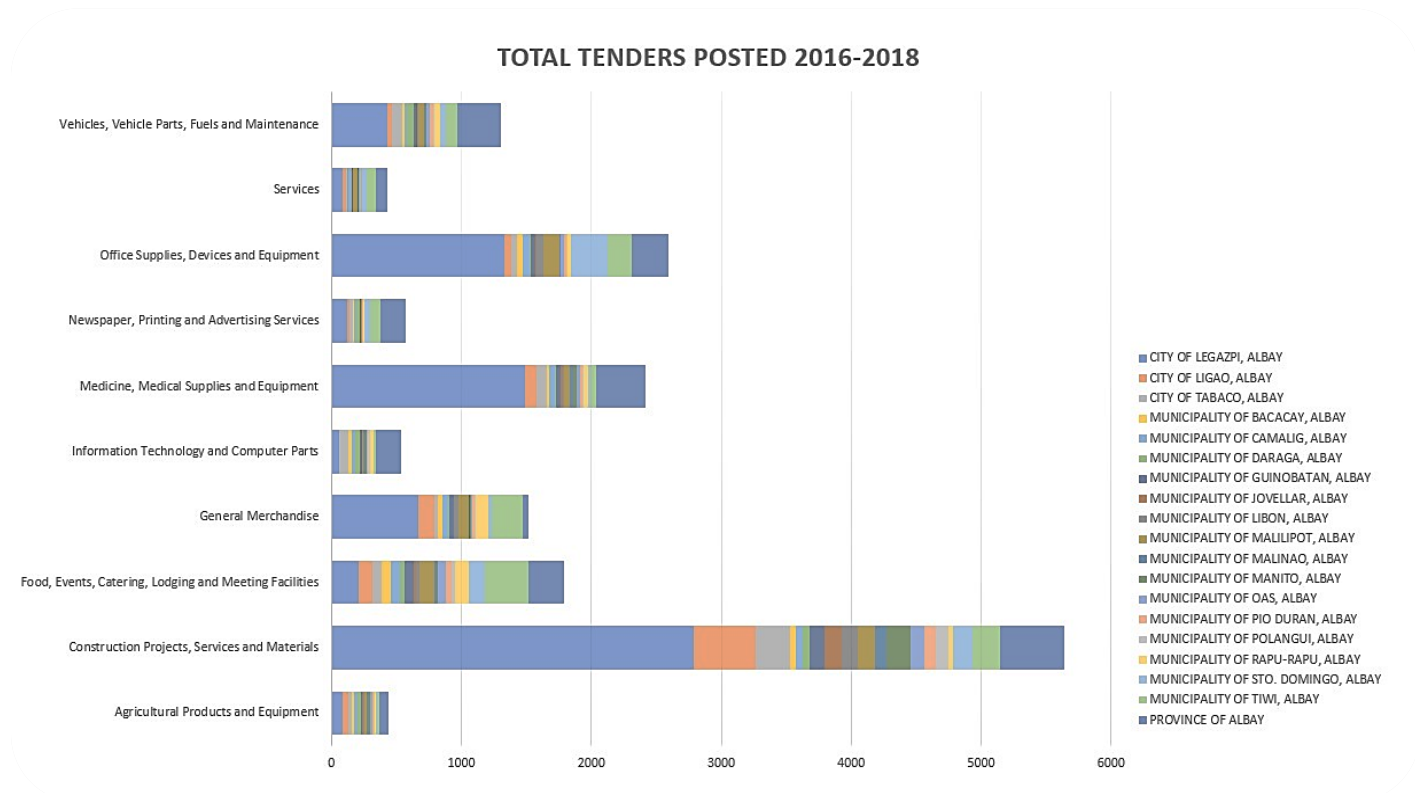
Figure 17: The Top Business Categories in Albay, Classified by LGU from 2016-2018

In Figure 17, we can immediately see that the highest number of tenders under each category are primarily from the Province of Albay and City of Legazpi (except for Food and Catering, which is from Municipality of Tiwi, and Information Technology, from Albay Provincial Government).

For a food catering business for example, the likelihood of a tender opening under its business category would be higher in Tiwi Municipality than in Legazpi City.
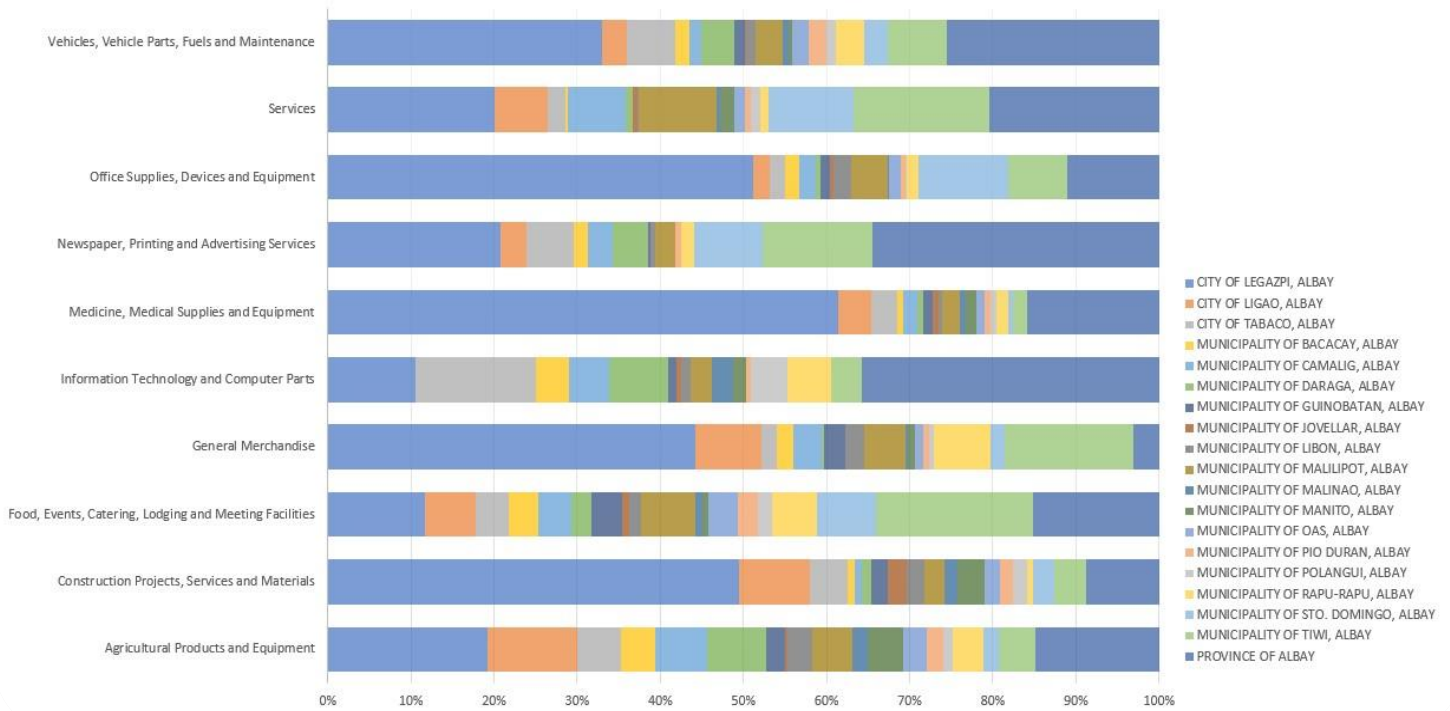
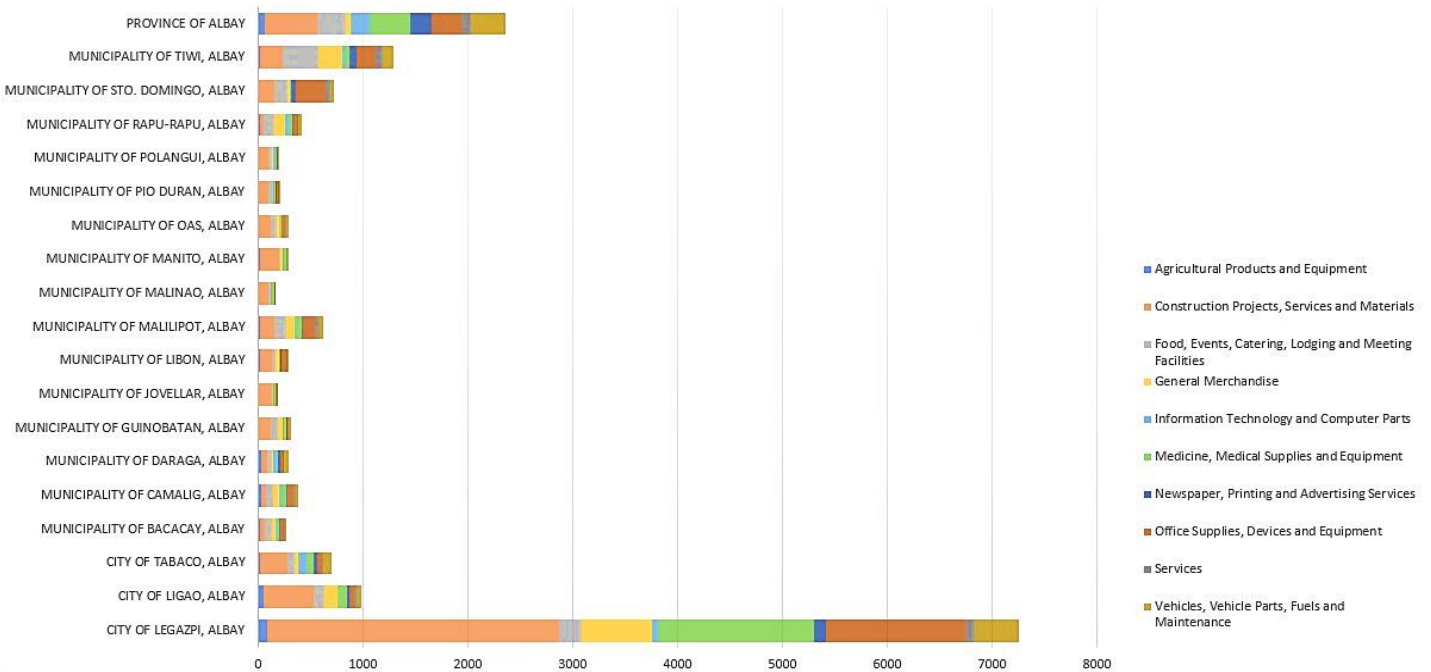Figure 18: Percentage of the Top Business Categories in Albay, Classified by LGU from 2016-2018

Figure 19: LGU-View of The Top Business Categories in Albay by Number of Tenders Posted from 2016-2018

TOTAL TENDERS POSTED 2016-2018

Legend:
- Agricultural Products and Equipment
- Construction Projects, Services and Materials
- Food, Events, Catering, Lodging and Meeting Facilities
- General Merchandise
- Information Technology and Computer Parts
- Medicine, Medical Supplies and Equipment
- Newspaper, Printing and Advertising Services
- Office Supplies, Devices and Equipment
- Services
- Vehicles, Vehicle Parts, Fuels and Maintenance

Figure 20: Percentage of Business Categories of Tenders posted by LGUs in Albay from 2016-2018

Figure 19 is another visualization focusing on each local government, and how many tenders they are posting per business category. If a business is geographically locked to a municipality or city in terms of delivery, this view might be more interesting, to understand the opportunity to participate in its target LGU's procurement.

Figure 20 is an LGU-view of Figure 18, showing the percentage of each business category in the total tenders posted by each LGU. This view can be helpful in identifying buying patterns of a select LGU in Albay.

For example, if a business is geographically catering to the Municipality of Rapu-Rapu (Island) only, the most frequent tenders for these are under the 'General Merchandise' and 'Food and Catering' business categories.

Question #2:
How Much Are the Local Governments in Albay Spending?

Figure 21: Average Approved Budget of Contract Per Business Category in Albay LGUs from 2016-2018
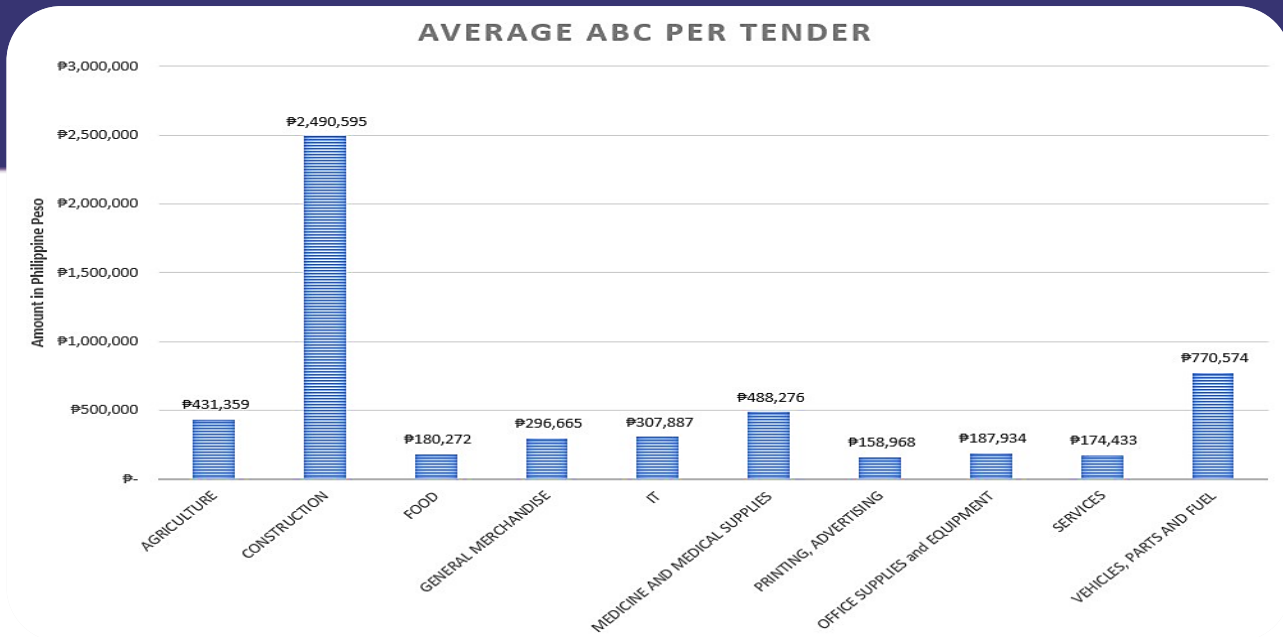
Figure 21 shows the average Approved Budget of Contract (ABC) per business category in Albay LGUs, and Figure 22 shows the collective Average ABCs of each LGU in Albay.
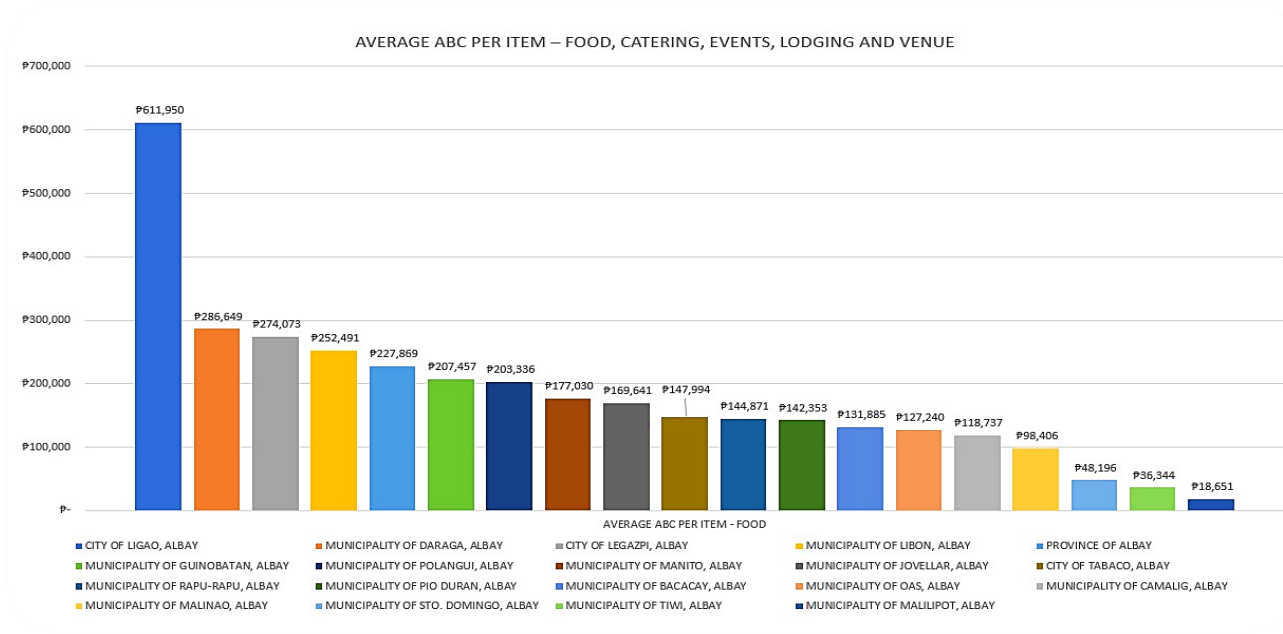
Figure 22: Average Approved Budget of Contract Per Business Category of all Albay LGUs from 2016-2018

As seen in Figure 22, the average ABCs of each LGU is not uniform across the different business categories. Figures 23-32 shows a more specific, business-view of the budget of each Albay LGU per business category.

Figures 23-32 shows significant variation among the average ABCs of the business categories across the LGUs in Albay. When estimating for the average ABC of an incoming tender, it is advisable therefore, to look at the disaggregated view of the average ABCs per business category.
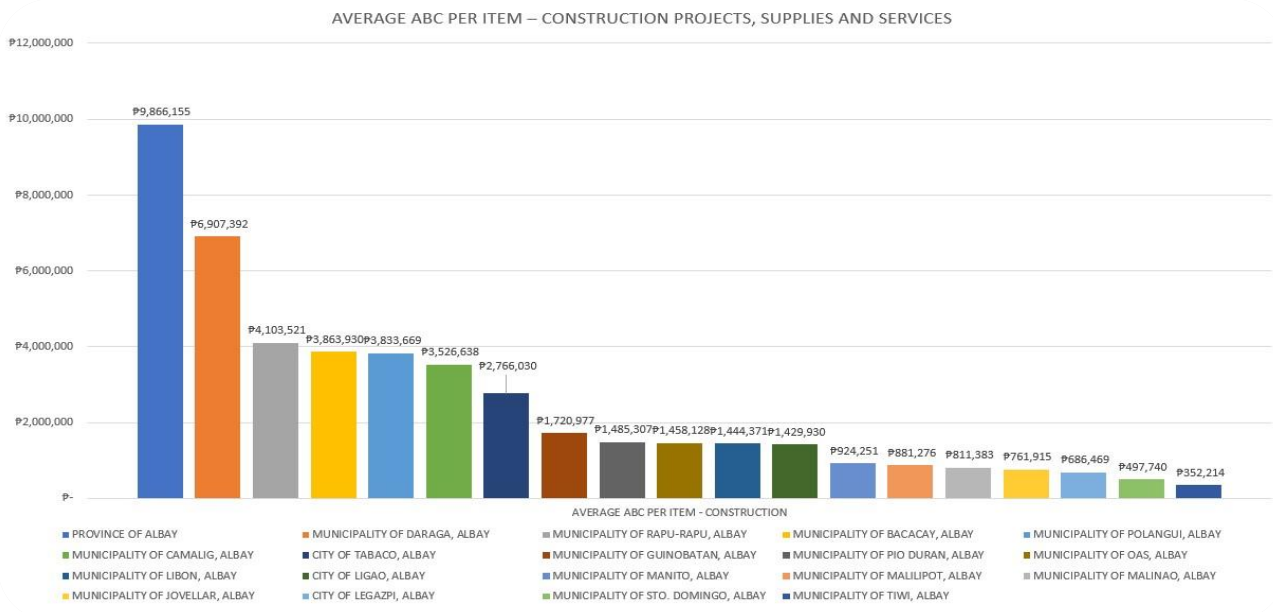
Figure 23: Average Approved Budget of Contract of Construction Projects
and Supplies of all Albay LGUs from 2016-2018
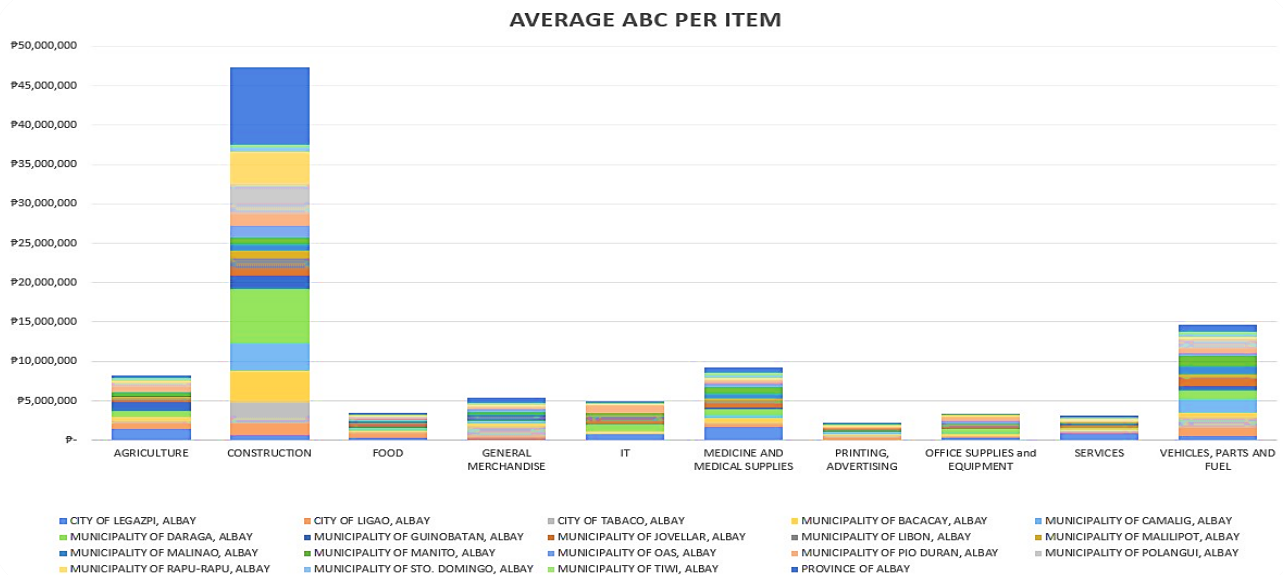
Figure 24: Average Approved Budget of Contract of Food, Catering
and Events of all Albay LGUs from 2016-2018
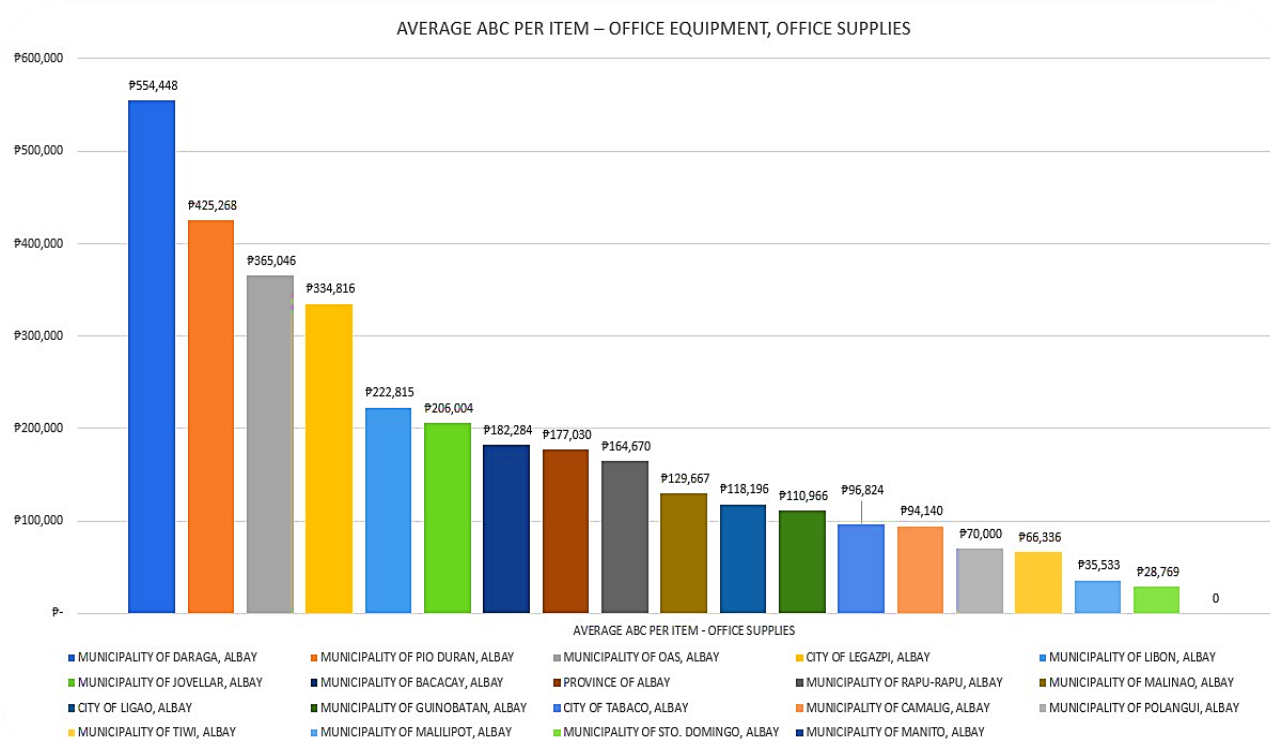
Figure 25: Average Approved Budget of Contract of Office Equipment
and Supplies of all Albay LGUs from 2016-2018
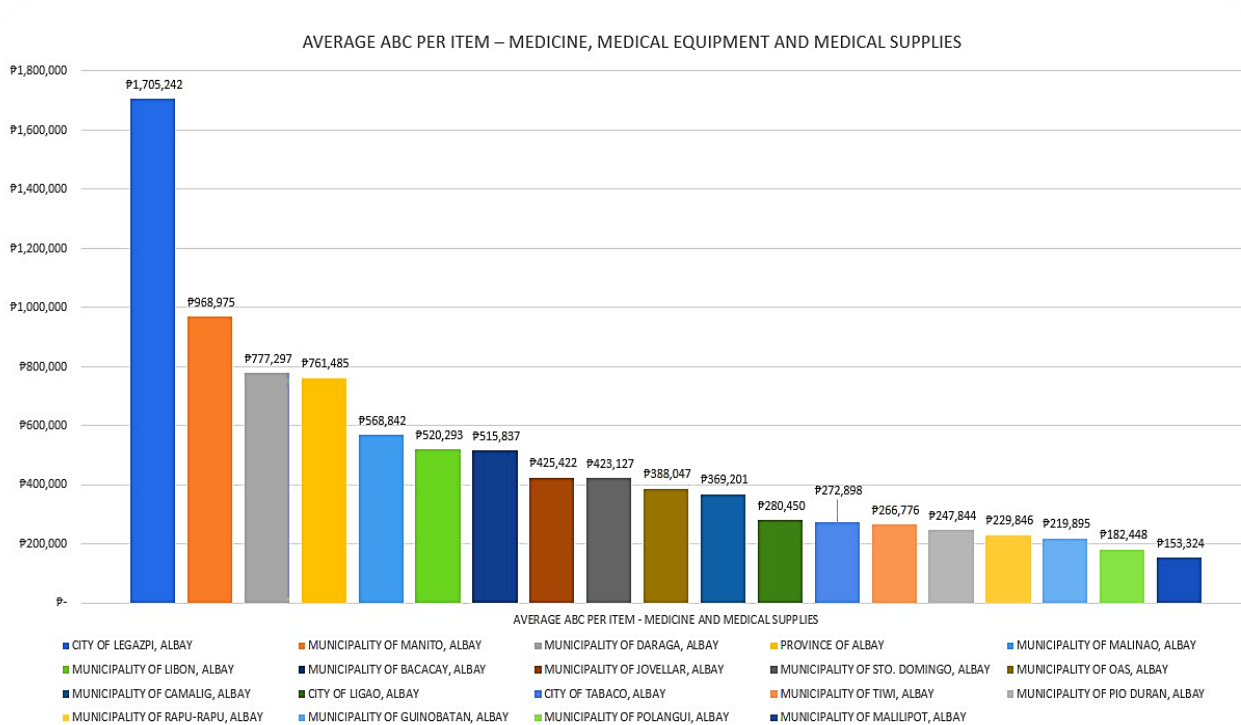
Figure 26: Average Approved Budget of Contract of Medicine, Medical Equipment
and Supplies of all Albay LGUs from 2016-2018
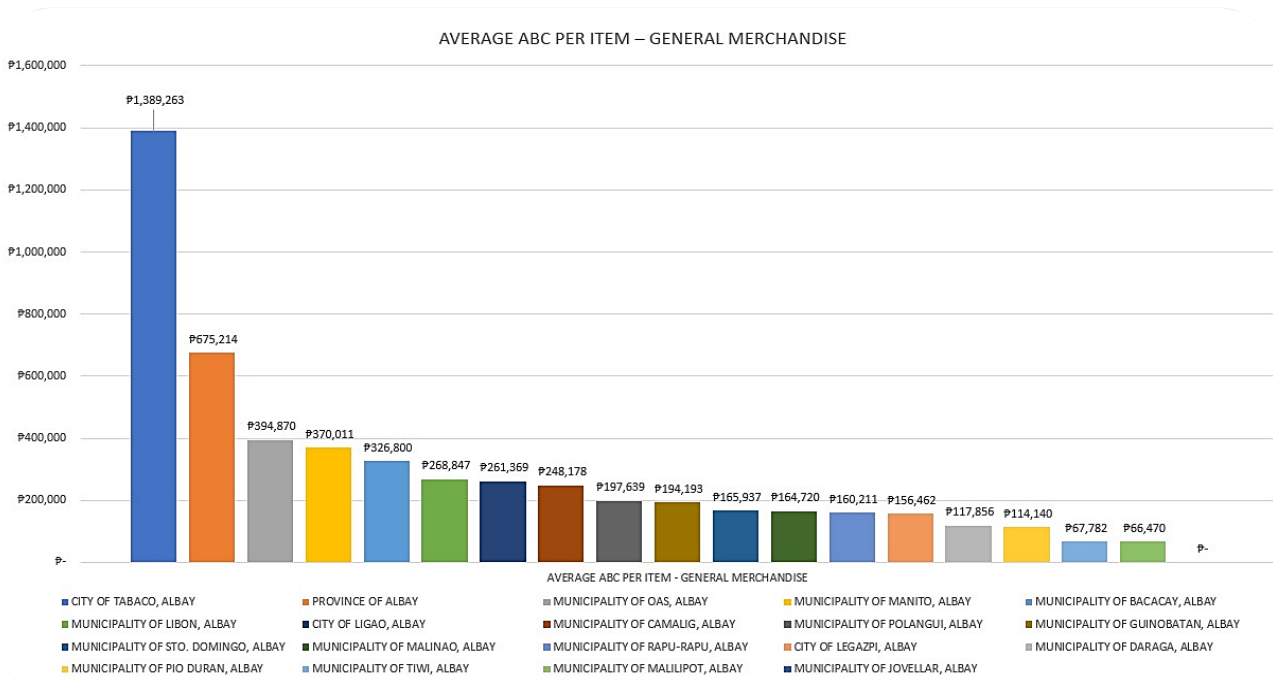
Figure 27: Average Approved Budget of Contract of General Merchandise of all Albay LGUs from 2016-2018
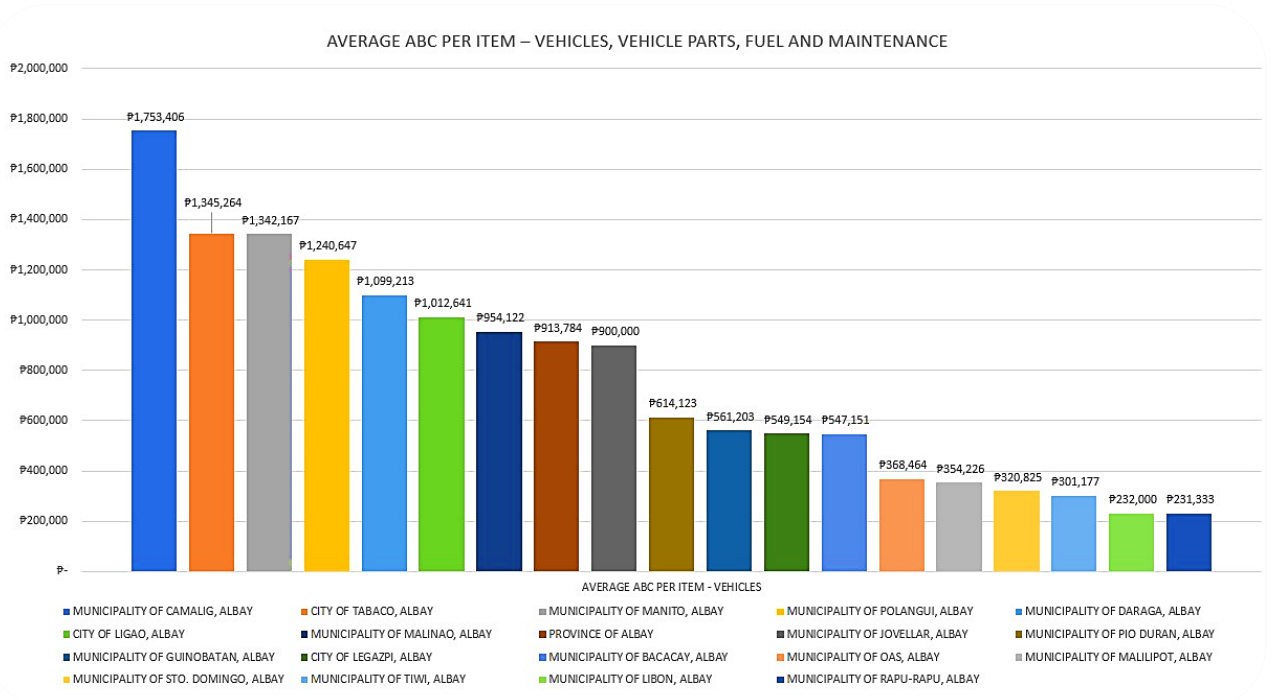
Figure 28: Average Approved Budget of Contract of Vehicles, Vehicle Parts and Accessories of all Albay LGUs from 2016-2018

AVERAGE ABC PER ITEM – GENERAL SERVICES
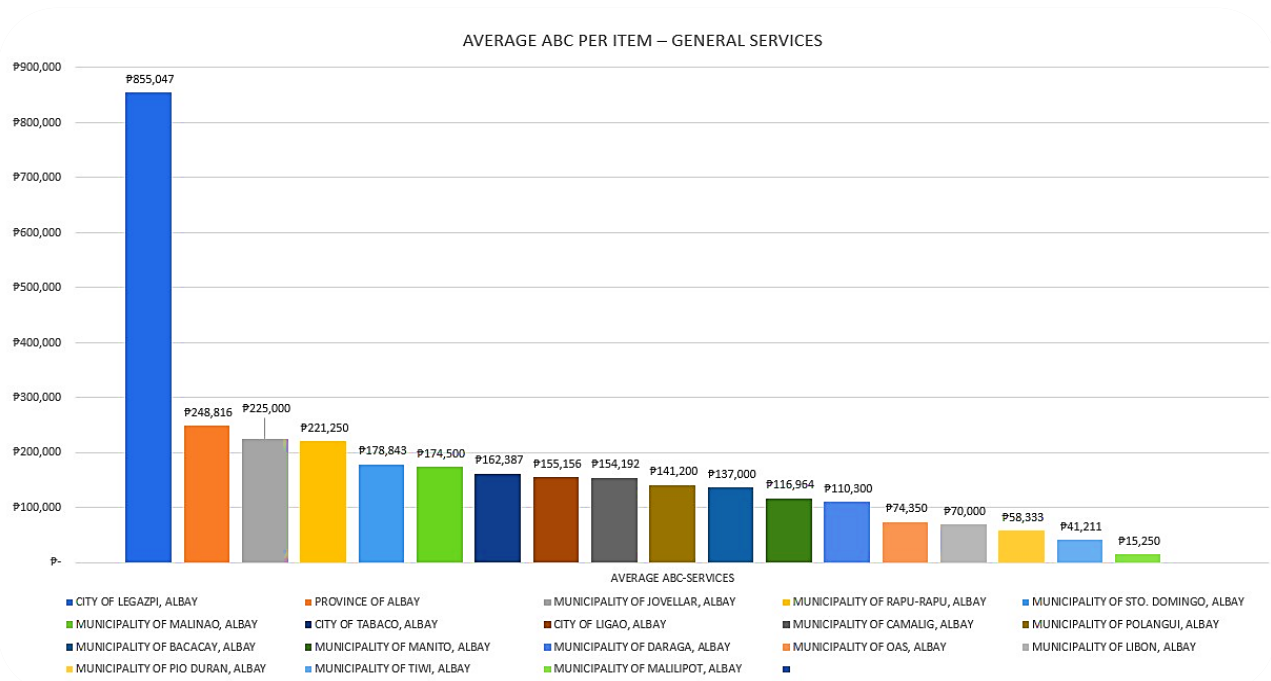
Figure 29: Average Approved Budget of Contract of General Services
of all Albay LGUs from 2016-2018

AVERAGE ABC PER ITEM – NEWSPAPER, PRINTING , ADVERTISING
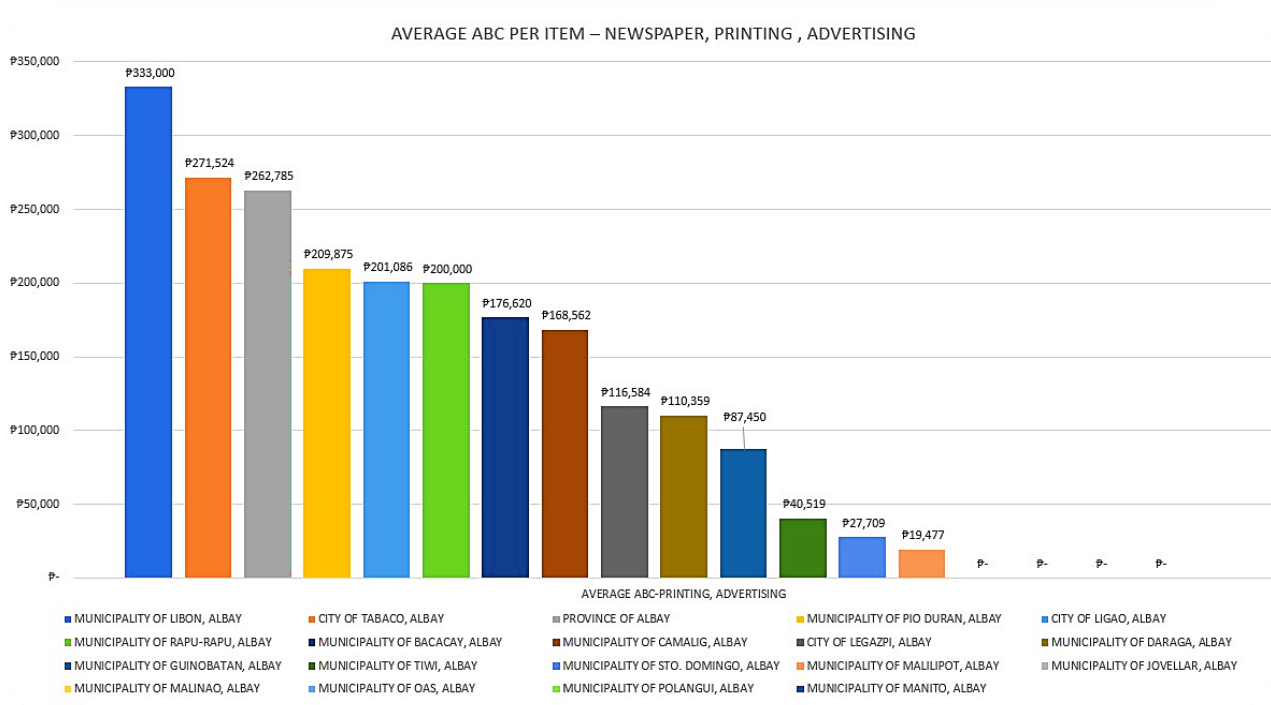
Figure 30: Average Approved Budget Contract of Newspaper, Printing
and Advertising of all Albay LGUs from 2016-2018
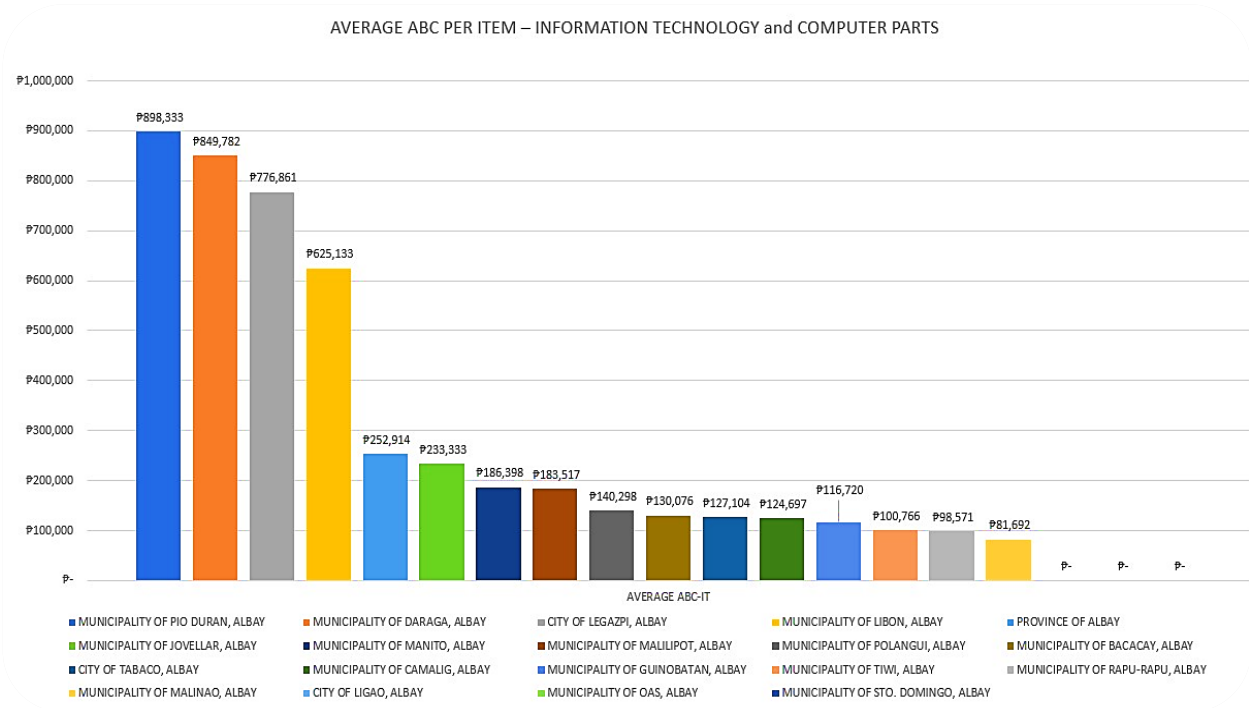
Figure 31: Average Approved Budget of Contract of Information Technology and Computer Parts of all Albay LGUs from 2016-2018
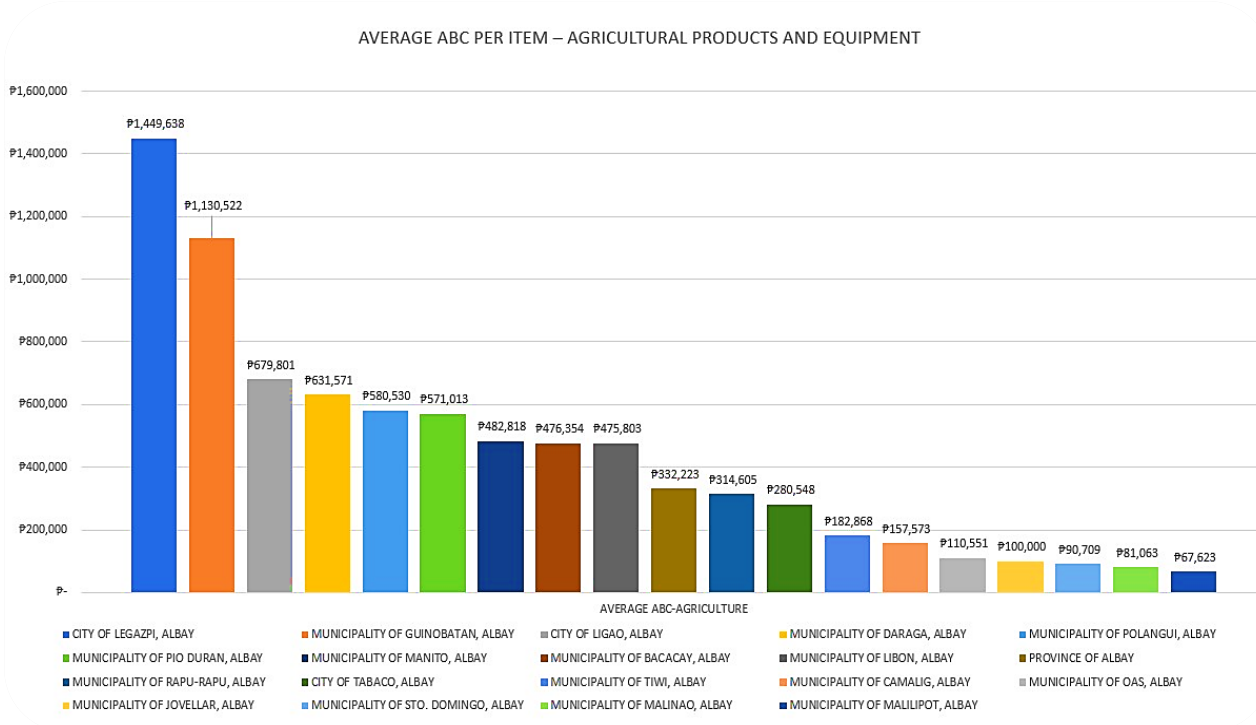
Figure 32: Average Approved Budget of Contract of Agricultural Products and Equipment of all Albay LGUs from 2016-2018

AVERAGE ABC PER LINE ITEM
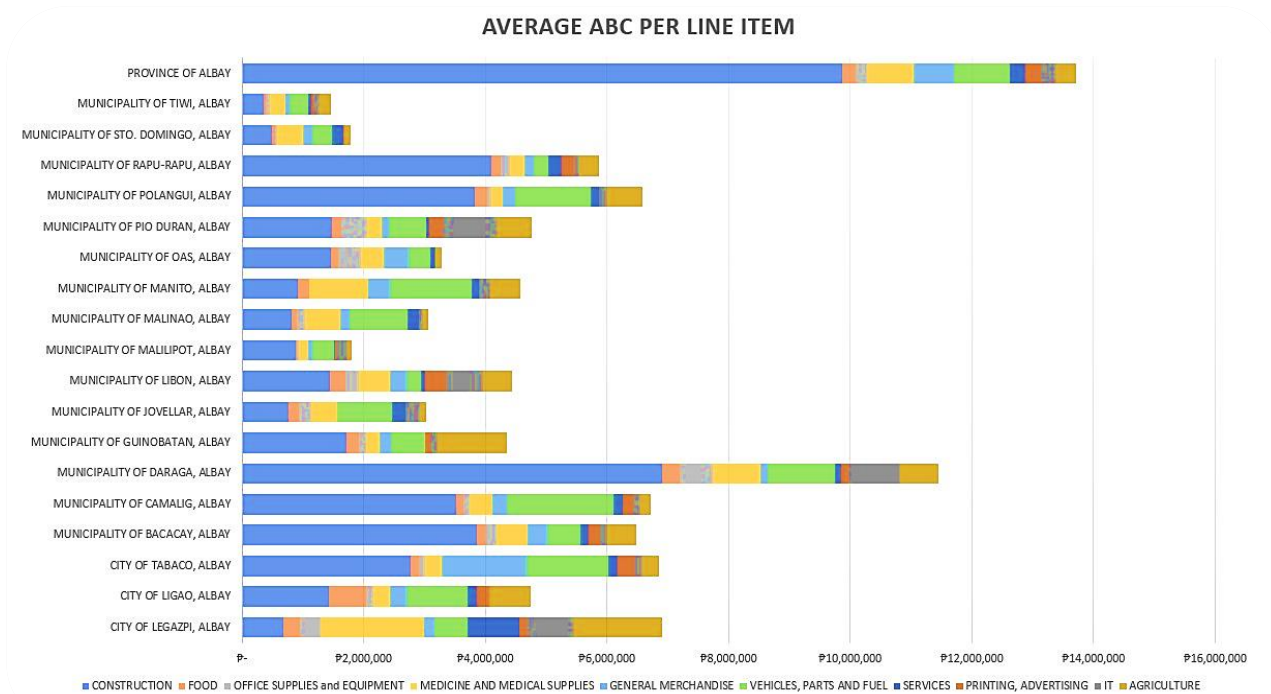
Figure 33: LGU-View of Average Approved Budget of Contract Per Business Category
of all Albay LGUs from 2016-2018

Figure 33 is an LGU-view of figure 22, and a summary of Figures 23-32, showing the average ABCs of each business category.

If a business is more interested in a specific LGU, the LGU-view figures may be more appealing and insightful compared to the business-views. On the other hand, if a business is more interested in the business category as a whole, the business-view offers a more appealing format.

> *NOTE: In general, Provincial Governments and City Governments have bigger budgets and needs than municipalities, with more expenditures, thereby resulting in more and higher tenders posted and larger average Approved Budget of Contract.*

Values vs Frequency
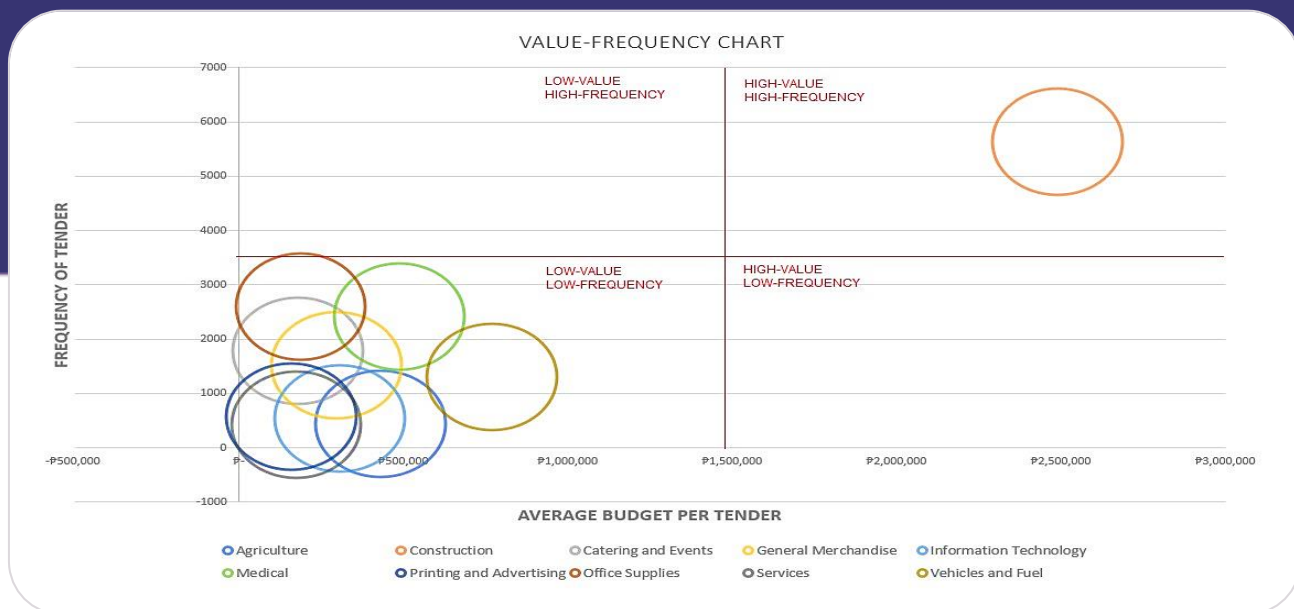
Figure 34: Relative Value-Frequency Chart of All Business Categories in Albay from 2016-2018

Figure 34 is a value-frequency chart of the top business categories in Albay. Construction-related procurement is noticeably higher both in value and in frequency of tender posting for all LGUs in Albay.

Removing the 'Construction' business category in the picture, we get a zoomed-in version of the relative value-frequency chart in Figure 20. In this zoomed-in chart, the relative value-frequency classifies vehicle purchases in the high-value, low-frequency quadrant, the 'Medical Supplies' in the high-value, high-frequency quadrant, 'Office Supplies' in the low-value, high-frequency quadrant, and the rest in the low-value, low frequency quadrant.
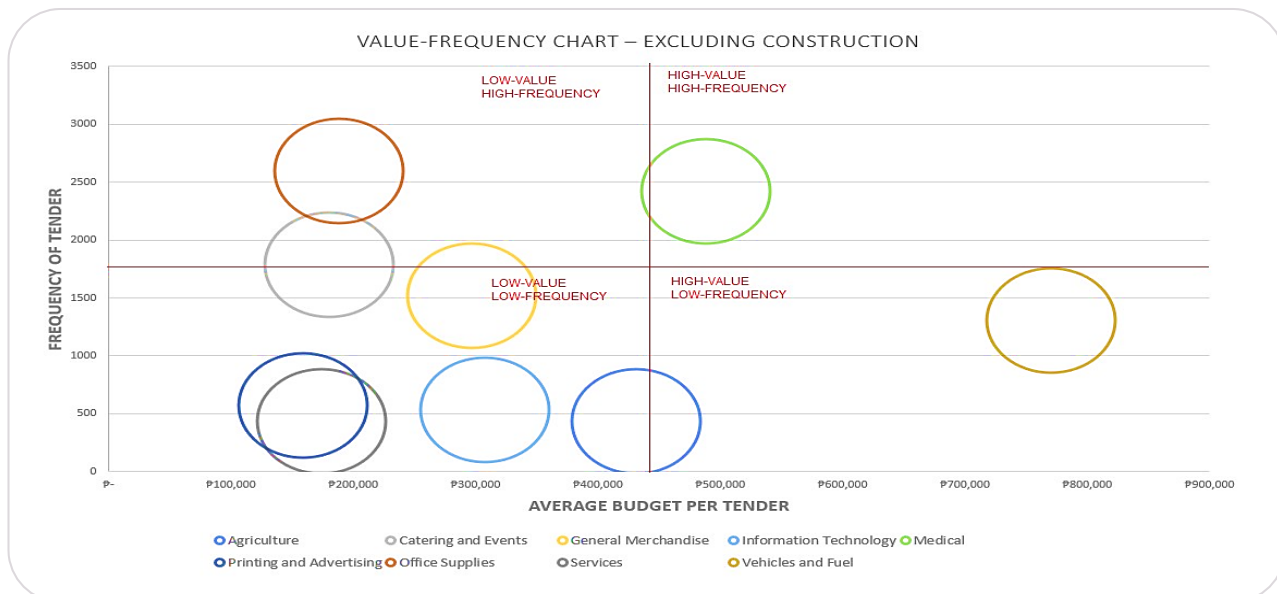
Figure 35: Relative Value-Frequency Chart of All Business Categories, except Construction, in Albay from 2016-2018

When are the LGUs posting tenders?
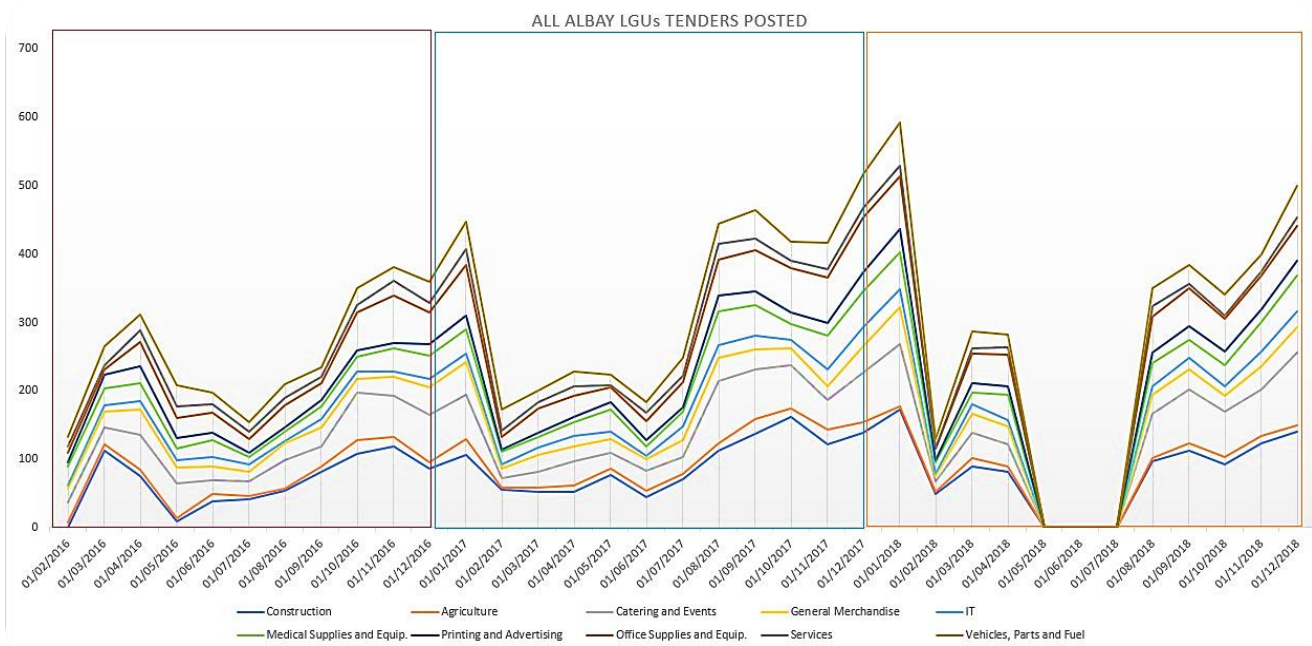
Figure 36: Temporal graph of Tenders Posted by Albay LGUs from 2016-2018

Figure 36 shows a graph of tender posting, each series/line representing a business category. The trends of all business categories are similar to each other, with 'Agriculture' and 'Construction' business categories having the most similar tender posting patters.

It is also worth noting that the number of tenders posted spike from the month of July, going up until December, while the lowest number of tenders are posted from February to June.

Please note that the flat line in Figure 36 shows ZERO tenders posted, due to the *barangay* elections, which restricts LGUs to post tenders during the elections and the transition period of the newly-elected officials.

How Long is Albay's Procurement?
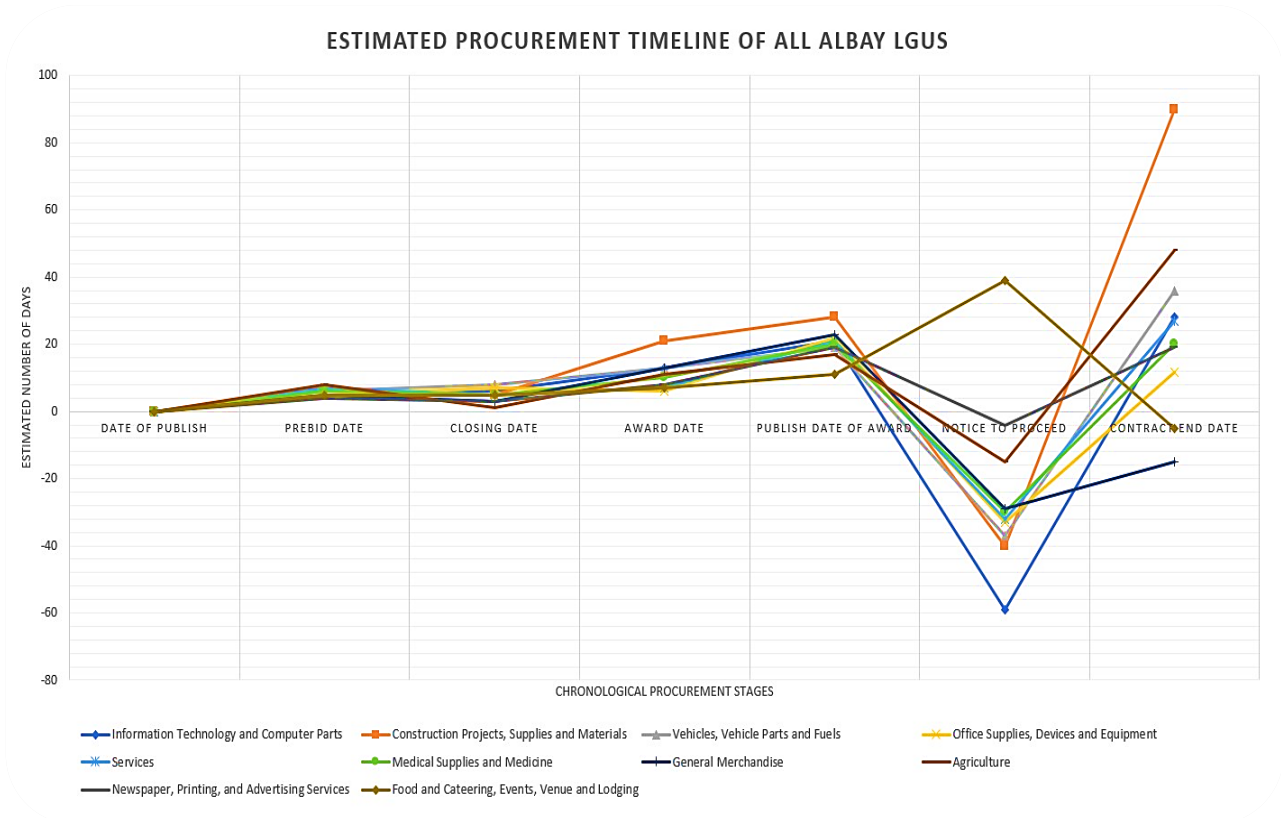
Figure 37: Average Procurement Timeline of Albay LGUs from 2016-2018

Figure 37 shows the approximate number of days from posting of tender to contract end date, per business category. Table 6 shows the average number of days for each procurement step, for each business category. Please note that the negative values in the table either mean that the step is made earlier than the prior step, or an input error by the procuring entity in PhilGEPS interface.

The graph shows the same pattern for all business categories, except for construction projects which takes approximately a week longer compared to other business categories, from the closing date to the award date. The major difference between the business categories arises when the procuring entity issues the 'Notice to Proceed' document, up to the contract's end.

Business Category	Date of Publish	Pre Bid Date	Closing Date	Award Date	Publish Date of Award	Notice to Proceed	Contract End Date
Information Technology and Computer Parts	0	5	6	13	21	-59	28
Construction Projects, Supplies and Materials	0	6	5	21	28	-40	90
Vehicles, Vehicle Parts and Fuels	0	6	8	13	19	-37	36
Office Supplies, Devices and Equipment	0	5	7	6	22	-33	12
Services	0	7	5	7	21	-32	27
Medical Supplies and Medicine	0	6	5	10	20	-30	20
General Merchandise	0	5	3	13	23	-29	-15
Agriculture	0	8	1	11	17	-15	48
Newspaper, Printing, and Advertising Services	0	4	3	8	19	-4	19
Food and Catering, Events, Venue and Lodging	0	5	5	7	11	39	-5

Table 6: Average Number of Days Per Procurement Step of Albay LGUs from 2016-2018

Bidders may want to take note of the potential bottleneck in the issuance of the Notice to Proceed, and/or Publishing of Awards. Possible reasons for these bottlenecks include post-qualification assessment issues and posting issues in PhilGEPS, as raised in focus group discussions with LGUs.

Question # 4
Who and How Many are Supplying the Local Government?

TENDERS TO SUPPLIERS RATIO
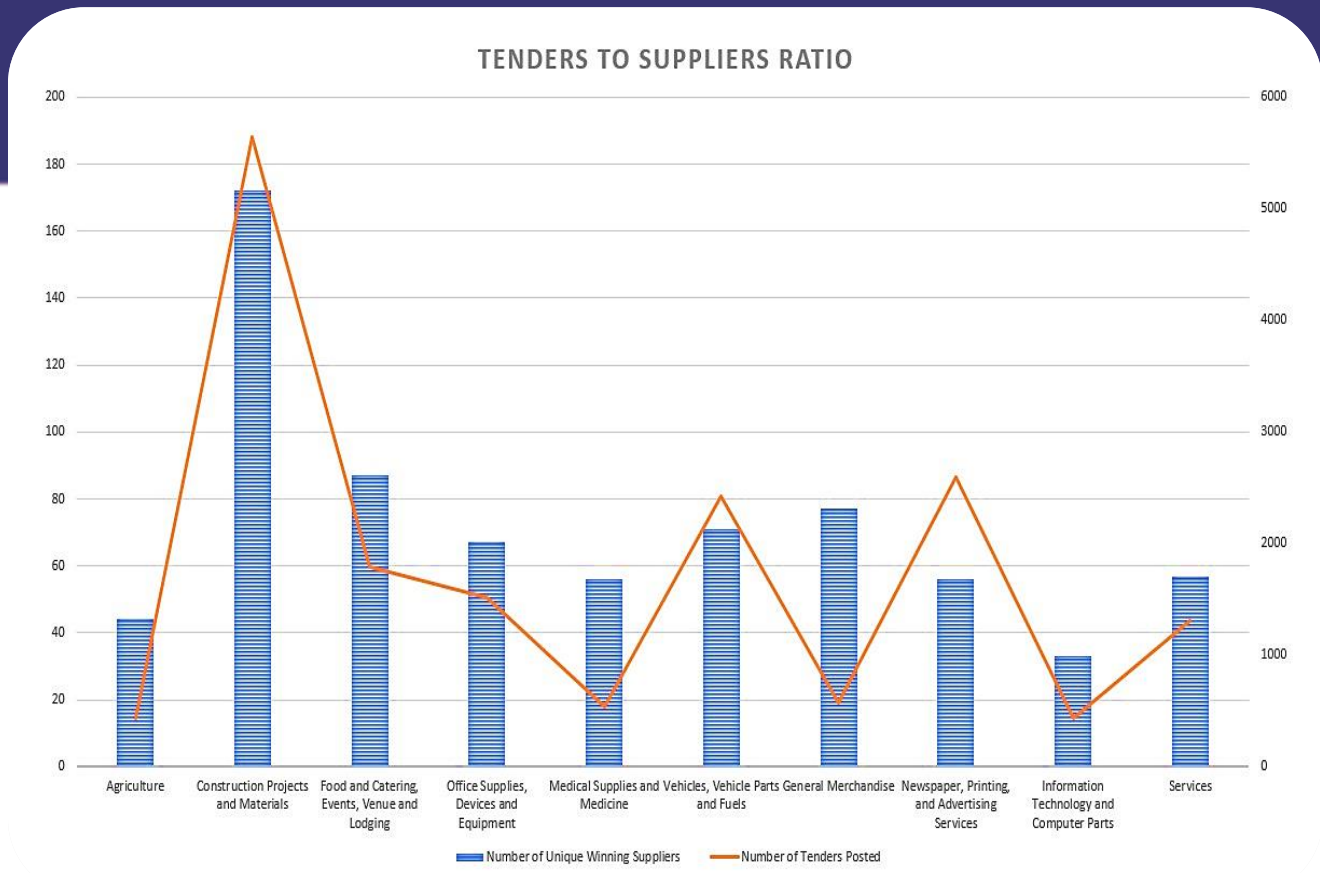
Figure 38: Tender to Supplier Ratio of Albay LGUs from 2016-2018 with the exception of Legazpi and Pio Duran

Figure 38 shows the ratio of tenders posted to the unique suppliers awarded per business category. For example, a potential bidder would want to look for business categories with more tenders and little suppliers.

Figure 38 shows that the business categories 'Construction Projects and Supplies', 'Vehicles and Vehicle Parts', and 'Newspaper Printing, and Advertising Services' have smaller number of supplier-to-tender ratio, compared to other business categories. On the other hand, business categories 'Agriculture', 'Medical Supplies and Medicine', General Merchandise' and 'Information Technology' have the highest number of unique suppliers relative to the number of tenders posted.

The corporate names of winning suppliers are also available in the PhilGEPS dataset.

Please be reminded that this report uses ONLY data from PhilGEPS. It is recommended that this be layered and compared vis a vis other industry-related data and visualizations, for a more complete picture.

Business Intelligence can be an extremely useful and powerful tool for decision making, but in itself, it is not a one-time cure-all. Business Intelligence guides us in asking the right questions, narrowing down potential bottlenecks and issues in a process, and monitoring immediate and long-term effects of activities in a business process.

The number of bidders per tender is not available in the PhilGEPS dataset. However, if LGUs have these data, the number of bidders per tender can be compared to the number of unique winning suppliers, as well as the number of tenders posted under a business category. This will answer Question #5. Similarly, if LGUs store records of the dates where awarded suppliers are paid, this data can answer Question #6.

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Invited Private Sector Representatives of Albay, Legazpi LGU BAC Members (2018) Stakeholders Meeting: Forum – Oriental Hotel, 21 May.

Invited Private Sector Representatives of Albay (2018) Focus Group Discussion– Venezia Hotel, 11 June.

Individual Contractor in Albay (2017) Conversation with Layertech, 22 February.

INSPECTING UNIVERSITY PROCUREMENT TIMELINE AND FAILED BIDDINGS

Bicol University (BU) is a State and Research University located in in the Bicol Region, established in 1969. The university has six campuses all over the region. It is an ISO 9001:2008 certified institution, with certificate no. TUV 100 05 1782. From 1998, BU was classified as level IV state university by Department of Budget and Management (DBM) standards, and is one of the 22 leading universities in the country. BU is declared CHED's Center for Development in Nursing Education, Center for Development in Fisheries Education, Center for Training Excellence (College of Education), and Center for Higher Education Research.

BU is part of Government Procurement Policy Board (GPPB)'s list of Duly Authorized State Universities and Colleges (SUCs) to conduct official procurement training on the Philippine Bidding Documents for National Government Agencies, Government Financial Institutions, Government Owned and Controlled Corporations, Other State Universities and Colleges in their respective regions.[20]

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[20] https://gppb.gov.ph/issuances/Resolutions/19-2004.pdf

DATA SOURCE

PhilGEPS - The Government Procurement Reform Act (GPRA) and its Implementing Rules and Regulations require all government procuring entities, state universities included, to post procurement information in the Philippine Government EProcurement System or PhilGEPS. PhilGEPS continuously releases these procurement datasets in quarterly increments as excel files, downloadable for free in the PhilGEPS official open data portal.

DATA PROFILE

There is a total of 3245 observations (line items) with Bicol University MAIN as the procuring entity, extracted from the official PhilGEPS dataset from years 2016 to 2018 (3 years). Figure 1 shows the breakdown of the mode of procurement for all line items (both awarded and failed). Majority of the line items are procured via small value procurement. This is expected, as there are more small valued line items in terms of frequency in the dataset (e.g. office supplies, pens, broken down into line items). The next largest mode of procurement is Public Bidding.

Among these 3245 line items, there are 1498 line items that are declared successfully awarded.
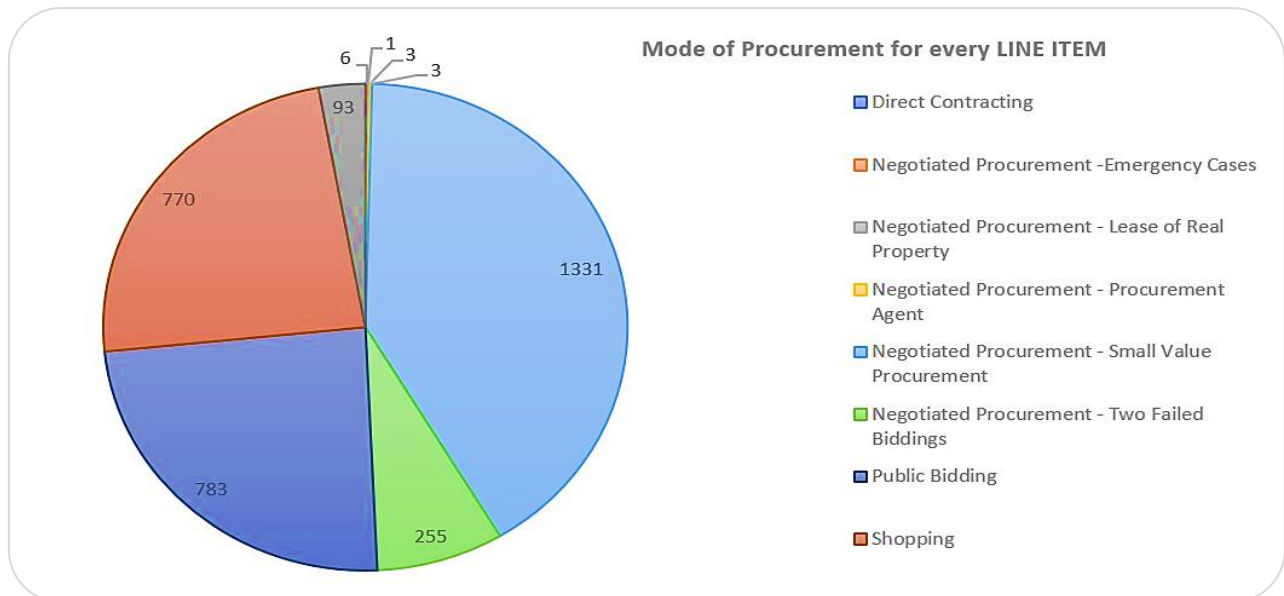
Figure 39: Mode of procurement for all line items in the Bicol University dataset from 2016-2018

Among the 3245 line items, 783 line items were procured by Public Bidding. And breaking down the 783, there are 362 line items that were successfully awarded and 421 line items that were not awarded or declared failure of bidding. What are these failed items?
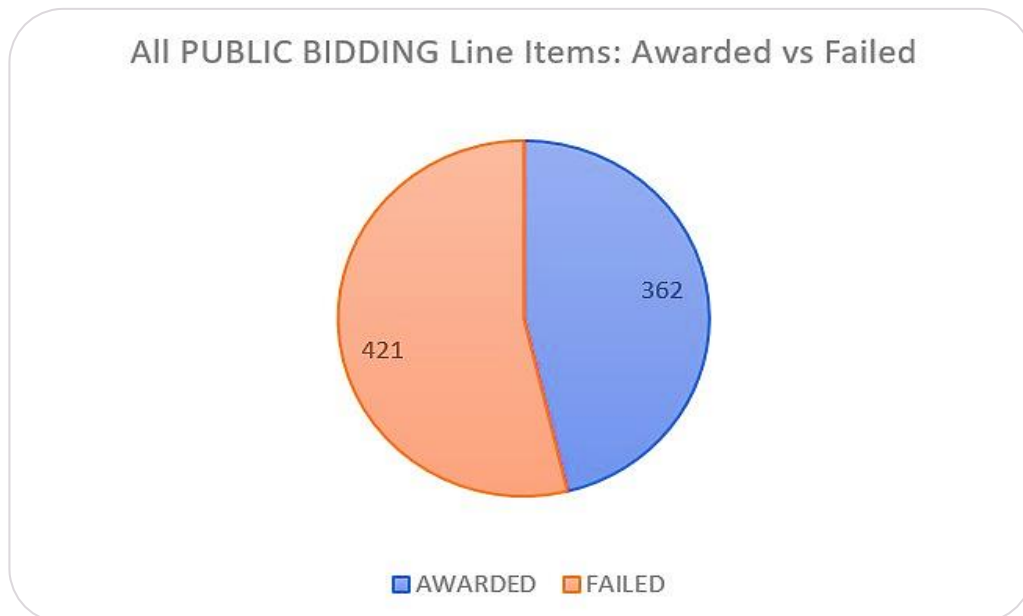
Figure 40: All Public Bidding line items- 362 awarded items versus 421 not awarded
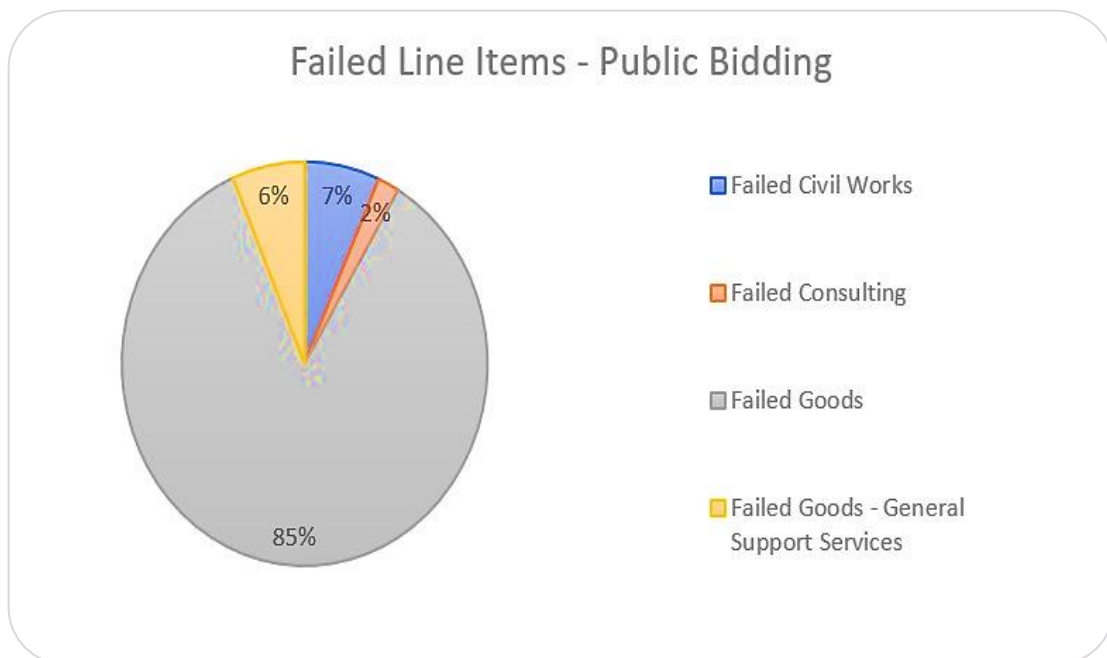
Figure 41: Classification for the line items that have not been awarded thru Public Bidding

Of the 421 line items that were not awarded successfully thru Public Bidding, 85% belong to Goods classification, 7% to Civil Works classification, 6% to General Support Services and 2% to Consulting classification.

Figure 42 shows the breakdown of these 421 failed line items by Business Category. We see that majority of the failed bidding line items belong to Office Equipment, Supplies and Consumables, followed by IT Supplies, closely followed by Laboratory Supplies, Construction Projects and Materials, and Drugs and Medicine and Medical Supplies.
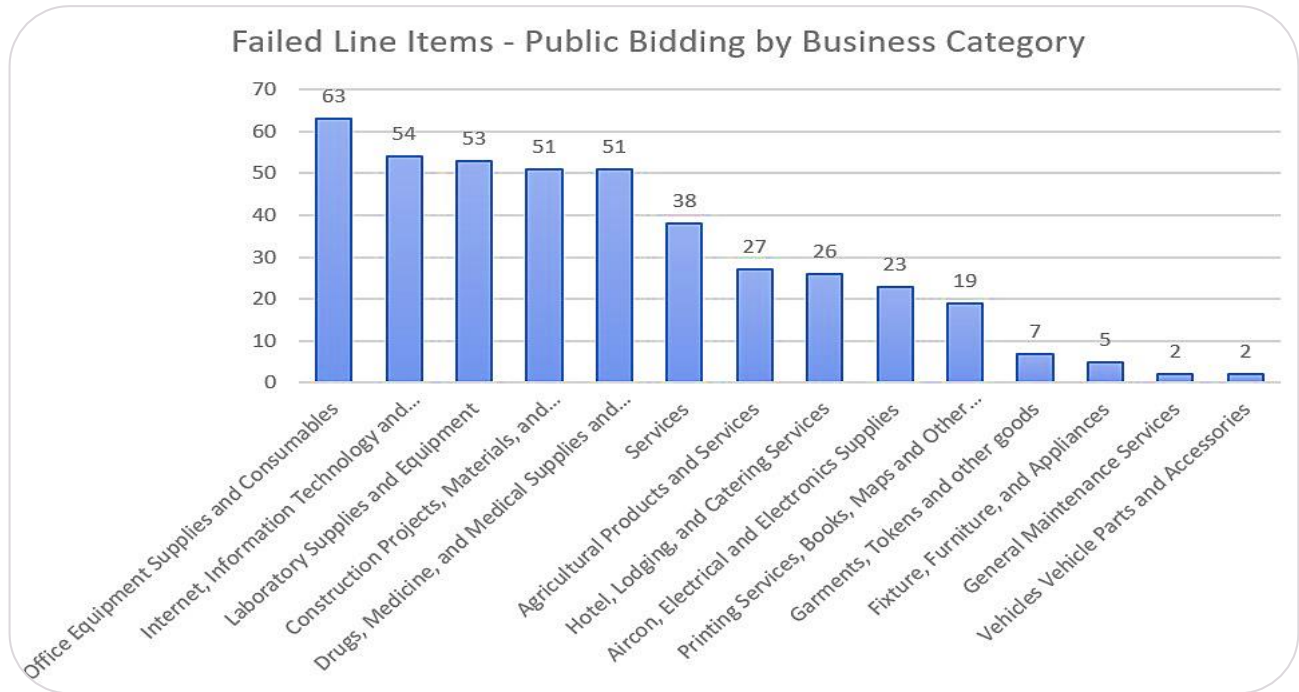
Figure 42: Failed Bidding Items by Business Category

PROCESSING METHODOLOGY

Figure 43 shows the general processing schematic used in this study. Bicol University data is extracted from PhilGEPS, pre-processed and processed using R Environment[21]. The resulting papers and datasets are uploaded to OCDex.tech for future use of interested organizations, individuals, or researchers.

The analysis part of this study comprises of two layers:
1. **Timeline Compliance Check Using Historical Data** – Pre-processed historical data is visualized and compared side-by-side to the minimum and maximum number of days prescribed by the GPRA-IRR for every stage of the procurement process.

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[21] Commonly used statistical software for Data Processing and Analysis

2. **Multivariate Data Analysis** - Multiple Linear Regression and Logistic Regression is used to detect Influential stages/factors in overall procurement timeline and rate of award/fail in public bidding.
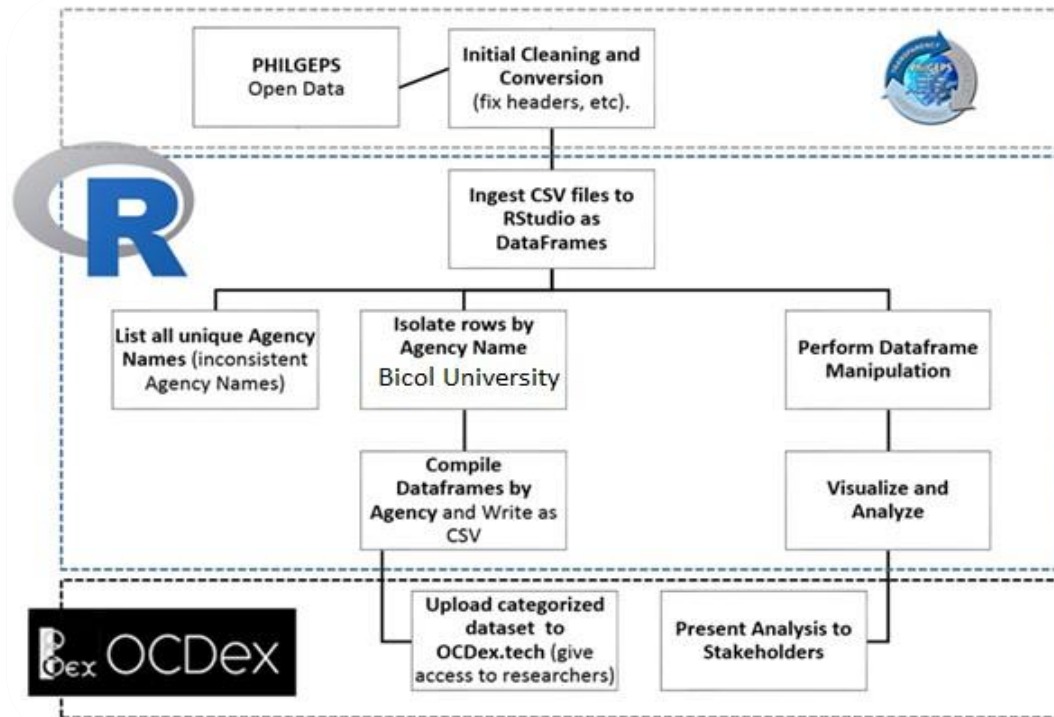
Figure 43: General Processing Schematic used in this study

Scope and Delimitation

This study assumes that the dataset extracted from the PhilGEPS portal is official and accurate. Should there be inaccuracies brought by the PhilGEPS dataset itself, such inaccuracies will not be taken into account. Validation interviews from Bicol University are conducted by the team to give context to the visualizations and results. We assume that their statements are truthful and accurate.

Please note that PhilGEPS dataset uploaded in the PhilGEPS Open Data Portal is the **SOLE SOURCE of DATA** used in this report. While the dataset does not have consistent field formats and requires standardization, this paper assumes that all data in the PhilGEPS dataset are **OFFICIAL and ACCURATE**.

RECOMMENDED VS. ACTUAL PROCUREMENT TIMELINE
RESULTS AND VISUALIZATION

STAGE	ABC > 1M	ABC <1M
STAGE 1	Date of Publish – Pre-Bid	Date of Publish – Closing Date
STAGE 2	Pre-Bid – Closing Date	Closing Date – Award Date
STAGE 3	Closing Date – Award Date	Award Date to Notice to Proceed
STAGE 4	Award Date to Notice to Proceed	--
STAGE TOTAL	Date of Publish to Notice to Proceed	Date of Publish to Notice to Proceed

Table 7: The Procurement Process from Date of Publish to Issuance of Notice to Proceed

For this analysis, we only consider all AWARDED line items from 2016 to 2018. Using the GPRA-IRR's prescribed timeline as guide, the entire procurement stage from "Date of Publish of Tender" to "Issuance of Notice to Proceed" is grouped into four stages as shown in Table 7.

Due to the information limits of the PhilGEPS dataset, the number of days from each available PhilGEPS column were calculated and classified into stages. Procurements with ABC above 1 million pesos have four stages, while procurements with ABC below 1 million pesos have three stages.

CLASSIFICATION	5FILTERED OBS w/ ABC > 1M	FILTERED OBS w/ ABC <1M
Civil Works	22	27
Goods	81	1078
Consulting Services	0	24

Table 8: Subsets of all awarded rows from 2016 to 2018, classified by ABC and Classification

> **NOTE!** The "Award Date" to "Publish Date of Award" is a common problematic stage in most procuring entities in the entire PhilGEPS dataset. This is why we remove the "Publish Date of Award" stage, and create a separate measurement of number of days from the Award stage. This stage has been excluded from the primary stages calculated in this report.

As shown in Table 8, the dataset was split into five (5) subsets, per classification, and whether the Approved Budget of the Contract (ABC) is greater than 1 Million PHP or less than 1 Million PHP. There are NO Consulting services procured over 1 Million PHP from 2016 to 2018.

Procurements with ABC > 1M: GOODS
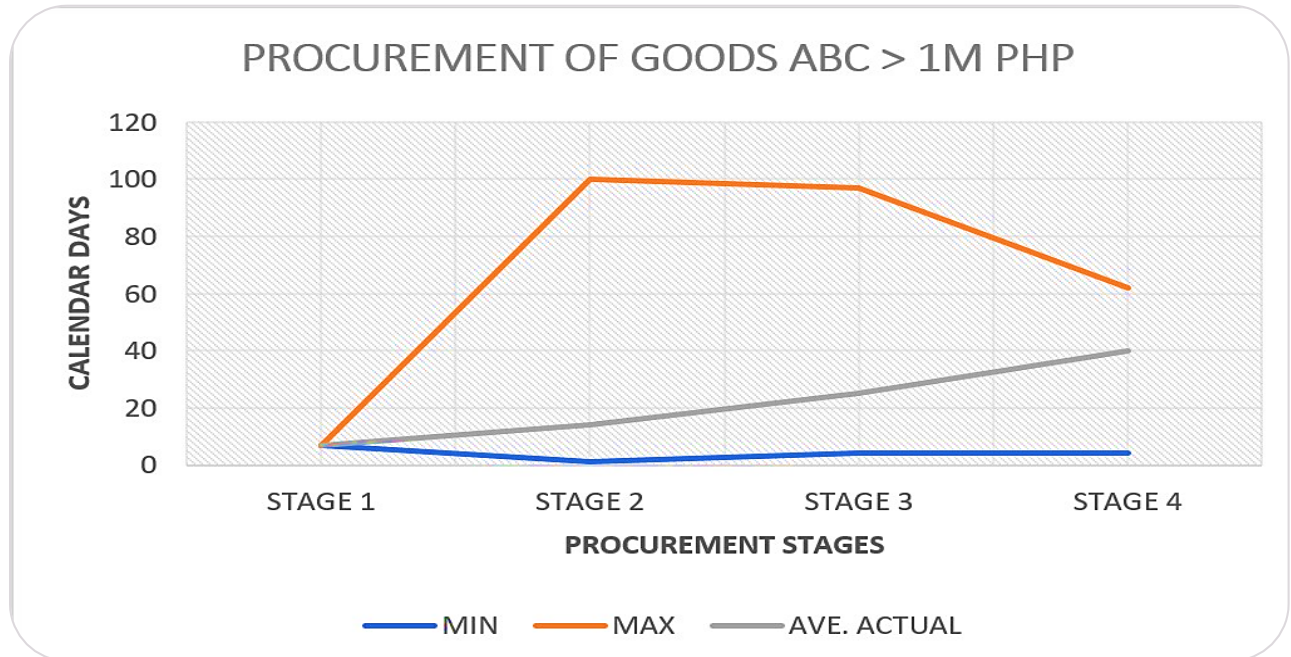
Figure 44: Procurement of Goods with ABC > 1 M PHP (Average Trend)
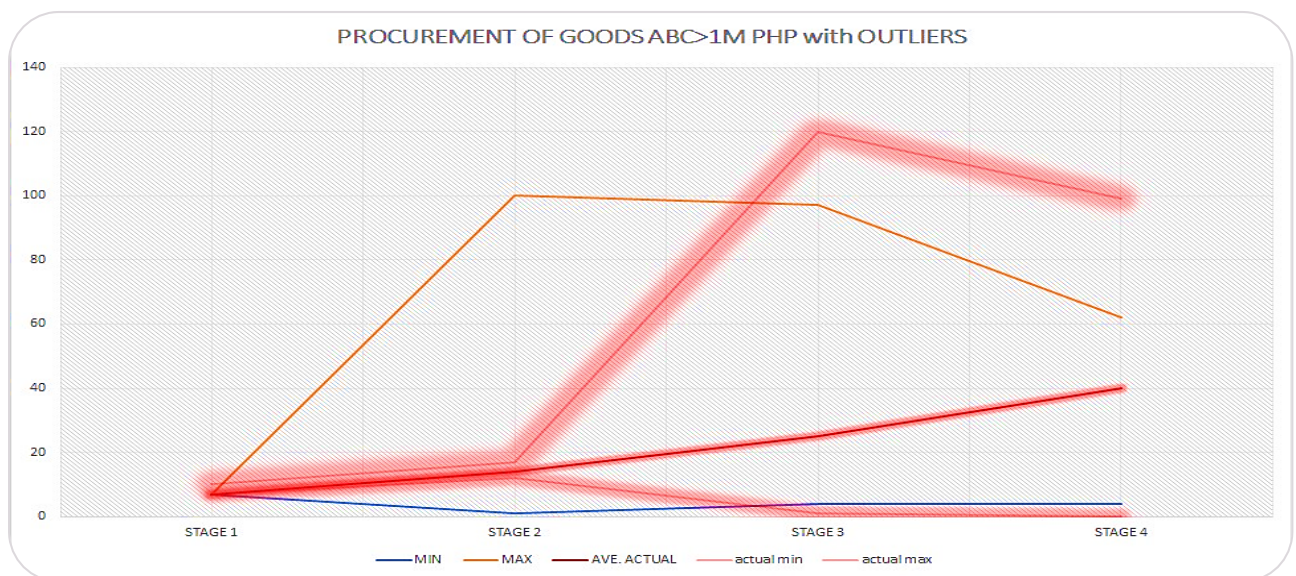
Figure 45: Procurement of Goods with ABC > 1M PHP (Outliers Included)

As shown in Figure 44, ✔ **Bicol University follows prescribed timeline in the IRR for all four procurement stages of Goods procurement with ABC over 1 Million PHP**. If outliers are included and the procuring entity wants to further optimize the process, the point of improvement is in stages 3 and 4, as shown in Figure 45.

Procurements with ABC > 1M: CIVIL WORKS
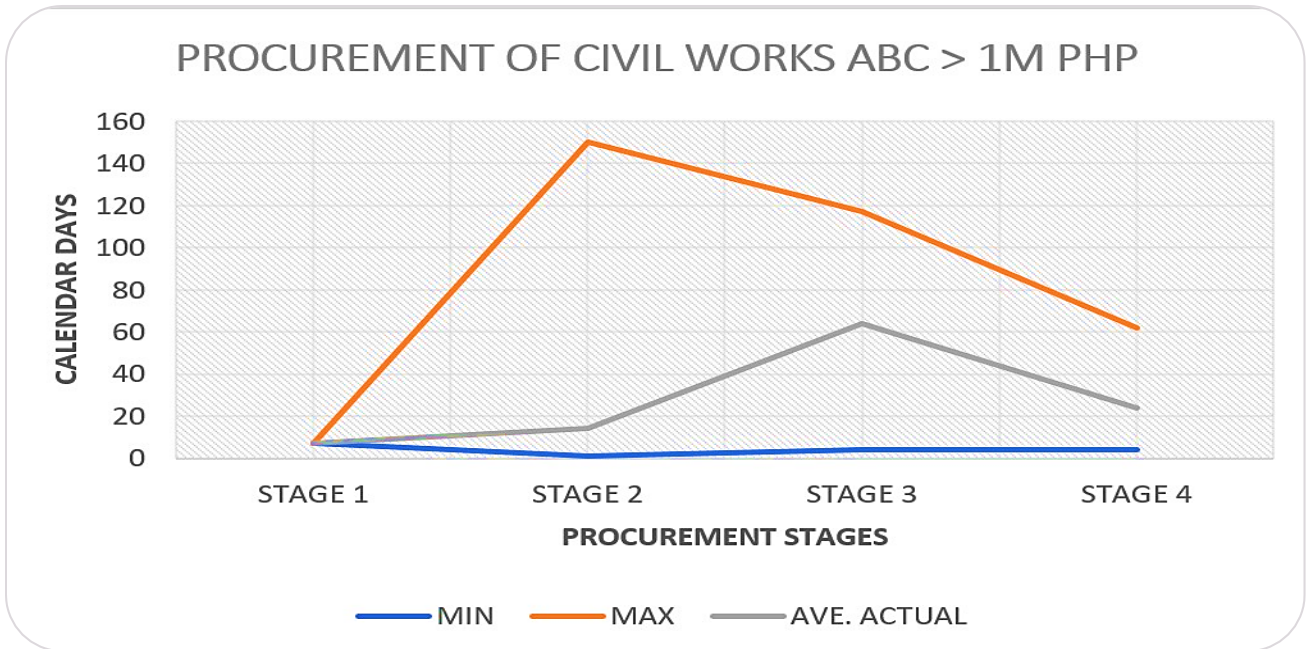
Figure 46: Procurement of Civil Works with ABC > 1 M PHP (Average Trend)
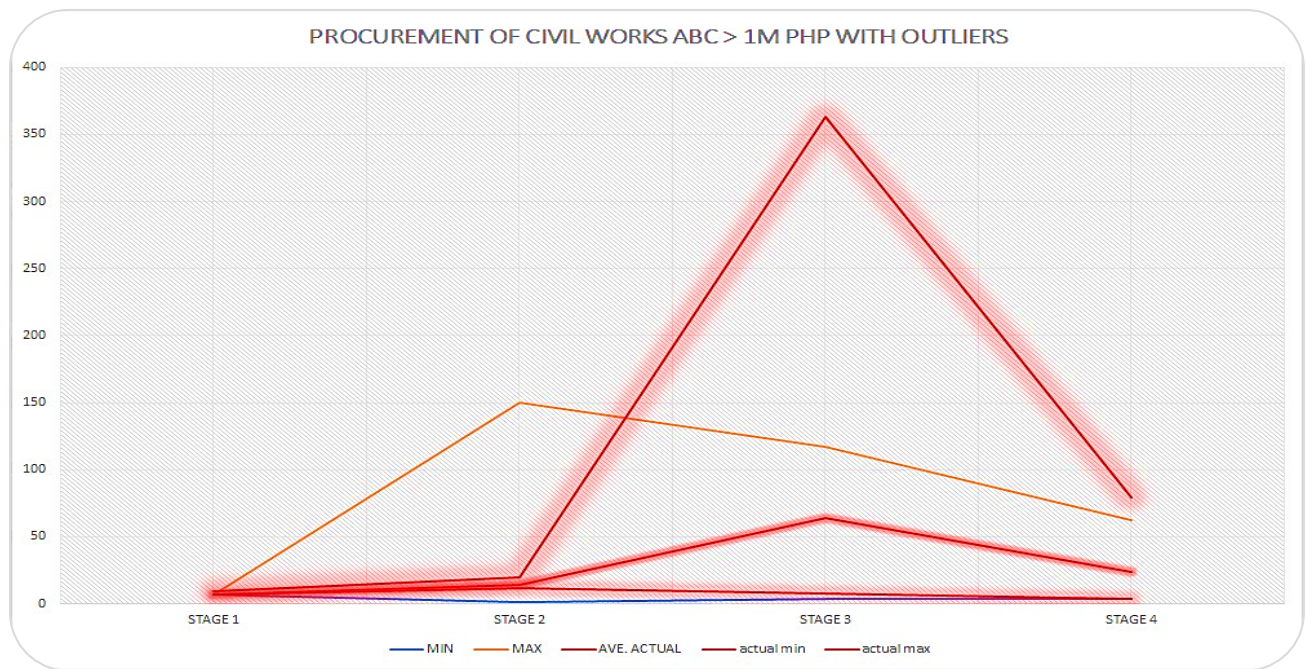
Figure 47: Procurement of Civil Works with ABC > 1M PHP (Outliers Included)

The same with Goods with ABC over 1 Million PHP, ✓ **average trend of procurement timeline of Civil Works with ABC over 1 Million PHP follows the prescribed timeline of the GPRA IRR.** If outliers will be considered, the procuring entity may want to inspect the outlier/s of stage 3.

Procurements with ABC < 1M: GOODS
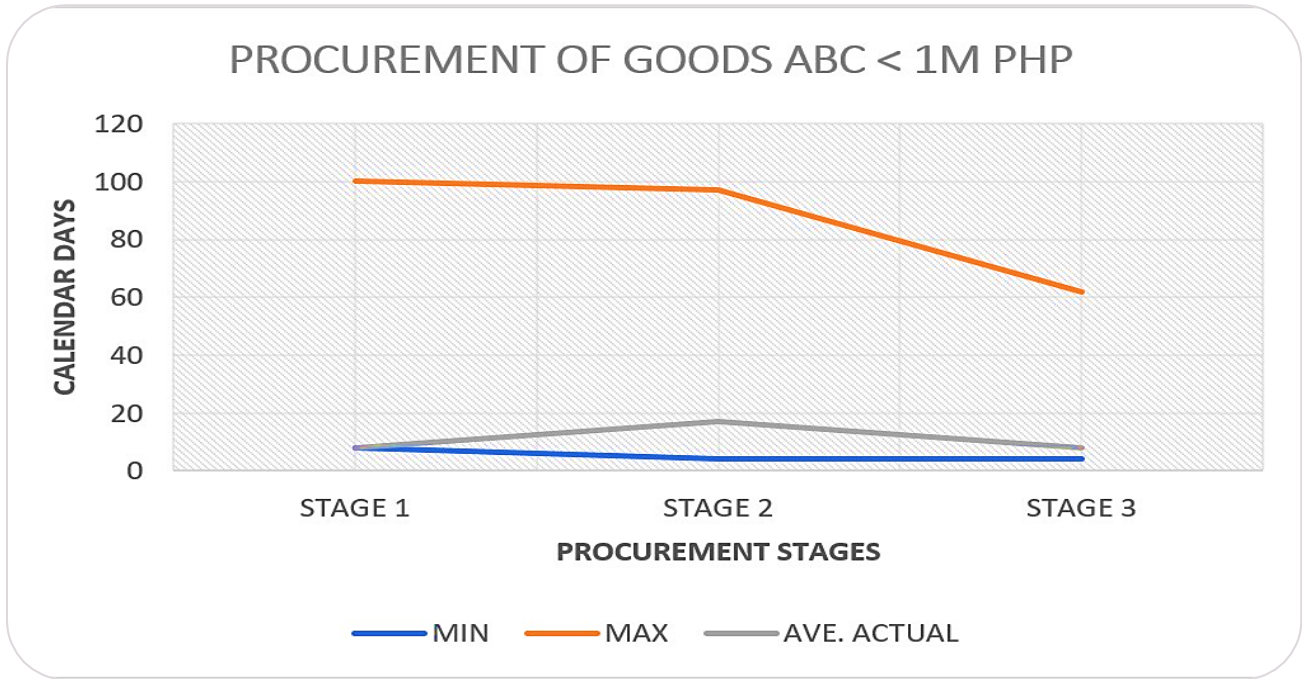
Figure 48: Procurement of Goods with ABC < 1 M PHP (Average Trend)
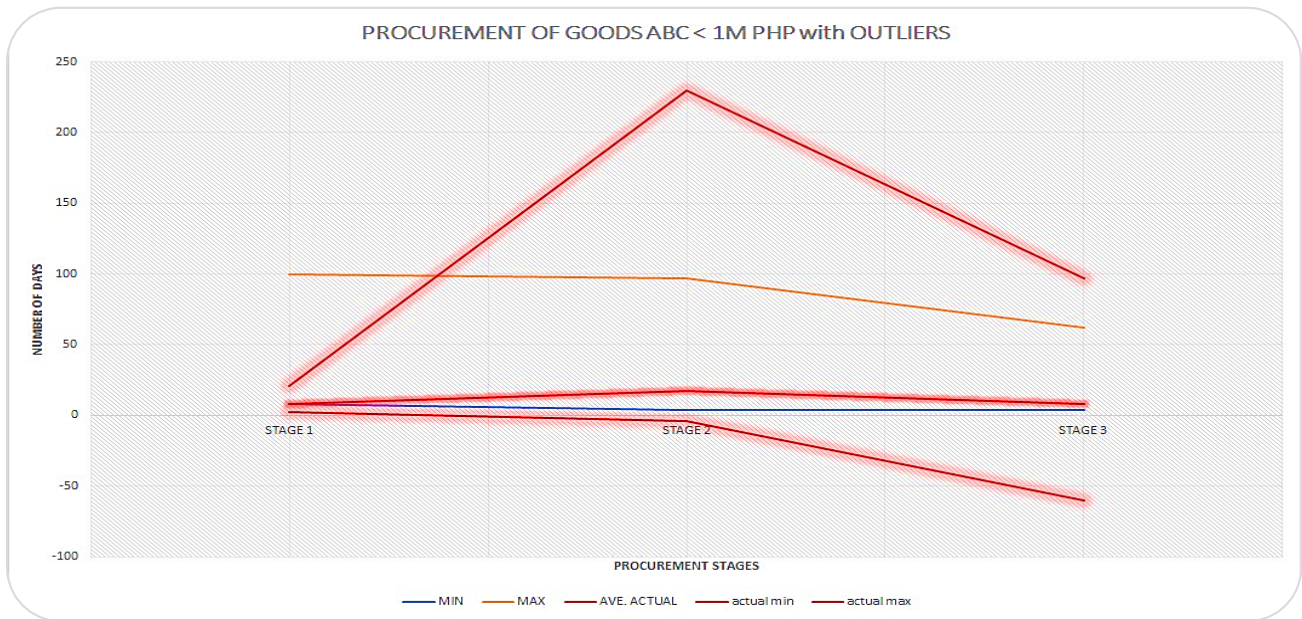
Figure 49: Procurement of Goods with ABC < 1 M PHP (Outliers Included)

✔ **For procurement of Goods with ABC below 1 Million PHP, average trend of procurement timeline follows the prescribed timeline of the GPRA IRR.** Figure 49 suggests inspecting stages 2 and 3 of this category to address outliers.

Procurements with ABC < 1M: CIVIL WORKS
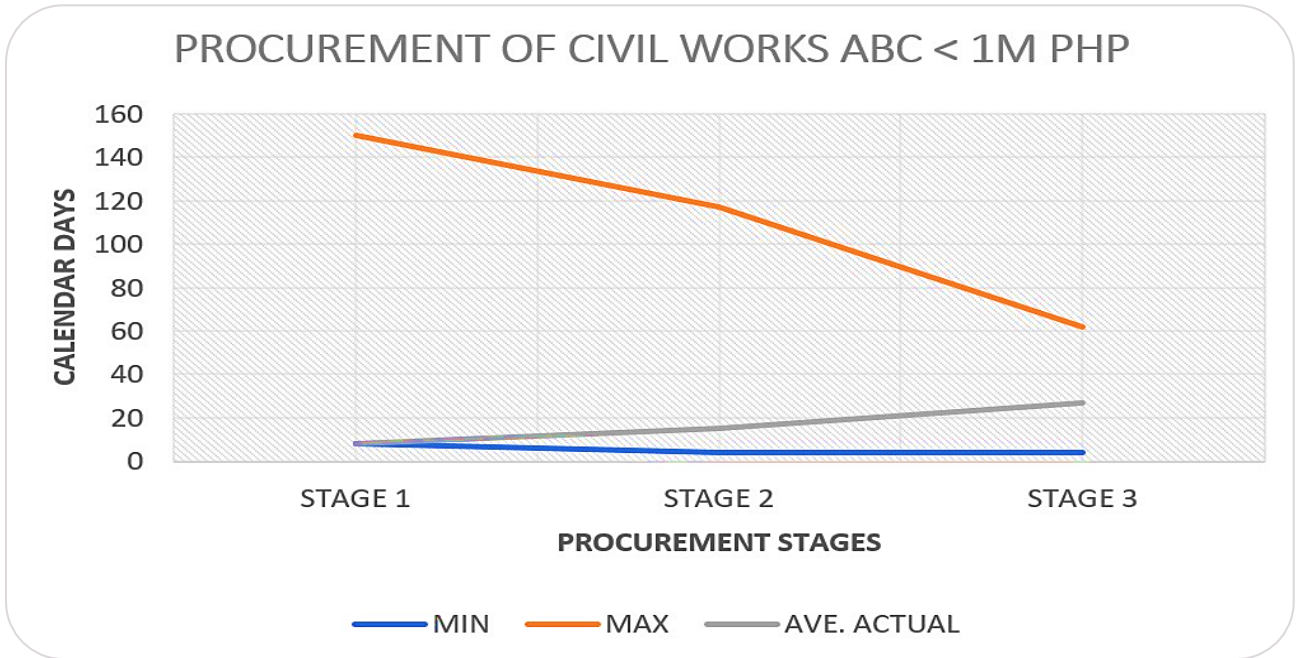
Figure 50: Procurement of Civil Works with ABC < 1 M PHP (Average Trend)
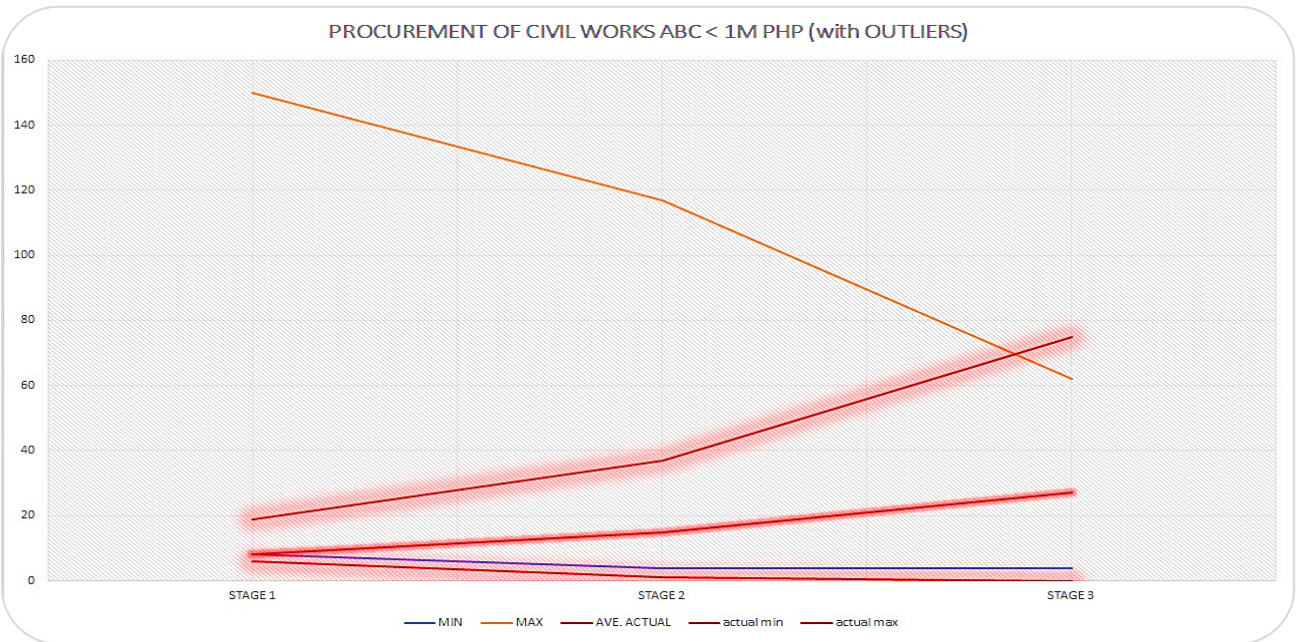
Figure 51: Procurement of Civil Works < 1M PHP (Outliers Included)

✔ **For procurement of Civil Works with ABC < 1 Million PHP, the average timeline follows the prescribed timeline of the GPRA IRR.** For this sub-category, we notice that outliers are mostly on the slightly 'early' than the prescribed minimum line and only in stage 3 that there is delay.

Procurements with ABC < 1M: CONSULTING SERVICES
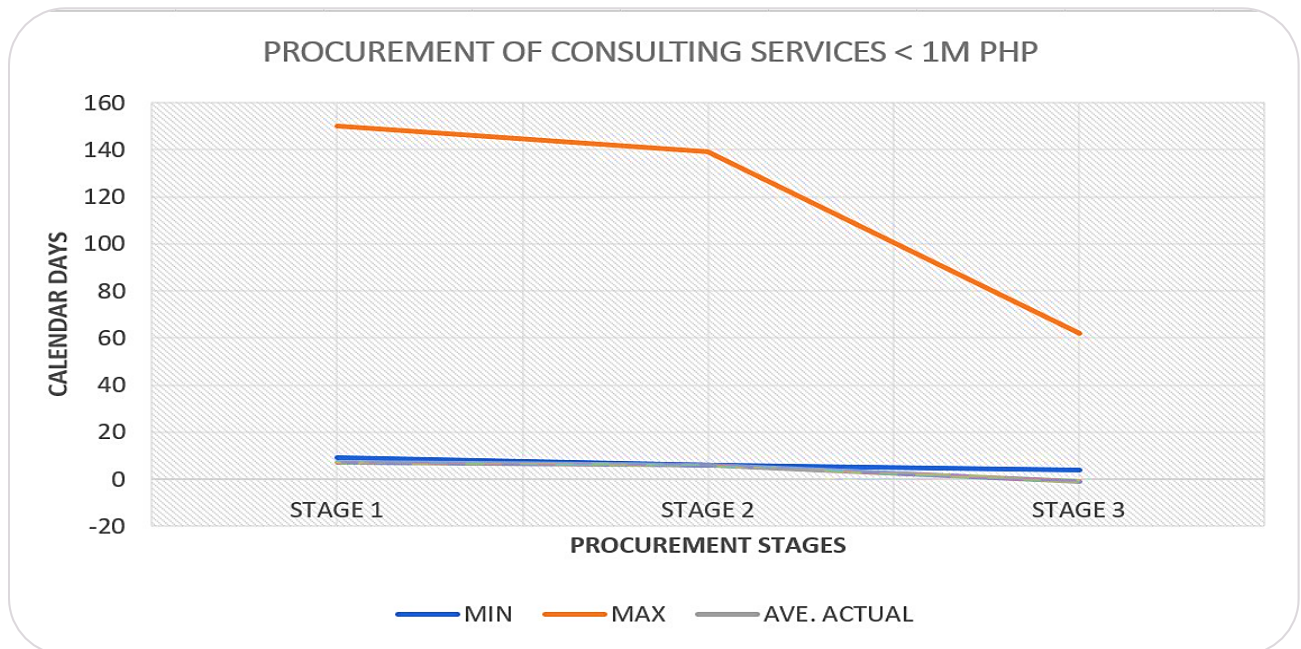
Figure 52: Procurement of Consulting Services < 1M PHP (Average Trend)
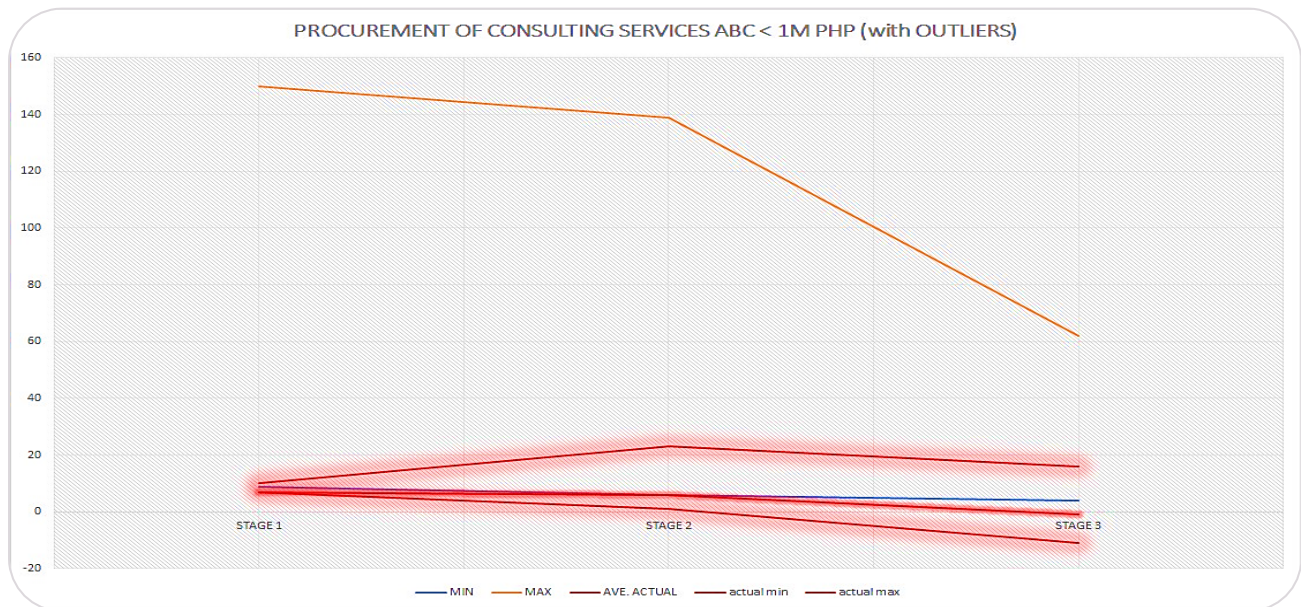
Figure 53: Procurement of Consulting Services <1M PHP (Outliers Included)

Procurement of Consulting Services under 1 Million is slightly on the minimum end of the prescribed timeline. When the researchers consulted with the Bids and Awards Committee Chair on Goods Procurement about this trend, it was stated that BU do not normally procuring consulting services, except for projects in partnership with National Government Agencies.

The following experiences were also stated during the interview:

- Posting difficulties using the PhilGEPS system. Posting can be difficult during office hours (due to PhilGEPS system downtime, or inavailability of internet connection due to frequent power outages or internet issues brought by frequent typhoons in the area[22].) Many times, the BAC staff had to post/update tender information at 12 midnight when the system's response is relatively faster.[23]

- On good average compliance trends, they attributed the success to BU being a GPPB certified training institution, and their desire and initiative to constantly improve and make the process more efficient despite the occasional setbacks.

- BU has de-centralized procurement system that gives more fiscal autonomy to department/cluster heads, reducing bottlenecks in the process.

- BU has a procurement management office with designated personnel to streamline process, especially contract management.

- BU's BAC personnel are designated in their positions relatively longer, compared to some Local Government Units with relatively higher turnover of personnel due to changing administrations. This may have resulted in their BAC personnel garnering more hours of training, experience, and expertise.

- Sometimes, they experience delayed Project Procurement Management Plan (PPMP) submissions from end-users, causing overall process delays.

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[22] Legazpi city's geographical location makes it prone to typhoons and rising sea levels.
[23] On August 2, 2018, the BAC Secretariat of Legazpi City shared exactly the same experience, posting at 12 midnight just to comply with the posting requirement.

Article 1 Sec. 3 of the GPRA LAW expresses support for extending equal opportunity for eligible private contracting parties through Public Bidding.

Figure 40 shows that of 783 line items, only 362 were successfully awarded through Public Bidding. In this part of the analysis, all failed and awarded bidding line items were analyzed using multivariate techniques to show possible influential factors that affect successful procurements through public bidding.

Logistic Regression Modelling:

Logistic regression is used to model dichotomous outcome variables (true/false), as a linear combination of both categorical and continuous predictor variables (UCLA, 2020). By modelling the pre-processed dataset extracted from PhilGEPS, we inspect the relationship of the predictor variables, and how each one affects the likelihood of a public bidding tender's success for Bicol University.

Predictor Variables Used[24]:

- Approved Budget of the Contract (ABC) – continuous variable
- Procurement Classification – factor of 4 levels (Goods, Civil Works, Consultation, and
- Business Category – factor of 5 to 32 levels (further Classified into 14 levels ~ 5 levels, from 32 levels)[25]

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[24] The predictor variables used were selected in consideration of the experience of the procuring entity, as well as the availability of the columns in the PhilGEPS dataset. We listed down what is BOTH interesting to them, and what is available.

[25] Runs with and without the Business Category predictor were made, including varying factor levels, lowest is 5. Different output models were assessed via predictability and goodness-of-fit. We could not discredit Business Category as its insights have a very strong practical value. Ultimately, this study prioritizes practical applicability.

What did the Logit model show?

Table 9 shows the commonly appearing factors and their respective coefficients to be significant in determining whether a bid will be approved or failed:

Significance	Coefficient	Estimate
***	Fixture, Furniture and Appliances	3.417
***	Laboratory Supplies and Equipment	2.493
***	Construction Projects and Materials	2.586
**	Approved Budget of Contract	6.979e-08
**	Aircon and Electrical Supplies	2.001
**	Internet, Information Technology and Related Parts and Accessories	2.161
**	Hotel, Lodging and Catering	2.135
**	General Maintenance Services	4.287
*	Printing, Books and Other Publications	1.761

Table 9: Significant Coefficients in the General Logistic Model – Run 1

What does Table 9 mean? In general, the logit model tells us that these are what affects the likelihood of a Public Bidding tender to succeed. For example, if the Public Bidding tender is under the Business Category of "Fixture, Furniture, and Appliances", a sofa, for instance, it is more likely to be procured successfully via Public Bidding, compared to a Catering Service Tender (given all other factors equal, such as ABC). Approved Budget of Contract (ABC) also has significance. This means that the possibility of successful award increases by a factor of 6.979e-08 for every unit increase of the ABC.

Increasing the ABC would, without a doubt, be more attractive to bidders. However, logit models can give us guide values as to how much exactly should we increase ABC, (not too much…) ***just enough to maximize probability of having a successful public bidding.***

Similarly, the Business Categories with significant negative coefficients[26] can be inspected in context, as to why these Categories lessen the probability of a successful bid.

A 70-30 training and testing split dataset was used to train the general model, and check its predictions (whether a line item will be successfully awarded or not given the predictor

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[26] Other runs with changing levels yield negative coefficients.

variables) using the decision boundary predicted value > 0.5. The model resulted in the following confusion matrix on Table 10:

	Predicted in TEST Dataset			
		AWARDED	FAILED	TOTAL
Actual in TEST Dataset	AWARDED	82	13	95
	FAILED	33	68	101
				196 rows tested

Table 10: Confusion Matrix for the Logit Model

Accuracy = 76.53% accuracy

Misclassification Rate =23.47% misclassification rate/error rate

Sensitivity or True Positive Rate (or Recall): 86.32%

Specificity or True Negative Rate: 67.33%

Precision: 71.3%
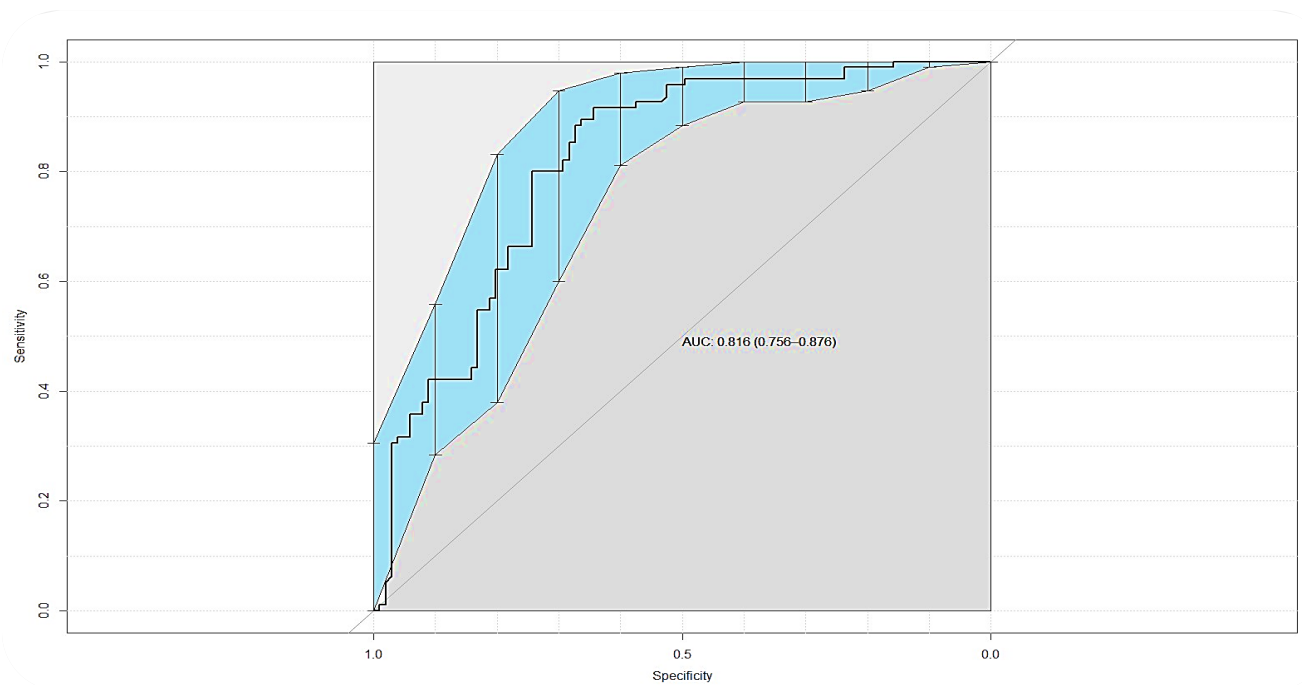
Figure 54: ROC Curve for the General Model

NOTE for V1! The specifics of the methodologies used are available separate research papers. This report may be updated, as soon as the DOI is available.

It is worth noting that during the interview with BAC Chairman for Goods of the procuring entity, he specifically noted having problems with low ABC estimates. When a line item's ABC is too low, minus the tax[27], vendors become uninterested, resulting in failure of biddings. Increase in ABC increases the probability of having a successful bid. It was also noted in the interview that end user PPMPs can sometimes under-estimate the market price of the items, resulting in lower ABC than what a successful bidding may require. **The run results agree with the suggestion of the BAC chair interviewed, on the need to strengthen the end users' capacity on creating optimal Project Procurement Management Plans (PPMP) with optimal estimates.**

CONCLUSION AND RECOMMENDATION

Having an automated internal monitoring system, with Official Government Data at its core is a powerful decision support system, especially for process optimization. Furthermore, the use of Government Data addresses a key data source requirement, which is accuracy and data authority.

This study greatly encourages the release of good-quality open data as it can become a powerful layer of decision support for government procuring entities. As shown in this use-case, BU was able to specifically pin-point outliers, deviations from the 'normal', and inspect influential factors in ensuring success of public biddings. BU was also able to showcase the results of their previous procurement streamlining initiatives.

Just like in process optimization, doing analytics is continuous and regular. With new data generated, influenced by new actions taken, the 'influential factors' also change. This requires for automation and constant analysis and inspection of official procurement data to ensure constant improvement, known as 'KAIZEN philosophy' in Six Sigma[28] terminology.

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[27] Tender ABC does not include taxes, as taxes are paid to the government. It doesn't make sense for the government to pay to itself. Hence, the less in tax is reflected in lower ABC.

[28] Popular set of tools and techniques to constantly improve business processes, used by companies worldwide.

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SEE-LOG: A Public Procurement Monitoring Portal

Alan Aliliano, Noel Layante, Sidney Bercasio, Marvin Banton

Information technology (IT) is now deeply integrated into our day-to-day lives. Over the years, IT revolutionized information gathering, dissemination, completely changing the landscape for global communication. And because of the increased interconnectedness and improvements in communication, transparency has also improved. See-Log is a public procurement monitoring portal designed and developed by a group of Information Technology students from Bicol University College of Science, in partnership with Layertech Labs.

Publication of data is NOT ENOUGH?

SEELog developers observed that while Philippine procurement information is published online, many stakeholders do not access or use these data. Some of the reasons include:

- Files are too large for download (for areas with little to no internet connectivity)
- Users do not have the technical capacity to filter dataset with 40 columns and thousands of rows (mostly opened via MS Excel)
- Users are finding it difficult to understand contents and what the values mean

The developers therefore, concluded that while Philgeps data is 'available', it is not easily 'accessible'. With such findings, the researchers believed that a well-managed, web-based, Open Contracting Data Standard (OCDS)-based, Monitoring System that uses data visualization can improve the current state on how the taxpaying public understand the procurement process of the Philippines.
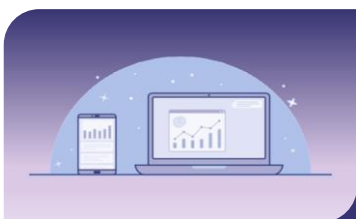
DEVELOPMENT METHODOLOGY

Extreme Programming (XP)
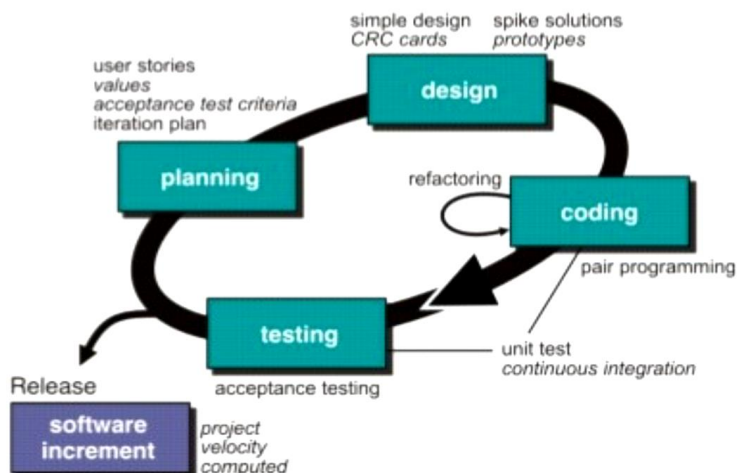
Figure 55: XP Process

Phase 1: Planning

The secondary sources of data were gathered from books, journals, theses and online websites. The sample forms provided by the Office also served as the secondary sources. These samples provided the needed information regarding to the flow of transactions that helped the researchers design the features of the portal.

Phase 2: Design

Software design is the process of transforming user requirements into appropriate abstracts which helps the researchers in designing, coding and implementing the developed software. It is important to create a design structure that organizes the logic in the system so too many dependencies in the system can be avoided. This was where the researchers determined the requirements of the proposed system, which can be presented by the various modules based on the presented objectives.

SeeLog Modules:

Compliance Monitoring Module. This module allows users to upload the JSON file that contains the tender details. It checks if the uploaded tender details has complied with the Philippine procurement law and the OCDS readiness. This module will create a reliable and accurate compliance monitoring system that will check the documents based on the standard. Procuring entities can also rate their contractors based on their performance.

Freedom Wall Module. This module provides a storytelling of procurement data through visualizations for the public. This is to bridge the gap between citizen and city governments, and civil organizations.

Flagging Module. This module provides marker on those tender that has discrepancies or anomalies. Which does not fit the standards given and those that are reported by the public.

Phase 3: Coding

The Coding Phase constitutes the most important phase in the Extreme Programming life cycle. XP programming gives priority to the actual coding over all other tasks such as documentation to ensure that the customer receives something substantial in value at the end of the day. The researchers created the database design so that the process of producing a detailed data model of a database will be clear. The logical data model contains all the needed logical and physical design choices and physical storage parameters needed to generate a design in a data definition language, which can then be used to create a database.

In developing the software, the researchers found Hypertext Pre-Processor (PHP) easy to use for the programming language that was designed for creating dynamic websites. PHP language is flexible and fairly forgiving, making it easy to learn. In translating the complicated data of the procurement documents, the researchers used the JavaScript Object Notation (JSON) to follow the Open Contracting Data Standard (OCDS) that is being used also by other countries.

PHP is a general purpose scripting language that is especially suited for web development. It generally runs on a web-server, taking PHP code as its input and creating web pages as output. It can be deployed on most web-servers, many operating systems and platforms, and can be used with many relational database management systems. It is available free of charge, and the PHP Groups provide a complete source code for users to build, customize and extend for their own use.

The languages used in designing the system were the Hypertext Mark Up language (HTML) and the Cascading Style Sheet (CSS). Apache HTTP Server was also used. It supports a variety of features, many implemented as compiled modules which extend the core functionality.
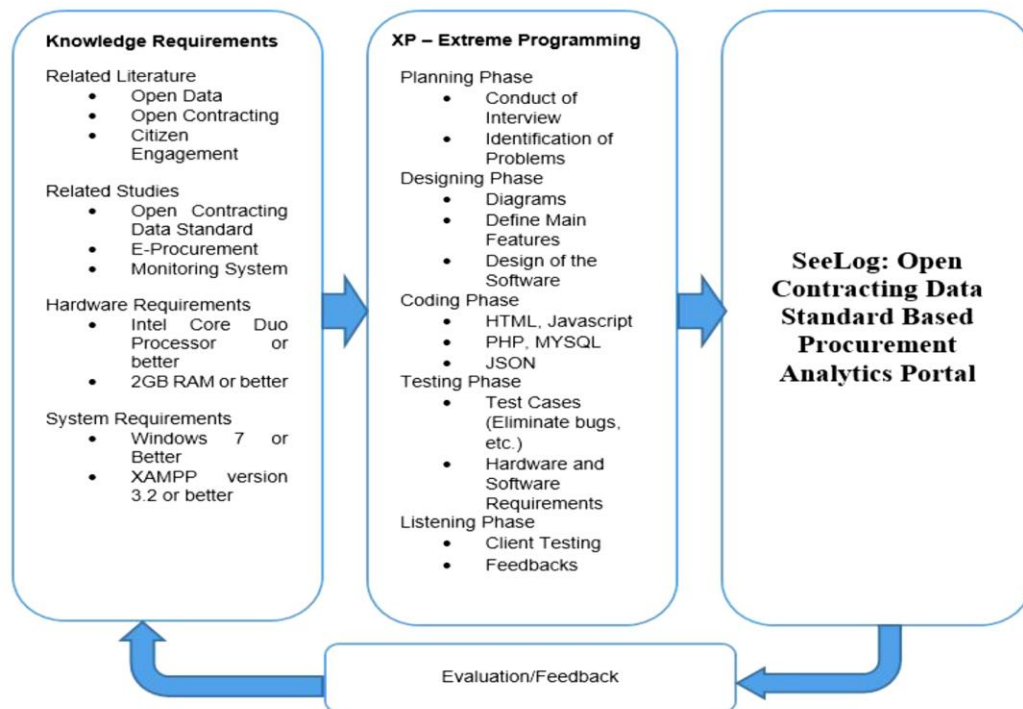
Figure 56: Development Framework Used

Phase 4: Testing

The testing of the software with the client and making of test cases were done to ensure that the software has complied with the requirements of the client and to find out if the system's features worked and had no bugs or defects.

Component	Minimum	Recommended
Operating System	Windows 7	Windows 10
Browser	Google Chrome, Microsoft Edge, Mozilla Firefox	Google Chrome
Apache, MySQL and PHP	Version 5	Version 5.5 or latest

Table 11: Software Requirement

Component	Minimum	Recommended
Disk Space	5GB	25GB
Memory Requirement	At least 1024 MB of Random Access Memory (RAM)	2GB of RAM or Higher
Processor	Intel or AMD Processor, at least 2.5 GHz	Intel or AMD Processor, 3.9 GHz

Table 11: Hardware Requirements

Phase 5: Listening

The basis of extreme programming is a continuous mechanism of customer involvement through feedback during the development phase. This is the phase where the client testing of the software takes place. Feedback from the customer and the project manager is essential for future iterations on the software. The basis of feedback is the customer acceptance tests. Each feedback of the customer that specifies revised requirement becomes the basis of a new design, and the process of design-coding-tests-listening repeats itself. If the customer remains satisfied with the test results the iteration ends there.

User stories is a very high-level definition of a requirement, containing just enough information so that the developers can produce a reasonable estimate of the effort to implement it. It is a great source of information on what features are still needed or what needs to be changed. It is shown in the table below the user stories that the researchers have gathered regarding the system.

User Stories

As an...	I want to...	So that i can...
Employee	Upload the JSON file that contains the procurement data and rate the contractors based on their performance.	Submit the required reports (both detailed and summarized) as needed.
Civil Society Organizations	Check and verify the flagged tenders and give feedback after checking.	See if there is suspicious data in procurement tender.
Public	See transparent and understandable data about the procurement	Know where our money is being spent, increase knowledge about procurement.

Figure 57: Sample Screenshot of SeeLog POC Version

Software Deployment Feedback

Measurement and assessment of the level of conformity of SeeLog based on ISO 9126-1 standards.

The pilot roll-out was tested by 20 users, coming from Civil Society Organizations and the City Government of Legazpi. Evaluation results are as follows:

Summary Evaluation Results

Evaluation Result	Mean
1.0 Functionality	4.6
2.0 Usability	4.5
3.0 Portability	4.7
Overall Mean	4.6

Rating Guide for Evaluation

4.1-5.0	Far more than the expected Quality Characteristic
3.1-4.0	More than the expected Quality Characteristic
2.1 - 3.0	Presence of the Quality Characteristic
1.1 - 2.0	Less than the expected Quality Characteristic
0 - 1.0	Expected Quality Characteristic is not Present

Table 13: Sample Evaluation Results of SeeLog
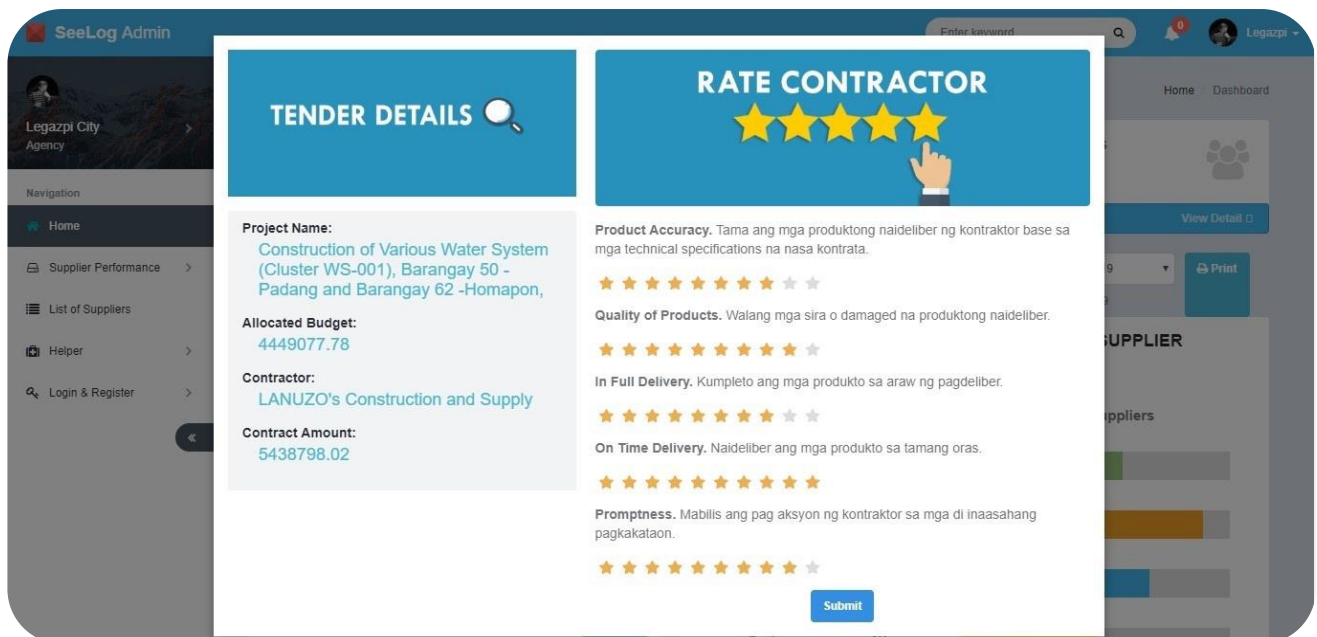
Figure 58: Contractor Rating Feature
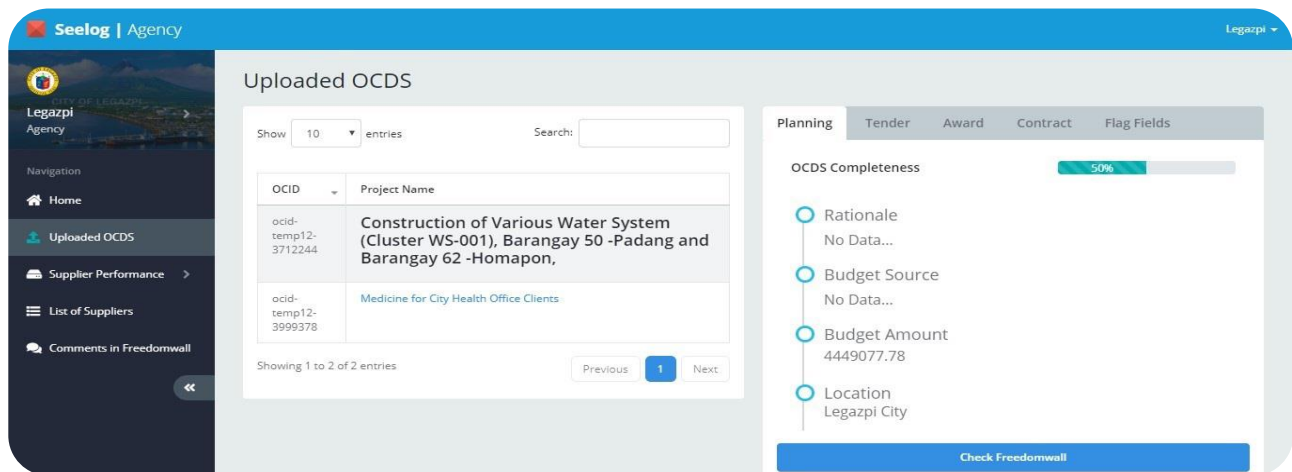
Figure 58: Agency View Feature
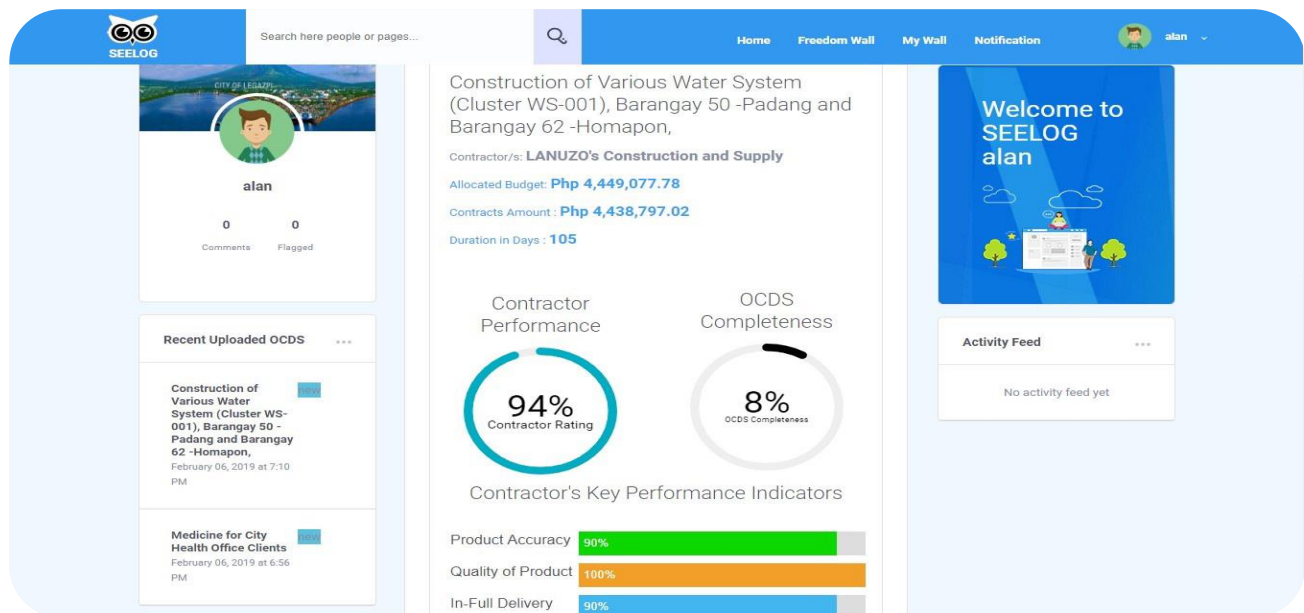
Figure 58:Freedom Wall Feature

Currently, SeeLog portal is in it Pilot phase, and integrations with OCDEX portal is being explored.

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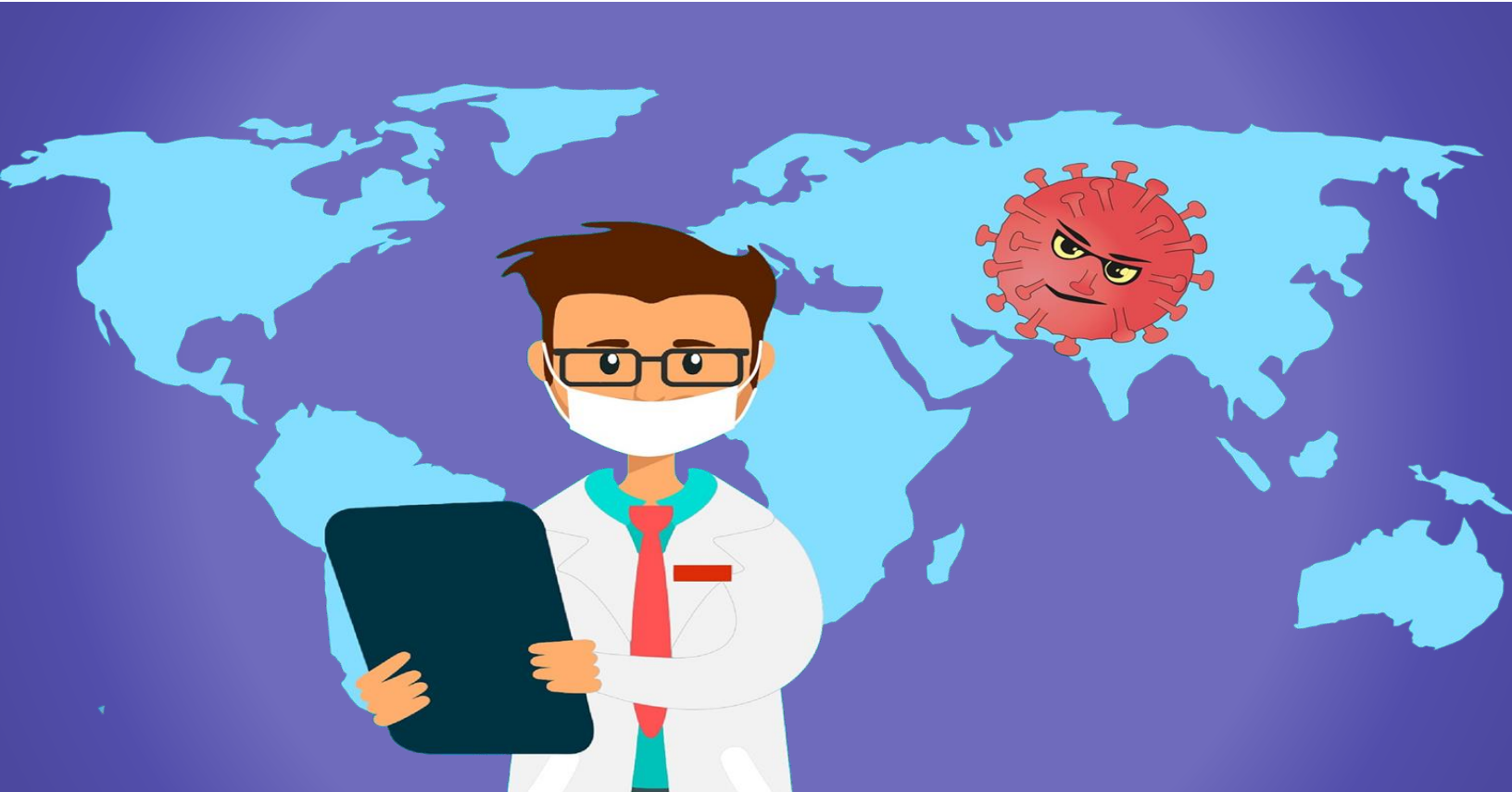
INSPECTING PHILIPPINE PROCUREMENT DATA DURING COVID-19 PANDEMIC

Because of COVID-19 crisis, pandemic response related procurements are being expedited, subject to the simplified guidelines on negotiated procurement under emergency cases issued by GPPB[29]. While fasttracking procurement is understandable, it is likewise important to maintain integrity of the process, preventing abuse of funds in the time of calamity. In May 18, 2020, Layertech opened an open call for proposals on Procurement Analytics on COVID-19 related procurement data. The selected proposals were awarded micro grants from Hivos and technical assistance from Layertech labs.

The following are case studies submitted by the selected proposals.

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[29] https://www.gppb.gov.ph/negotiatedprocurement_emergencycases.php

PROCUREMENT MANAGEMENT OF THE RESOURCES USED ON TESTING COVID-19 CASES IN THE BICOL REGIONAL DIAGNOSTIC AND REFERENCE LABORATORY (BRDRL)

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With the number of COVID-19 cases increasing exponentially, a large number of people are getting infected worldwide, in the Philippines as well as the Bicol Region. In this health crisis, availability of sufficient life-saving goods and services such as testing is essential in the fight against the COVID-19. Hence, supporting the health response including the procurement, allocation and management of essential health facilities and products ensuring that utilization of such limited resources are being managed efficiently is crucial. It is in this context that the study was conducted to analyze available data from the Department of Health (DOH) Data Drop (DOH, 2020) and DOH Regional Office V (DOH-RO V) to evaluate how existing resources are being managed.

The study mainly aims to determine and analyze the procurement transactions made by the Department of Health Regional Office V on testing COVID-19 cases in the Bicol Regional Diagnostic and Reference Laboratory (BRDRL). Particularly, this intends to provide statistics on the specimens processed by the Bicol Regional Diagnostic and Reference Laboratory. It also assessed the procurement management of the resources being purchased by the DOH for use of BRDRL to facilitate the COVID-19 testing and identified the procurement needs of BRDRL through DOH that ma y further enhance their operation on specimen testing.

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World Health Organization

characterized COVID-19 as a pandemic
March 11, 2020
confirmed cases of COVID-19
Worldwide: 13,876,441
(As of July 18, 2020)

Philippines under State of Calamity
Proc. 929 s. 2020 (March 16, 2020)
confirmed cases of COVID-19
Philippines:
41,464 (Active)
65,304 (Total confirmed cases)
Bicol:
146 (Active)
273 (Total confirmed cases)
Albay:
23 (Active)
98 (Total confirmed cases)

(As of July 18, 2020)

Bicol Regional Diagnostic and Reference
Laboratory (BRDRL)
A COVID-19 symptomatic testing center
A DOH-run facility in Legazpi City

Procurement Management

Republic Act No. 9184
Government Procurement Reform Act

GPPB Resolution No. 03-2020
Negotiated Procurement
(Emergency Case)

Specific Objectives

1. To provide statistics on the specimens processed by the Bicol Regional Diagnostic and Reference Laboratory;

2. To assess the procurement management of the resources being purchased by the DOH for use of BRDRL to facilitate the Covid - 19 testing; and,

3. To identify the procurement needs of BRDRL through DOH that may further enhance their operation on specimen testing.

The study employed the data analytics methods by observing the steps as depicted in Figure 59 such as data scraping, data pre-processing, data processing and analysis and data validation. The evolution from data sources to analysis and validation of results passed through these steps.
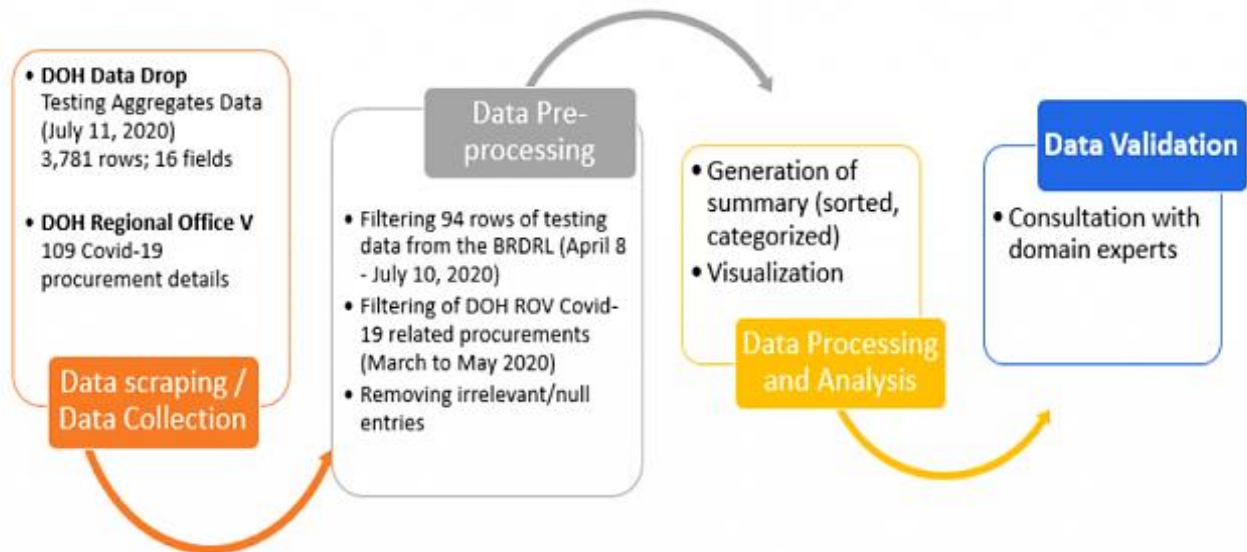
Figure 59: Data Processes

Data Scraping. Data collection was done by scraping data from the DOH Data Drop dated July 11, 2020. Specifically data on testing aggregates was utilized with 3,781 rows and 16 fields. In relation to COVID-19 procurement details, data were provided by the Department of Health Regional Office V. Said data was composed of PR No, particulars, Approved Budget for the Contract (ABC), Contract Amount and Status of approximately 109 procurement activities from March until May 2020.

Data Pre-processing. Data cleaning of data scraped included filtering testing data from the BRDRL. 94 rows were filtered from the Data Drop with reporting dates from April 8, 2020 until July 10, 2020. Fields found relevant on the analysis of aggregate testing data were the facility_name, report_date, daily_output_positive_individuals, daily_output_negative_individualsdaily_output_unique_individuals,daily_output_samples_tested, cumulative_unique_individuals, cumulative_samples_tested, and the remaining_available_tests. Other irrelevant fields and with NULL entry were either corrected or discarded. For the DOH RO V procurement data, only COVID-19 related activities were considered from the procurement data from March to May 2020.

Data Processing and analysis. After the completion of data pre-processing, the data were sorted, summarized and visualized. A plot of the specimens tested daily at BRDRL was visualized by plotting the daily_output_unique_individuals values versus the daily_output_samples_tested. A graph of the cumulative number of specimens tested daily at BRDRL was likewise prepared by plotting the cumulative_unique_individuals daily values versus that of the cumulative_samples_tested. Further, the BRDRL daily testing results was plotted with the scraped values for daily_output_positive_individuals, and the daily_output_negative_individuals. Finally, the remaining PCR testing kits of BRDRL was visualized with the scraped values for the remaining_available_tests. On the other hand, the procurement activities provided by the DOH ROV undergone processing by categorizing each activity according to its purpose, then computing for the sum and percentages needed for analysis.

Data Validation. The results of the study were sent to DOH ROV for feedback and validation before presenting the results to various stakeholders through a public forum. Comments and suggestions were taken into consideration. Further improvement shall be considered on the processing of next iteration of the study.

SALIENT FINDINGS

Statistics on the specim ens processed by the Bicol Regional Diagnostic and Reference Laboratory;
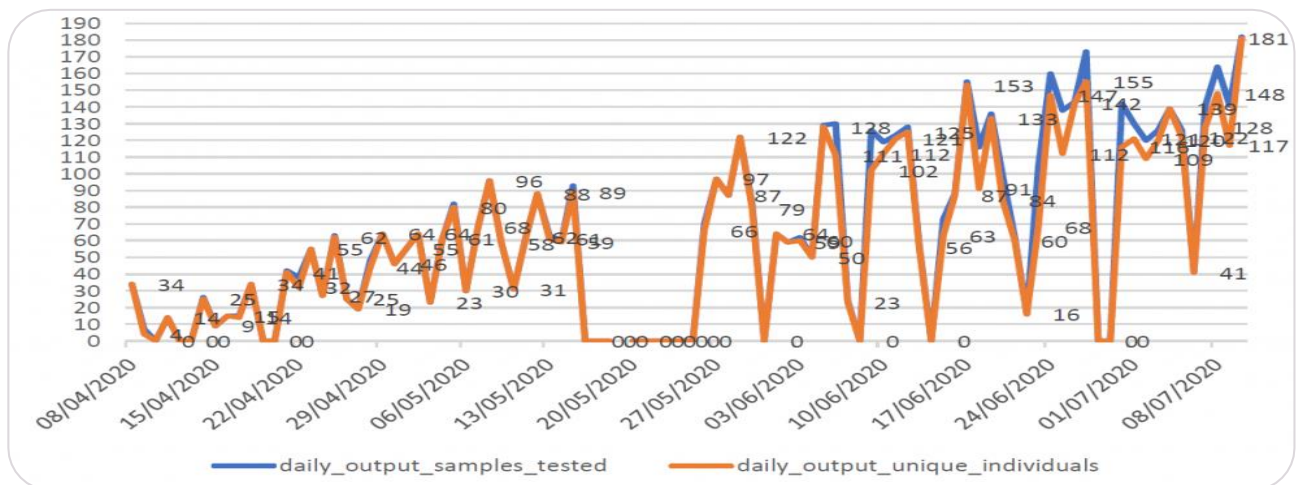
Figure 60: Data Specimens Tested Daily

Figure 60 presents the total specimens processed daily with results which could either be positive, negative, equivocal or invalid as well as sum of all unique individuals tested resulting positive or negative released from 6pm the previous day to 6pm of the reporting date. BRDRL started with a testing capacity of 34 samples per day since the laboratory had only one PCR machine. May 16-25, 2020 has zero samples tested since testing at the Bicol Regional Diagnostic and Reference Laboratory (BRDRL) for coronavirus disease 2019 stopped when Typhoon "Ambo" damaged the exhaust duct at the roof of the facility. With the two RT-PCR machines donated by the LGU Legazpi and a private donor, the laboratory in BRDRL can already test 380 to 420 samples per day, but so far 182 is the highest number of total specimens processed in a day, hence testing capacity has not yet been maximized and according to DOH RO V, Bicol has 'zero backlog' in COVID-19 testing.

The cumulative number of samples tested which refers to the sum of all specimens tested with validated results from the start of laboratory operation up to the reporting date is presented in Figure 61. Further, the cumulative number of unique individuals tested which is the total number of unique individuals who underwent COVID-19 testing, regardless of result, accumulated since the start of operations in the laboratory is likewise presented. It should be noted however, that since an individual may have to undergo the testing more than once, the 2 or more specimen results will only be counted once. As of July 10, a total of 5988 samples and 5629 unique individuals were tested.
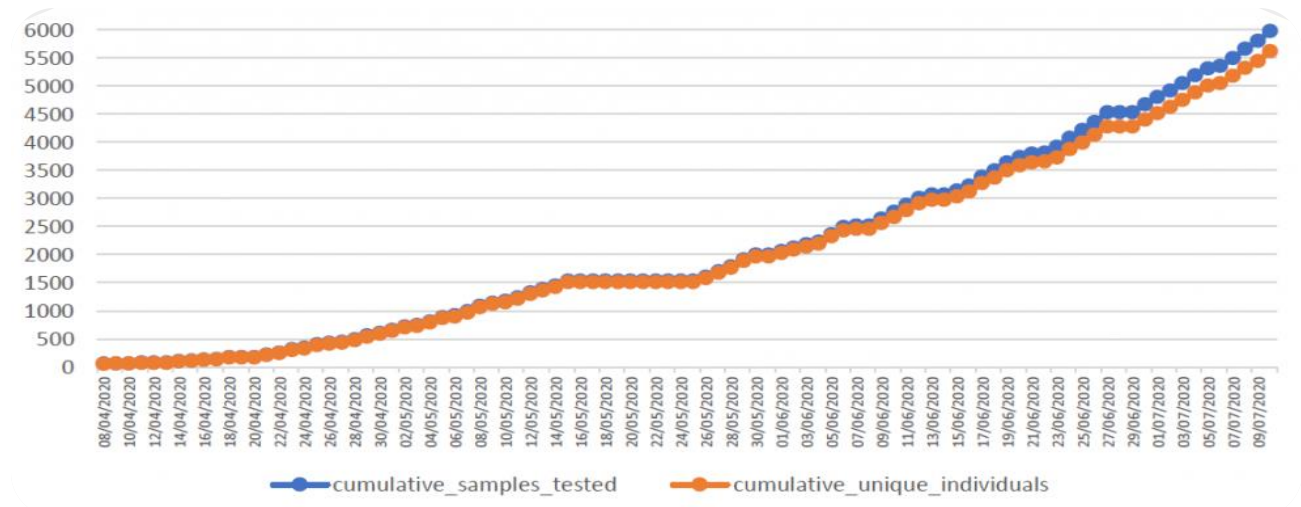
Figure 61: Cumulative Number of Samples Tested Daily

Procurement Management of the Resources Being Purchased by the DOH for Use of BRDRL to Facilitate the COVID-19 Testing

The remaining COVID-19 tests that can be conducted by the BRDRL based on the PCR testing kits they currently have is presented in Figure 62. It is evident that as of July 10, 2020, 18,865 tests can still be conducted. It implies that there are available testing kits to conduct COVID-19 testing with Bicol having 'zero backlog' in testing.
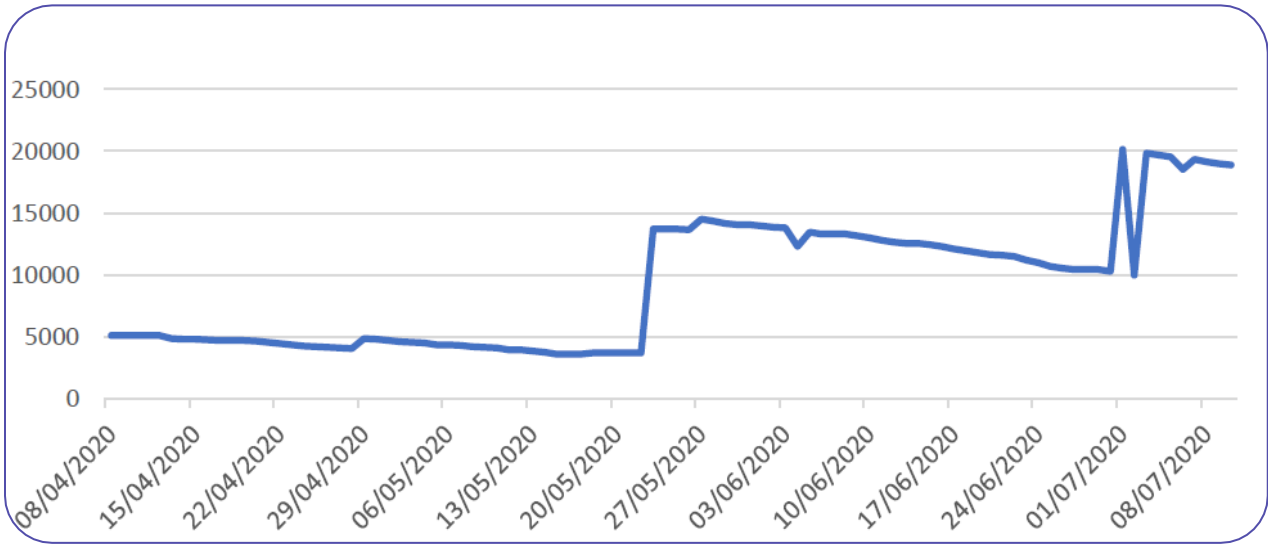
Figure 62: BRDRL Remaining PCR Testing Kits

The awarded procurement activities of DOH Regional Office V in relation to COVID-19 is presented in figure 63. DOH RO 5 awarded COVID-19 Procurement Activities
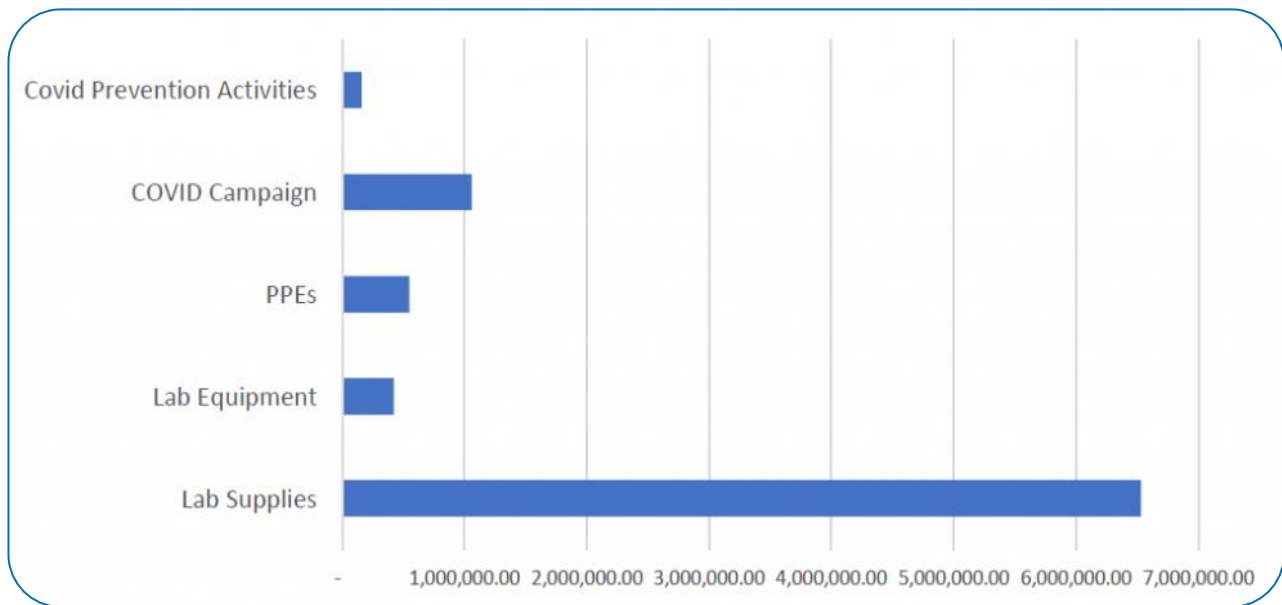
Figure 63: DOH RO5 Awarded COVID-19 Procurement Activities

These are the resources being purchased by the DOH for use of BRDRL to facilitate the COVID-19 testing. It is apparent that the biggest procurement cost is on purchase of laboratory supplies followed by conduct of COVID-19 related campaigns, purchase of Personal Protective Equipment (PPE), purchase of laboratory equipment and conduct of COVID-19 prevention activities. For laboratory supplies the highest cost is on purchase of the Viral RNA Extraction kit & Consumables with an approved budget contract of approximately 4 million which is used for testing COVID-19 specimens in BRDRL.

COVID-19 campaign activities on the other hand refer to placement of Radio/TV Infomercials as well as various signages for COVID-19 response and containment. Procurement of PPE refers to procurement of surgical gowns, surgical masks, goggles, coverall, shoe cover and head cover which are vital in the conduct of the testing procedures. Further, laboratory equipment includes purchase of equipment such as LED Digital Dry Bath / Dry Block Heater and finally, COVID-19 prevention activities includes activities like accommodation or quarantine for health workers and technicians from NCR as well as anti-bacterial fogging/misting treatment to ensure that the workplace is properly disinfected, ventilated, and maintained as part of infection control procedures.

The Procurement Needs of BRDRL through DOH that may Further Enhance their Operation on Specimen Testing

From the identified COVID-19 related procurement activities of DOH RO V, approximately 8.6 Million worth or 77% is already awarded, 2.5 Million which is 23% is waiting for quotation and 41,000 or 0.37% has a quotation that is above the approved budget as presented in Figure 64. This shows that most of the requested items to be purchased has been already awarded and that procurement of resources by the DOH Regional Office V for use of BRDRL to facilitate the COVID-19 testing is well managed with Bicol having 'zero backlog' in testing and available PCR testing kits. The remaining 23% procurement needs are presented in figure 63.
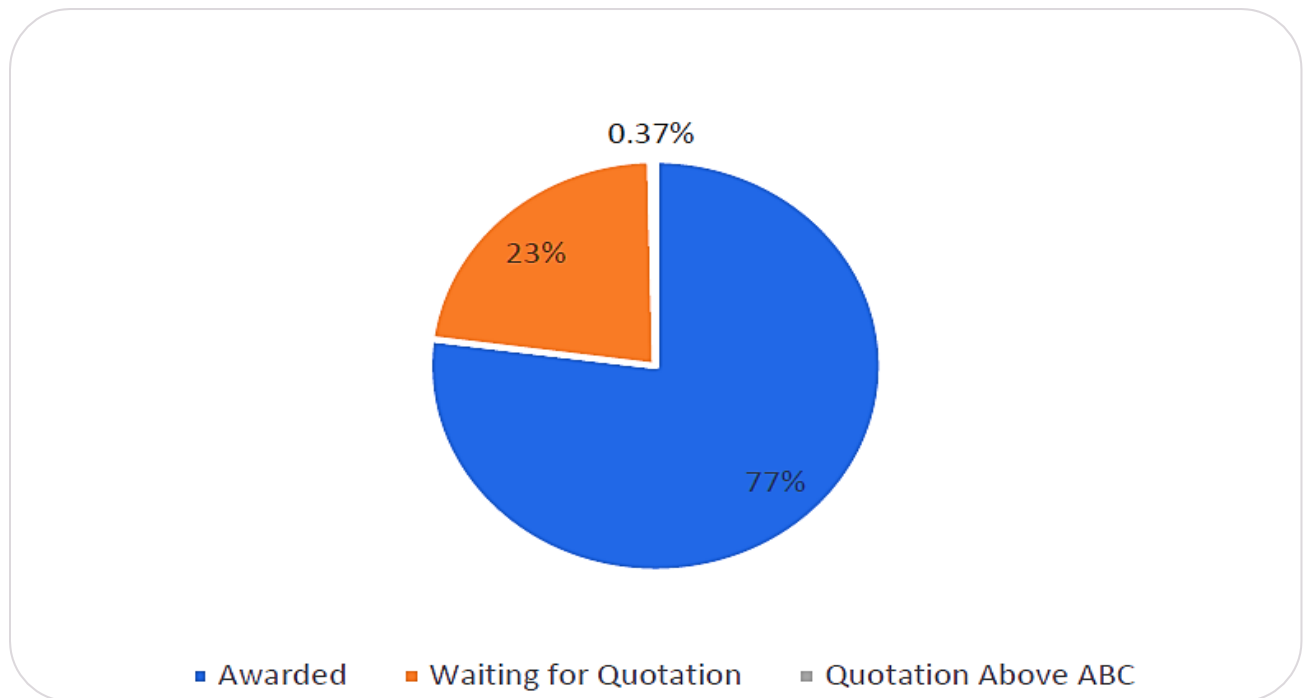
Figure 64: DOH RO5 Status of Purchase Requests for COVID-19 Procurement Activities
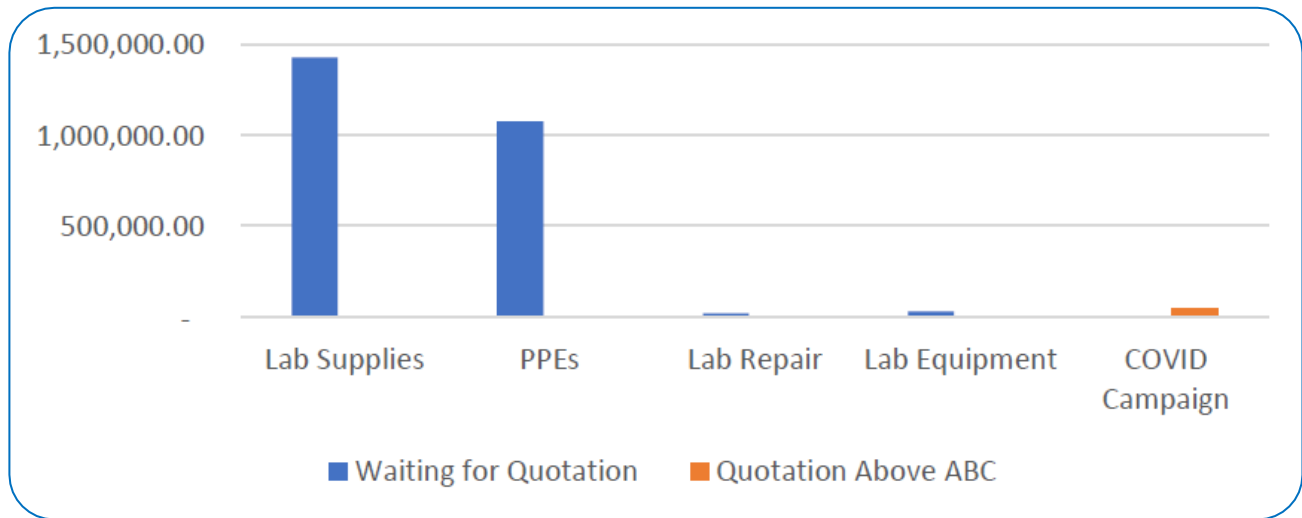
Figure 65: DOH RO5 COVID-19 Procurement Needs

The procurement needs of BRDRL through DOH Regional Office V to further enhance their operation on Covid-19 specimen testing is presented in Figure 65. These are the resources being requested by the DOH for use of BRDRL to facilitate the COVID-19 testing which are either still waiting for quotation or has quotation above the approved budget for the contract. It is evident that the biggest procurement cost is on purchase of laboratory supplies followed by purchase of Personal Protective Equipment (PPE), conduct of covid19-related campaigns, purchase of laboratory equipment and repair of Covid-19 laboratory at BRDRL.

CONCLUSIONS

Based on the foregoing findings, the study concluded that DOH Regional Office V so far had shown to have managed well their COVID-19 related procurement activities for BRDRL based on data scraped from the DOH Data Drop and procurement data provided by the DOH ROV with Bicol having 'zero backlog' in testing and with available PCR testing kits which can be partly attributed to the strong partnership with the LGU of Legazpi City. Other local government units may replicate the partnership of Legazpi City with DOH. Likewise, innovative partnerships with business and civil society are needed since it is a fact that the DOH cannot win the fight in stopping the spread of COVID-19 without the cooperation and support of stakeholders and the public. Early detection and isolation of new COVID-19 cases is critical to managing potential outbreaks, especially as the government is considering gradually lifting quarantine measures. This makes testing all the more vital.

What's Next?

During an emergency like the COVID-19 crisis, procurement procedures need to be as fast as possible as it adheres to the rules on Negotiated Procurement (Emergency Case) by simplifying its process as stipulated in the GPPB Resolution No. 03- 2020, however, emergency procedures still need to be public and open. Although the Department of Health Regional Office V was able to provide some procurement data as requested, yet, it would have been more beneficial if said data are disclosed publicly online, in the GPPB online portal, or in their website. With this, the study recommends that open procurement data such as the Annual Procurement Plan FY 2020, request for quotation, technical specifications, purchase order, and notice of award be made available to public since it may enable fairer competition among companies, identify red flags, as well as deliver better services for governments and citizens. Publishing data for each step of the contracting process is highly recommended to promote transparency and accountability. COVID-19 procurement strategies need to be rapidly updated to form a global, digital and data-driven plan since how the government manages emergency public procurement will play a major role in how COVID-19 be contained and how many lives can be saved. Finally, it is also suggested for PhilGEPS or the procuring entity to establish an online platform to allow for an online submission and receipt of bids for procurement modalities by all procuring entities.

Perceived impacts of the study

The findings of the study could serve as feedback to the Department of Health Regional Office V on their procurement management of the resources used on testing COVID-19 cases in the Bicol Regional Diagnostic and Reference Laboratory (BRDRL) during this pandemic. Further, the utilization of data analytics in this study could serve as guide to future researchers on the importance of analyzing data sets and how it could give meaning to a simple data, translating data on hand to meaningful stories, thereby building a model for a data-driven decision making. Finally, this could provide an open data accessible to the community members while reinforcing scientific cooperation. Being a researcher requires inspiration, commitment and dedication. Without these, no research shall be accomplished and realized. As Microsoft co-founder Bill Gates said and we quote "I believe in innovation and that the way you get innovation is you fund research and you learn the basic facts." Hence, this research will only find its meaning when shared with others and others learned from it.

COMMENT AND READ MORE ABOUT THIS PAPER: https://www.ocdex.tech/procurement-management-of-the-resources-used-on-testing-covid-19-cases-in-the-bicol-regional-diagnostic-and-reference-laboratory-brdrl/

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THE PHILIPPINE GOVERNMENT PRECAUTIONARY MEASURES THROUGH PROCUREMENT OF COVID-19 RELATED ITEMS

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With the widespread of COVID-19 as an infectious disease caused by a newly discovered coronavirus, the Philippines had a large number of confirmed cases reported from early of this year up to the present. This research deemed it necessary to determine and analyze the procurement transactions made by the Philippine Government as response measures during the first quarter of the Covid-19 pandemic occurrence in the country. This may serve as baseline data in the preparation of the Annual Procurement Plan (APP) and/or the supplemental one to respond to Covid-19 crisis. Particularly, this intends to identify the items procured during the first quarter by the government agencies as response measures to Covid-19 pandemic. It also evaluates the transaction details of the procured items, and determine the response measures initiated by the government agencies as precautionary to the spread of Covid-19.

China

Thailand

13,221 confirmed cases
73.2% of deaths from NCR,
11.6% from CALABARZON,
3.5% from Central Luzon
3.3% from Central Visayas
(DOH, May 20, 2020)

Pandemic

World Health Organization

International community's Strategic Preparedness and Response Plan

Procurement Preparations:

LGUs
Offices
Barangays
Provincial Offices
Public Schools

Section 75 of Republic Act No. (R.A.) 9184 Government Procurement Reform Act

Resolution 03- 2009 Revised IRR Approved by Government Procurement Policy Board (GPPB)

Specific Objectives

1. To identify the items procured during the first quarter by the government agencies as response measures to Covid-19 pandemic;

2. To evaluate the transaction details of the procured items; and,

3. To determine the response measures initiated by the government agencies as precautionary to the spread of Covid-19.

This research employed the data analytics methods by observing the steps as depicted in Figure 66 such as data scraping, data cleaning, data processing, and data analysis and iteration.

Figure 66: Data Processes

Data scraping: The collection of data was made through data scrapping from PhilGeps website along Bid Notice and Award Details for the first quarter of year 2020, that is from January to March 2020. As to procurement data within the duration period, the total number of collected datasets were 231,784. However, focusing primarily on Covid-19 procurement and removing the non-covid related procurement, this resulted to 245 data sets only. Other legitimate sites such as GPPB and DOH were also looked into. From Regions 1 to 15 including NCR, this was well-represented by various government agencies with 22 offices, 5 public schools, 8 barangays, 73 LGUs, and 9 Provincial Offices.

Data Cleaning: This includes the processes of filtering the PhilGeps procurement data if it is Covid-related based on its notice titles, item name and descriptions. Filtering also involves selecting the necessary fields found relevant on the analysis of data such as organization name, business category, funding source and instrument, notice type, procurement mode, area of delivery and the like since the datasets to be collected may be in the form of a machine-readable format. The keywords used were "covid" and "covid-19." Other irrelevant fields and with NULL entry were removed.

Data Processing: After cleaning the datasets, the organization names were grouped accordingly to its organization type to come up with a collective view. Stemming was used for the item descriptions and business category for easier analysis to remove the inflexional and/or sometimes the derivational. The approved budget was also sorted into data ranges. The "count" value were used in the analysis of each unique instances. The purpose of those processes was to get the unique value of each data to give meaning and help in telling the stories.

Data Analysis and Iteration: Visualization of each significant finding was made by curating data into a form easier to understand and make the necessary inferences on the results as per GPPB and DOH issuances. Afterwards, consultation with the Legazpi City LGU procurement personnel shall be made for presentation and validation of results. Further improvement shall be considered on the processing of next iteration of the study.

RESULTS

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

The items procured in terms of its business category by various government agencies as represented by the five (5) organization types is shown in Figure 67. Results revealed that the LGU, offices, provincial offices, and schools similarly had the medical supplies and laboratory instruments as their top procurement priorities during the first quarter of 2020 as prevention and response for Covid-19. General merchandise such as other supplies, printing, information materials, and the like, followed by drugs and medicines were found to be the next top-most procured items by the various government agencies especially those at the barangay levels. Since even during the early times of pandemic, some families and even individuals got displaced, that is why groceries had also been part of the most procured items especially by the LGUs. It is good to note that LGU took the lead in taking its initiative for the prevention of the spread of virus.

Findings also showed that Region 7 or Central Visayas, particularly Cebu City, had made the most number of procured items on medical supplies and laboratory instrument, and drugs and medicines during the first quarter of 2020. Region 1 or Ilocos as they also had a big count of purchases on medical supplies and laboratory instrument and so with the other item categories. Next to it were Regions 8 of Eastern Visayas and NCR with medical supplies and laboratory equipment, and general merchandise respectively.
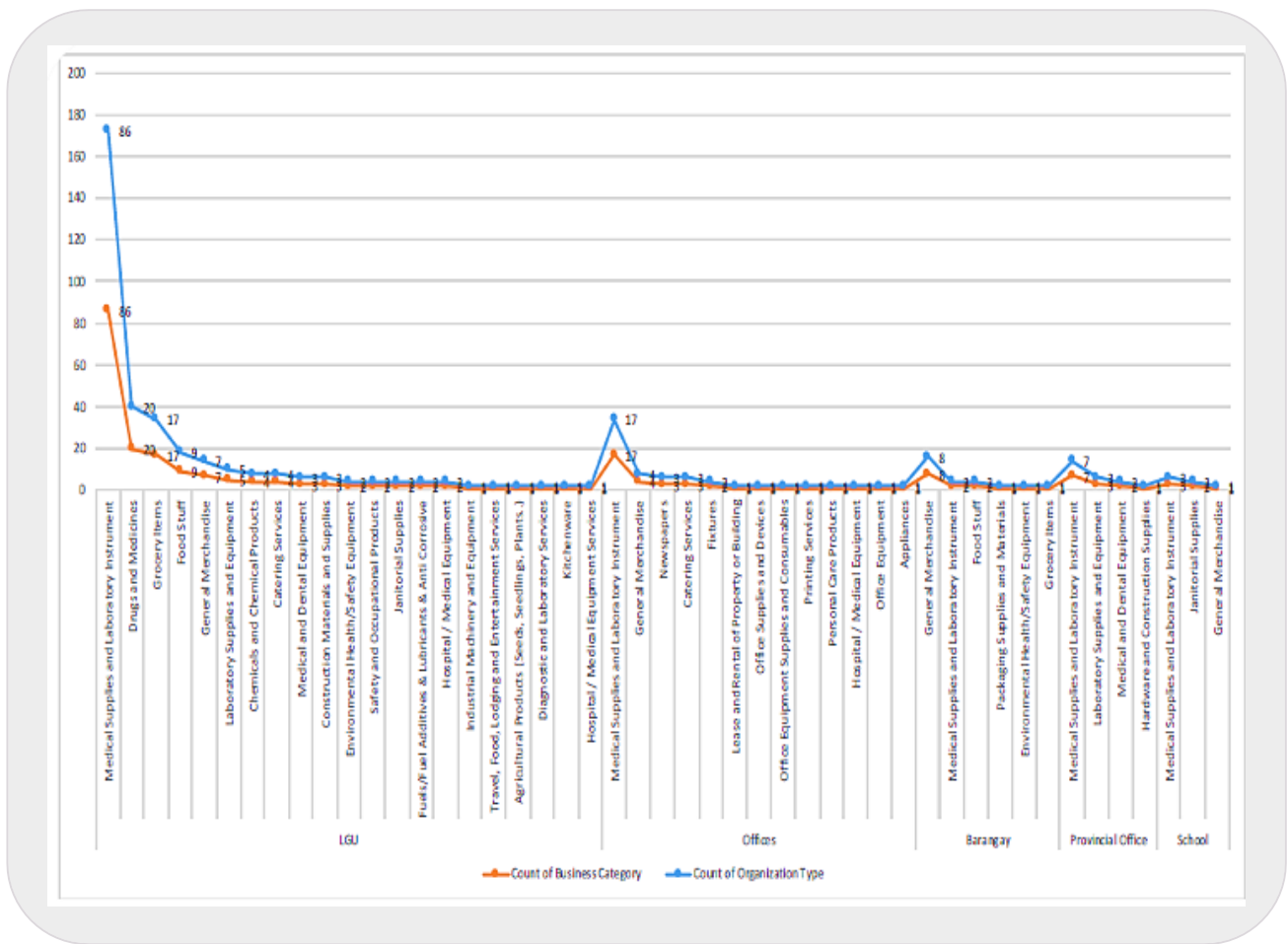
Figure 67: Items Procured in Terms of its Business Category

Transaction Details of the Procured Items

Majority of the funding source and instrument of the procured items as reflected in Figure 67 had its budget for the contract as approved by the Sanggunian followed by those from the General Appropriations Act (GAA). With the holistic view, since the study covered the various government agencies such as LGU, public offices and schools, this showed the utilization of two (2) alternative procurement modes. Results inferred that most of the procurement mode is on alternative mode which is Negotiated Procurement-Small Value Procurement followed by those posted from public bidding.
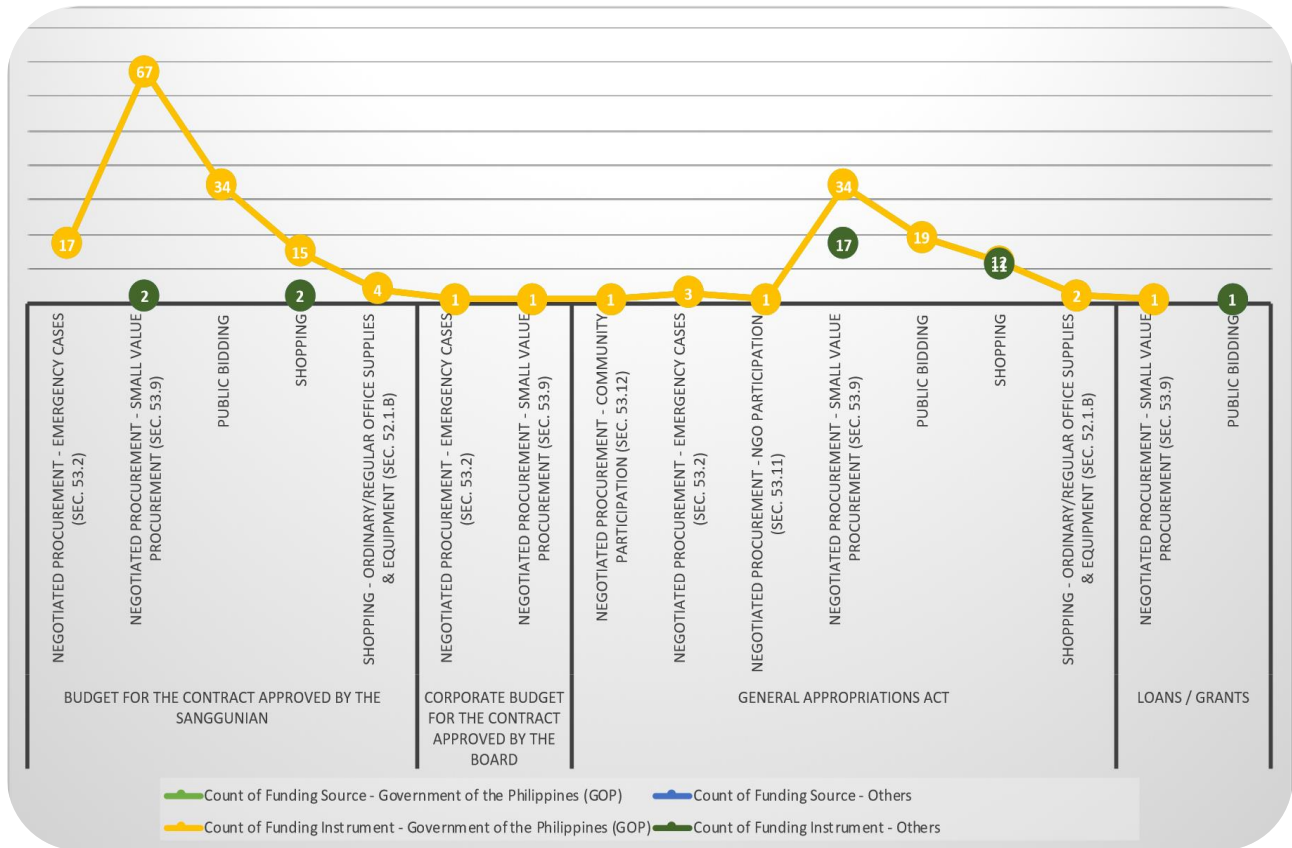
Figure 68: The Funding Source and Instrument and Procurement Mode

As to the budget utilization, Figure 68 shows the procured items based on its business category along with its approved budget. For the barangays, the top-most procured items were on general merchandise with budgets ranging from 501,000 to 1M. With the LGUs, medical supplies and laboratory instruments with an approved budget of 400,000 to 1.5M was the top procured items. Grocery items were also 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 ranging from 51,000 to 100,000. Almost similarly, other government offices had also the medical supplies and laboratory instruments as the most procured items during the first quarter of 2020 with approved budgets ranging from 51,000 to 4M and general merchandise also as the next most procured items. Further, the provincial offices and schools had similar to other government agencies on the top-most procured items which is medical supplies and laboratory instruments with budgets ranging from 251,000 to 8M and 51,000 to 400,000 respectively.
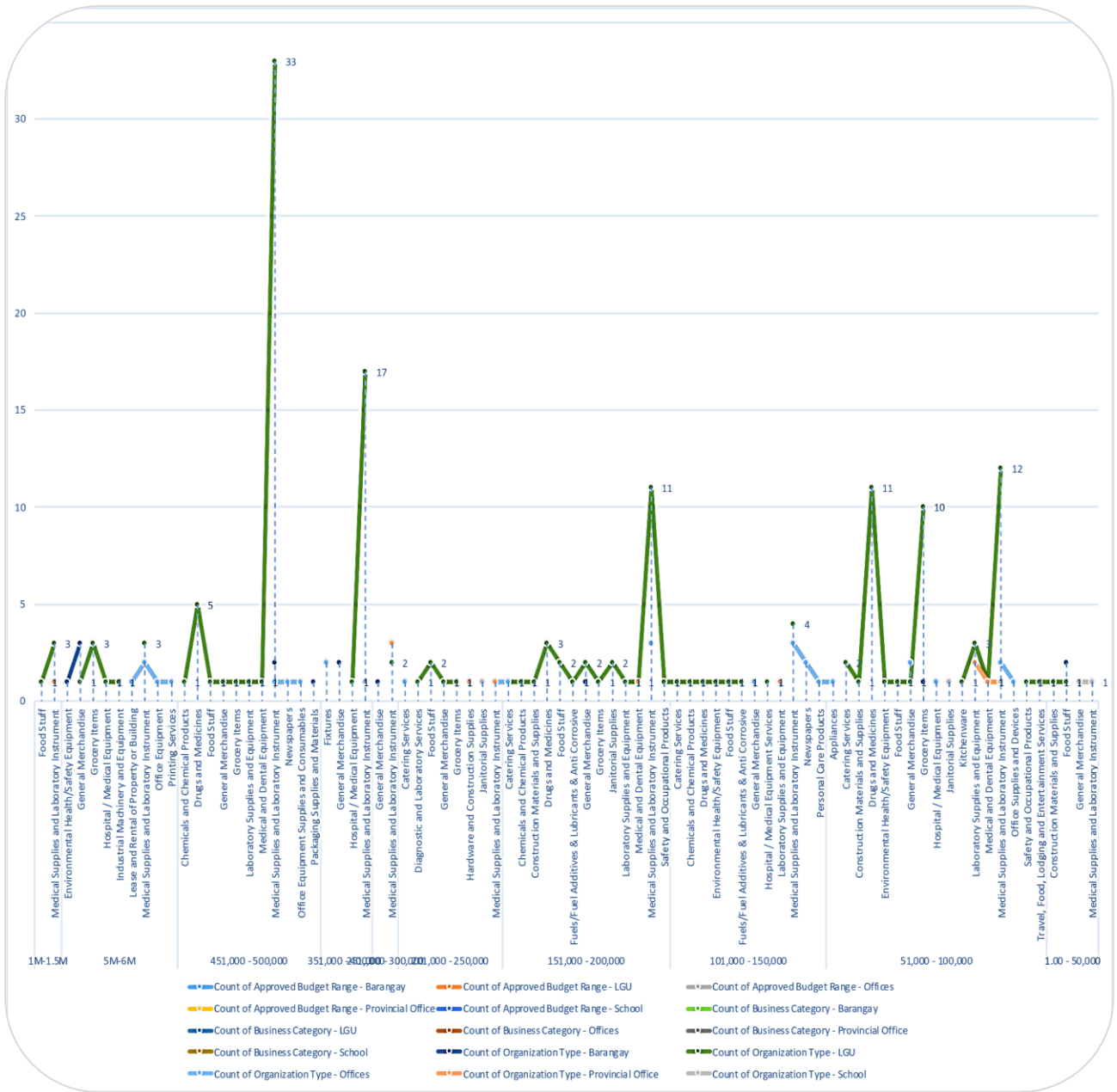
Figure 69: Top 10 Business Categories

Top 10 Business Categories along with the Approved Budget as part of the procurement process, based on the procurement details on the first quarter of this year, mostly of the award notice granted was on negotiated procurement on emergency cases as presented above which was evidently shown on Figure 69. Notably, the lowest calculated and responsive bidder, and emergency cases were most of the reasons in giving the award to the concerned suppliers as shown also in the Figure. Other reasons for award shown were lowest calculated and responsive price quotation and most reliable supplier.
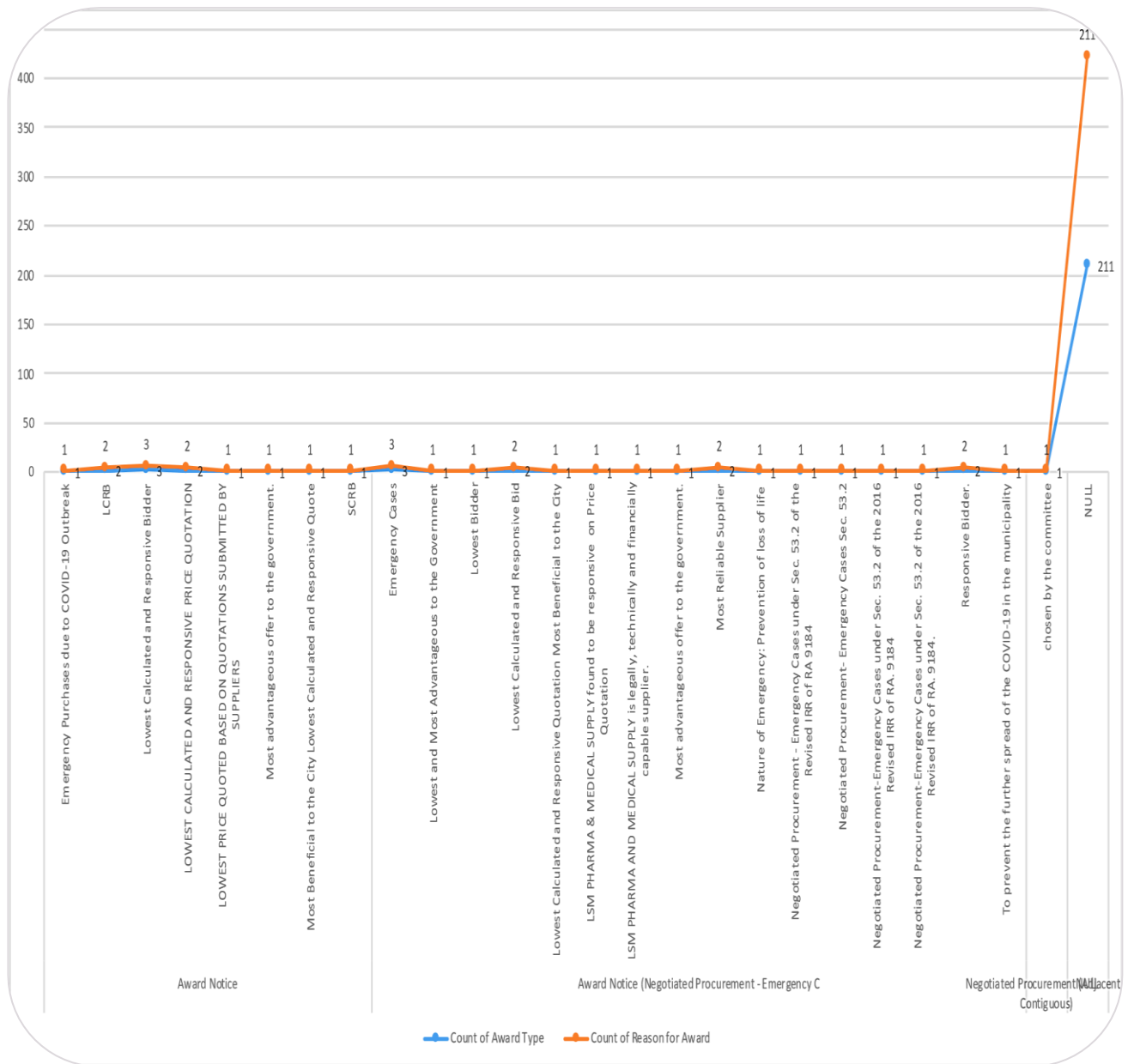
Figure 70: The Award Type and Reason for Award

As part of the procurement process, based on the procurement details on the first quarter of this year, mostly of the award notice granted was on negotiated procurement on emergency cases. Notably, the lowest calculated and responsive bidder, and emergency cases were most of the reasons in giving the award to the concerned suppliers. Other reasons for award shown were lowest calculated and responsive price quotation and most reliable supplier.

Response Measures Initiated by Government Agencies as Precautionary Measures to Covid-19
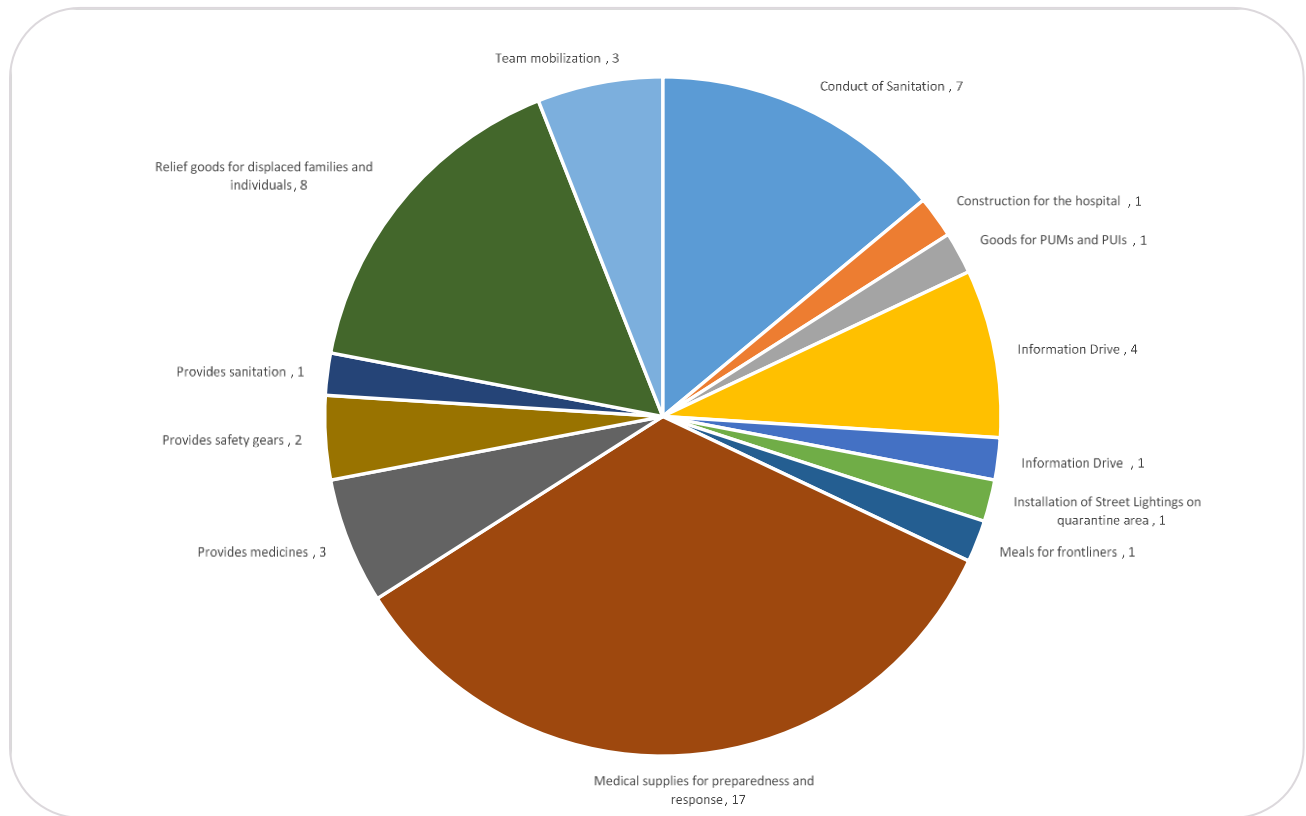
Figure 71: Summary of the Precautionary Response to Covid-19

The response measures initiated by various government agencies as precautionary measures to Covid-19 were identified based on their procured items during the first quarter of 2020. Findings revealed that from among the various government agencies in the country, foremost of the precautionary measures conducted were the availability of medical supplies for the preparedness and response, distribution of relief goods for the displaced families and individuals, the conduct of sanitation, and taking the initiative in disseminating information through an information drive such as seminars or orientation and printing of tarpaulins relating to Covid-19 preventive measures. Most of the measures were initiated by the LGUs and this may be inferred to the idea that the frontliners mostly came from the LGUs.

The LGU, offices, provincial offices, and schools similarly had the medical supplies and laboratory instruments as their top procurement priorities during the first quarter of 2020 as prevention and response for Covid-19 followed by general merchandise especially those at the barangay levels. Region 7 or Central Visayas particularly Cebu City had the most number of procured items of medical supplies and laboratory instrument, and drugs and medicines during the first quarter of 2020. As to area of delivery, Region 1 or Ilocos had the biggest count of purchases followed by Regions 8 of Eastern Visayas and NCR. Majority of the funding source and instrument of the procured items came from the Government of the Philippines (GOP) with the budget for the contract of 51,000 to 4M as approved by the Sanggunian followed by those from the General Appropriations Act (GAA). Most of the procurement mode is on Negotiated Procurement-Small Value Procurement followed by those posted from public bidding. And, foremost of the precautionary measures conducted were the availability of medical supplies for the preparedness and response, distribution of relief goods for the displaced families and individuals, the conduct of sanitation, and taking the initiative in disseminating information through an information drive relating to Covid-19 preventive measures.

CONCLUSIONS

Based on the foregoing findings, the study concluded that the various government agencies had shown limited procurements on covid-related items in preparation for the pandemic although the LGUs had the most procured items during the first quarter of 2020 on medical supplies and laboratory equipment. The procurement processes adhere to the rules on Negotiated Procurement (Emergency Case) as stipulated in the GPRA. In addition, a number of precautionary measures were conducted by the various government agencies in the Philippines although further measures with urgency should still be initiated to help control the virus transmission nationwide and even worldwide.

What's Next?

The study recommended that there should be procurement of materials to be used for sanitation and protocol set-up as preventive measures for the spread of Covid-19 specially to quarantine areas and other public areas mostly visited by community members. Said items may be considered in the preparation of the Annual Procurement Plan (APP) and/or the supplemental one to respond to covid-19 crisis. It is also suggested for the GPPB to formulate a policy guideline by expediting the procurement processes through an online platform by designing a Decision Support attributes in the system to further promote transparency and competitiveness. Lastly, there should be an urgency on the procurement of the most needed medical supplies and laboratory equipment to strictly implement the health protocols to help address the increasing number of PUM's, PUI's and LSI.

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PROPER REACTION IN SECURING INTEGRITY ON THE PUBLIC BIDDING OF CONSTRUCTION AND INFRASTRUCTURE TENDERS AMIDST THE COVID-19 PANDEMIC

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As of July 22, 2020, a total of 72,269 total COVID-19 cases has been reported, of which 46,803 are still classified as active cases. With this continual rise of COVID-19 cases, it is estimated that this would cost about PHP2.2 trillion economic losses and is equivalent to at least a 2% contraction in the nominal gross domestic product (GDP) of the country. As a consequence of this economic loss, about 26% of businesses operating in the country have already closed resulting to about 100,000 Filipinos losing their jobs in the 1st half of 2020 Indeed, there is an immediate need to control the spread of COVID-19 in the country to further mitigate the impact of the said disease to the Filipino people.

New Issuances of Government Procurement Policy Board

Public procurement is playing a vital role in curbing the impact of COVID-19 in the Philippines. As previously reported in the Stakeholder Engagement Plan (SEP) published by Department of Health (DOH, 2020b), the Philippines COVID-19 Emergency Response Project (P173877) – financed under the Fast Track COVID-19 Facility of the World Bank COVID-19 Response program— have allotted 1.14 billion Philippine pesos (US $23, 000, 000) for the establishment, construction, retrofitting, and refurbishment of identified quarantine facilities in all major points of entry in the country, increase in number of isolation rooms establishment of negative pressure isolation rooms in DOH and provincial hospitals, establishment of first line decontamination facilities in international airports and seaports, and setting up of isolation tents for triaging in health facilities. In response to this project, the Government Procurement Policy Board (GPPB) issued new resolutions, particularly GPPB resolution numbers 03-2020, 05-2020, 06-2020, and 09-2020, to fast track the public procurement process in such projects as demanded by the sense of urgency brought by the COVID-19 pandemic (Government Procurement Policy Board [GPPB], 2020a, 2020b, 2020c, 2020d). To describe the changes adopted to supplement the implementing rules and regulations (IRR) of Republic Act (RA) 9184 (Government Procurement Reform Act) in times of emergencies, key directives stipulated in the new GPPB resolutions are summarized as follows:

- Authorize the Head of the Procuring Entity (HoPE) to delegate the Bids and Awards Committee (BAC), End-user unit, or any other appropriate procuring unit to directly negotiate with a legally, technically, and financially capable bidder for procurement undertaken through Negotiated Procurement (Emergency Cases) (GPPB, 2020a).

- Allow the HoPE to delegate the awarding of contract under Negotiated Procurement (Emergency Cases) to any official of the procuring entity except to the BAC Chairperson or members (GPPB, 2020a).

- Allow Procuring Entities (PE) to accept expired Business or Mayor's Permit with O_cial Receipt of renewal application and unnotarized Omnibus Sworn Statement subject to compliance therewith after award of contract (GPPB, 2020b, 2020d).

- Increase the allowable amount of advance payment from 15% to 30% of the contract amount of procurement projects which include establishment, construction, and operation of temporary medical facilities (GPPB, 2020c).

- Allow PEs to accept an unnotarized Performance Securing Declaration (PSD) in lieu of a performance security subject to submission of a notarized PSD before payment as prescribed (GPPB, 2020d).

A Proposed Control Measure

With the purpose of providing another control measure to support PEs in integrously awarding contracts in this time of a pandemic, this project developed and explored a risk indexing system as a possible supplemental tool to the current system for evaluating eligibility of contractors in undertaking construction and infrastructure tenders. The developed risk indexing system which aims to rapidly evaluate and assess contractor traits (REACT) have been used to collate and analyze collected data from the 28th and 29th Contractors Performance Evaluation Summary (CPES) report published by GPPB. Through the use a multi-objective decision analysis approach, the risk indexes, as applied to construction and infrastructure tenders in Region V, showed usefulness and convenience in quantifying and describing risks associated relative to the previous performance of an eligible contractor. The use then of this tool in conjunction to the revised IRR of RA amended by the new GPPB resolutions is thus seen to tighten" the relaxed process for Negotiated Procurement (Emergency Cases), expand capacity of PEs to evaluate eligible contractors, and improve the objectivity of the amended Negotiated Procurement (Emergency Cases) process as a whole.

Objective and Research Questions

The overall objective of this project, through the REACT risk indexing system, is to provide an intervening means for COVID-19 related construction and infrastructure tenders to be rapidly awarded to eligible contractors while minimizing the risks induced by the fastracking of the negotiated mode of procurement in response to the urgency brought by the COVID-19 pandemic. To address the issue described, this project aimed to investigate the following research questions:

- What does a low contractor risk index imply relative to the identified contractor attributes based on the processed CPES data?

- What does a high contractor risk index imply relative to the identified contractor attributes based on the processed CPES data?

- What is the most crucial contractor attribute that could indicate a possible case of misrepresentation and fraudulence?

- How appropriate is the developed contractor risk indexing system in relation to assessing contractor eligibility for Negotiated Procurement (Emergency Cases)?

Data Source

The CPES report data published by GPPB was used to develop the REACT risk indexing system. The most recent (28th and 29th) CPES reports released by GPPB have been explored in particular (GPPB, 2019a, GPPB2019b). These open government procurement data contained construction and infrastructure tenders from the period 2016-2019. The 29th CPES report was observed to be most complete as these contained the dates corresponding to the start and target date completion of a construction and infrastructure tender, and slippages incurred by each contractor. The 28th CPES report, on the other hand, significantly differed as this did not include those data (e.g. slippage) reported in the 29th release. Nevertheless, both data frames were used as these consisted essential data for the development of the REACT risk indexing system.

Procurement Data Processing Method

Data Digitization and Filtering

The 28th and 29th CPES report data were retrieved in PDF format with images. The document was first digitized into a machine-readable format. The digitized data was then ingested as a base data frame containing 9026 rows and 28 columns. The data frame was filtered and pre-processed, to align the format of the 28th CPES report to the most recent format presented in the 29th CPES report data. The dataset was also transformed and imputed due to the inavailability of starting and completion dates in the 28th CPES report from 2016 – 2018. These incomplete observations were dropped from the base data frame. The negative slippage, which represented whether completion of a construction and infrastructure tender is delayed, was also not included in the 28th CPES report. Data transformation was performed for the 28th CPES report data to incorporate contractor negative slippages. The negative slippages for each contractor listed in the 28th CPES report data were then calculated in accordance to the thresholds described in the published CPES guidelines (Construction Industry Authority of the Philippines [CIAP], 2014; GPPB, 2011). The final data frame after data cleaning (e.g. removal of duplicate entries and missing data entries) and data transformation represented 242 contractors from the Bicol Region.
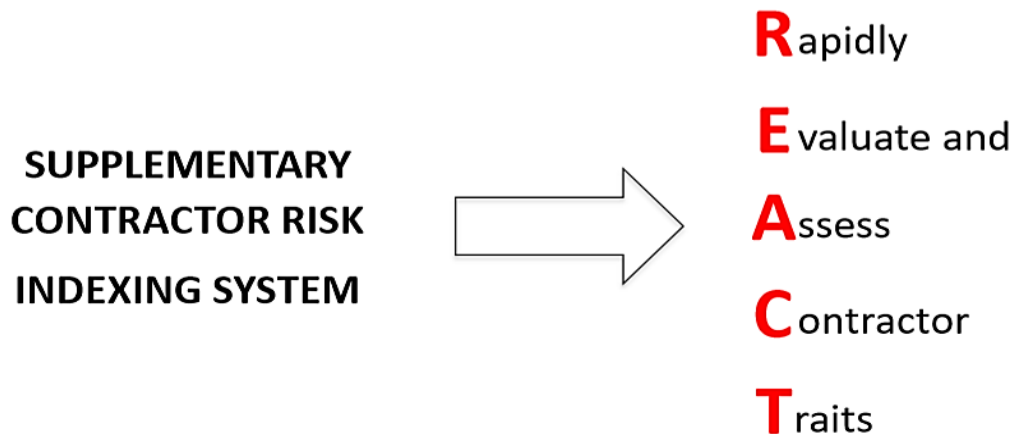
A multi-objective decision analysis approach was implemented to strategically assign numerical quantities to the following contractor traits for the 242 identified contractors who were awarded construction and infrastructure contracts from Region V (Bicol Region) (Santos, Pagsuyoin, & Latayan, 2016; Zavadskas & Podvezko, 2016; Pagsuyoin, Santos, Latayan, & Barajas, 2015):

- Average Contract Duration (C1): corresponds to the average of the reported contract duration in calendar days for awarded construction and infrastructure tenders.

- Average Contract Amount (C2): pertains to the average awarded amount for construction and infrastructure tenders.

- Average Negative Slippage (C3): corresponds to the time a project is late compared to the approved baseline schedule in the implementation of the awarded construction and infrastructure tenders.

- Lack in Average CPES Rating for On-going Projects (C4): pertains to the difference between the maximum CPES rating achievable (i.e. "Outstanding" qualitative description) and the average CPES rating of a contractor for on-going construction and infrastructure projects.

- Lack in Average CPES Rating for Completed Projects (C5): pertains to the difference between the maximum CPES rating achievable (i.e. "Outstanding" qualitative description) and the average CPES rating of a contractor for on-going construction and infrastructure projects.

- Number of On-going Projects (C6): corresponds to the number of on-going projects reported for each contractor.

- Number of Completed Projects (C7): corresponds to the number of completed projects reported for each contractor.

- Approximate Net Financial Contracting Capacity (NFCC) (C8): an approximate contractor financial capacity based on the awarded contract with the highest reported contract amount.

- Total Number of Projects (C9): corresponds to the sum of on-going projects and completed projects reported for each contractor.

The contractor risk indexes were established through the linear calculation of the scores assigned to each contractor in accordance to the identified contractor traits. Interpretation of the risk indexes were then made based on the magnitude of the calculated numerical quantities. Visualization of the results was also made to further aid in the interpretation of the results.

RESULTS AND INSIGHTS

Describing the Collated Data

The summary of the final data frame established is visualized in Figure 1 and Figure 2. As seen from Figure 1a, a total of 463 construction and infrastructure tenders, comprising of 240 and 223 contracts for completed and on-going projects, respectively, were extracted from the period 2016 - 2019 and the distribution of completed and on-going projects were found to be equivalent with each other. In terms of the C4 and C5 contractor traits, the calculated median value of about 10% as shown in the box-plot of Figure 1b indicated contractor performance equivalent to at least a qualitative description of "Very Satisfactory" for majority of the awarded contracts in Region V. This implied that contractors generally delivered their contractual obligations as agreed upon with PEs.

Implications of Data on Average Contract Amount and Approximate Net Financial Contracting Capacity

Examination of contractor trait C2 as summarized in Figure 2b indicated that majority of contractors (about 170) in Region V have recently engaged in contracts amounting to a maximum Approved Budget Contract (ABC) of about PHP39 million. This averaged amount represented a total of 331 contracts which primarily comprised of horizontal and vertical projects.

This then indicated that eligible and experienced contractors in the region are available and could be readily tapped for the on-going implementation of the nationwide SEP program headed by DOH. The contractor trait C8 confirmed, however, that contracts with ABCs amounting to at most PHP47 million (see Figure 2c) could possibly be the maximum NFCC of locally available contractors in the said region.

Implications of Data on Average Contract Duration

Drawing insights from the data on the contractor trait C1 further confirmed that contractors in Region V are capable of delivering contractual obligations for both horizontal and vertical projects. A total of 288 contracts with duration ranging from 95 to 227 calendar days that were awarded to 158 contractors validated the results shown in Figure 2c.

Implications of Data on Negative Slippages

Evaluation of the collated data in terms of C3, however, implied that 69 out of 242 evaluated contractors garnered negative slippages. The pareto chart describing this observation is summarized in Figure 73a. While majority (about 195 contractors) of the reported negative slippages of these contractors are well within the threshold, 47 contractors were reported to be well beyond the acceptable negative slippages (GPPB, 2019). The negative slippages incurred by these contractors already warrants possible termination of such contracts as stipulated in GPPB resolution number 05-2019 (GPPB, 2019). Possible participation of such contractors in bids for construction and infrastructure tenders under the SEP program headed by DOH therefore necessitates further scrutiny.
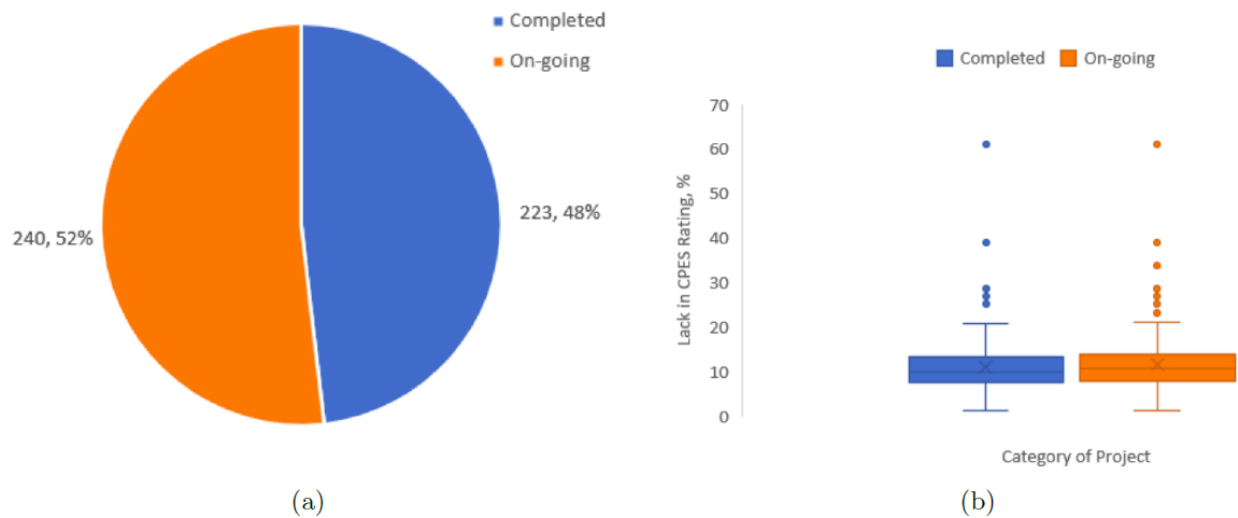
Figure 72: Distribution of Projects (a) and Lack in CPES Rating Calculated (b)
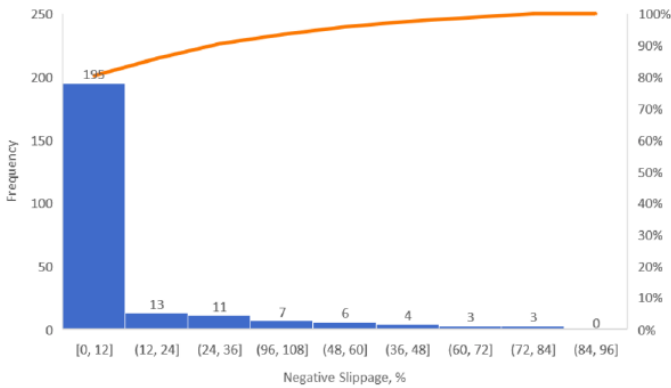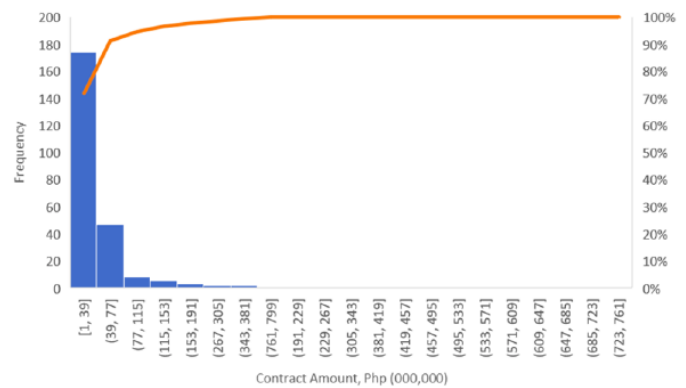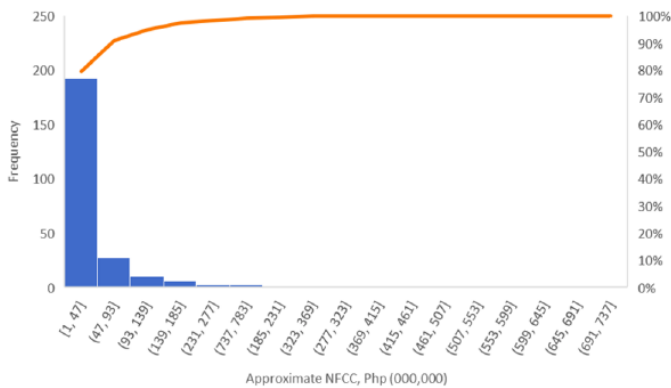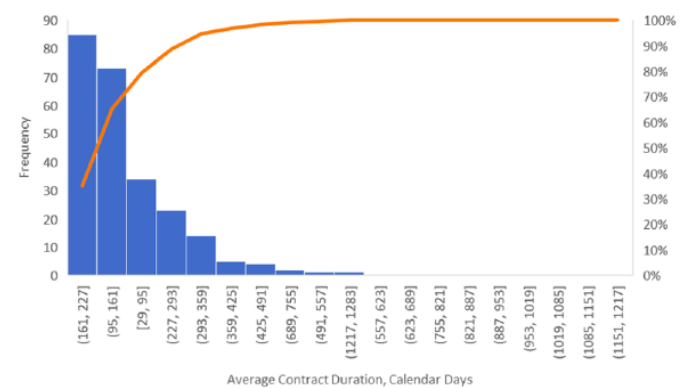
Pareto Charts for Negative Slippages Incurred (a), Average Contract Amount (b),
Approximate NFCC (c), and Average Contract Duration (d)

Ranking of Contractor Traits

With the goal to identify the least and most relevant contractor traits that could imply possible misrepresentations and intent of fraudulence in government tenders related to construction and infrastructure projects, the contractor traits (C1 - C9) described in this report were ranked in accordance to the procedure described in literature (Santos et al., 2016; Zavadskas & Podvezko, 2016; Pagsuyoin et al., 2015). The contractor trait that was observed to contribute the most to the risk index developed is C3 while C1 was seen to be least of all contractor traits considered (see Table 14). It is worth noting that contractor traits C6 and C7 were omitted. This was the case since data for C6 and C7 showed strong collinearity with each other and deemed that such collinearity be removed to ensure robustness of the implemented analysis (Zavadskas & Podvezko, 2016). Hence, C6 and C7 were transformed into a single attribute. The calculated weights totaling to 1.0 validated that the final contractor traits considered were appropriate for the analysis employed.

Contractor Trait	Contractor Trait Code	Calculated Weight	Rank
Average Contract Duration	C1	0.0375	5th
Average Contract Amount	C2	0.1876	3rd
Average Negative Slippage	C3	0.4430	1st
Lack in Average CPES Rating (Completed)	C4	0.0317	6th
Lack in Average CPES Rating (On-going)	C5	0.0312	7th
Approximate NFCC	C8	0.1932	2nd
Total Number of Projects	C9	0.0758	4th

Table 14: Calculated Influence of Contractor Weights

Most Crucial Contractor Traits

Drawing insights from Table above, further supplemented the published CPES guidelines for evaluating contractors awarded with construction and infrastructure projects. As quantitative analysis allowed, the negative slippage incurred by a contractor contributed 44.30% of the calculated risk index from the collected CPES data. Additionally, the approximate NFCC was also found to be significant and contributed 19.32% of the calculated risk index. These results were found to be congruent to GPPB resolution numbers 05-2019 and 20-2013 (GPPB, 2019, GPPB2013) which declared negative slippages and NFCC as most essential to the evaluation of contractor eligibility to undertake contractual obligations necessitated by government construction and infrastructure tenders.

Classification of Calculated Risk Indexes

Collation of the calculated risk indexes led to the initial classi_cation of the evaluated contractors into five (5) general categories. As shown in Figure 74, the calculated risk indexes were grouped into "Very Low", "Low", "Moderate", "High", and "Very High" which were given equivalent numerical scores of 1, 2, 3, 4, and 5, respectively. Finally, looking into the behavior based on the averages of the values for each contractor trait further simplified this classification into "Low", "Moderate", and "High" risk categories and these were given equivalent numerical scores of 1, 2, and 3, respectively (see Figure 75). As an example, contractors with calculated risk indexes less than or equal to 59.3 were associated with the "Low" risk category while those with values greater than 78.3 were pooled with the "High" risk category. The corresponding numerical quantities indicative of these qualitative descriptions are detailed in Table 15.
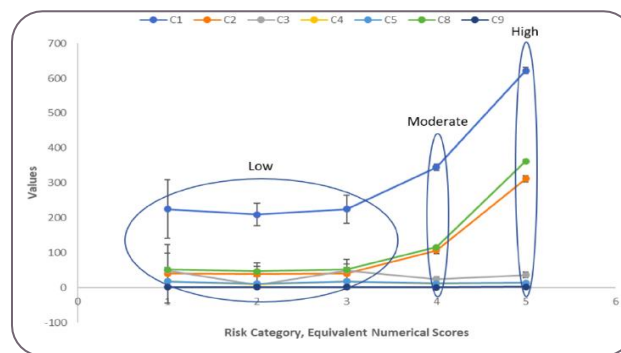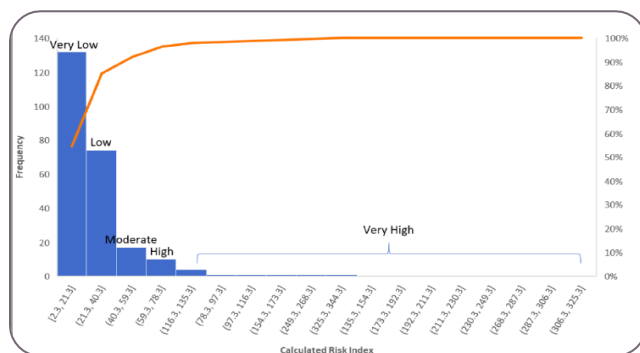

Figure 74: Initial Classification of Calculated Risk Indexes
Figure 75: Slimplified Classification of Risk Categories in Accordance to Average Values

Contractor Trait	Contractor Trait Code	Calculated Weight	Rank
Average Contract Duration	C1	0.0375	5th
Average Contract Amount	C2	0.1876	3rd
Average Negative Slippage	C3	0.4430	1st
Lack in Average CPES Rating (Completed)	C4	0.0317	6th
Lack in Average CPES Rating (On-going)	C5	0.0312	7th
Approximate NFCC	C8	0.1932	2nd
Total Number of Projects	C9	0.0758	4th

"**Average Negative Slippage**" (1st), "**Approximate NFCC**" (2nd), and "**Average Contract Amount**" (3rd) are the contractor traits that primarily determine the risk involved in awarding contracts to eligible contractors. These results are congruent to GPPB resolutions 05-2019 [10] and 20-2013 [11].

Table 15: Calculated Influence of Conractor Traits

Implications of Calculated Risk Indexes

Visualization of the collated data for each contractor trait investigated described the implications of "Low", "Moderate", and "High" risk contractor categories. Numerical values to quantitatively supplement these findings are further summarized in Table 16. As illustrated in Figure 76, data collected describing the traits of each contractor in terms of C1-C9 were transformed into their standardized score counterparts to better picture the implications of the calculated risk indexes. Generally, almost all of the standardized scores for all contractor traits increased as risk category was changed from "Low" to "Moderate" and "Moderate" to "High". For instance, C3 was seen to indicate a huge jump from "Low" to "Moderate" and "Moderate" to "High" risk category. This observation provided additional evidence that establishes C3 as the contractor trait that largely contributed to the risk index calculated for contractor. Instances similar to that of C3 could also be observed for majority of the contractor traits with the exception of C9. This observed decrease could indicate that contractors categorized a \Moderate" risk category could have been awarded with at most 1 construction and infrastructure tender. Collectively, with these established insights, it could be generally drawn that:

- "Low" risk contractors are those that incur very few instances of negative slippages with magnitudes less than 10%, engaged in contracts with an average approved amount of PHP23.6 million, and have an approximate NFCC of PHP27.9 million.

- "Moderate" risk contractors are those that incur approximate average negative slippages of about 24.9%, engaged in contracts with an average approved amount of PHP107.0 million, and have an approximate NFCC of PHP115.8 million.

- "High" risk contractors are those that incur approximate average negative slippages of about 36.8%, engaged in contracts with an average approved amount of PHP312.4 million, and have an approximate NFCC of PHP362.4 million.

Final Qualitative Descriptions of Calculated Risk Indexes

Risk Category	Equivalent Numerical Score	Lower Limit	Upper Limit
Low	1	0.0	59.3
Moderate	2	59.3	78.3
High	3	78.3	78.3 or greater
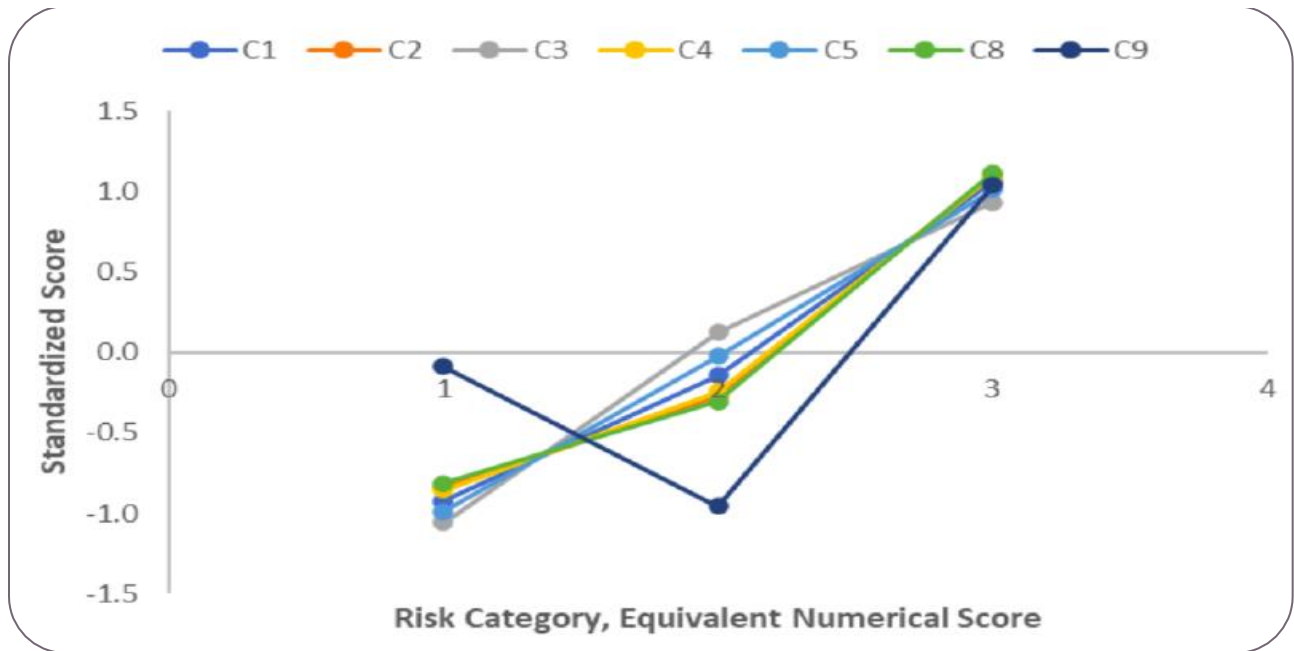
Figure 76: Standardized Scores of Contractor Traits

Contractor Trait Name	Contractor Trait Code	Average		
		Low	Moderate	High
Average Contract Duration (CD)	C1	166.0	345.1	621.6
Average Contract Amount (3rd) (million PHP)	**C2**	**23.6**	**107.0**	**312.4**
Average Negative Slippage (1st) (%)	**C3**	**7.5**	**24.9**	**36.8**
Lack in Average CPES Rating (Completed)	C4	10.9	12.1	14.6
Lack in Average CPES Rating (On-going)	C5	11.5	13.1	14.7
Approximate NFCC (2nd) (million PHP)	**C8**	**27.9**	**115.8**	**362.4**
Total Number of Projects	C9	1.9	1.3	2.8

Table 16: Average Values and Ranges of Low, Moderate, and High-risk Contractors

Classified Contractors in Region V
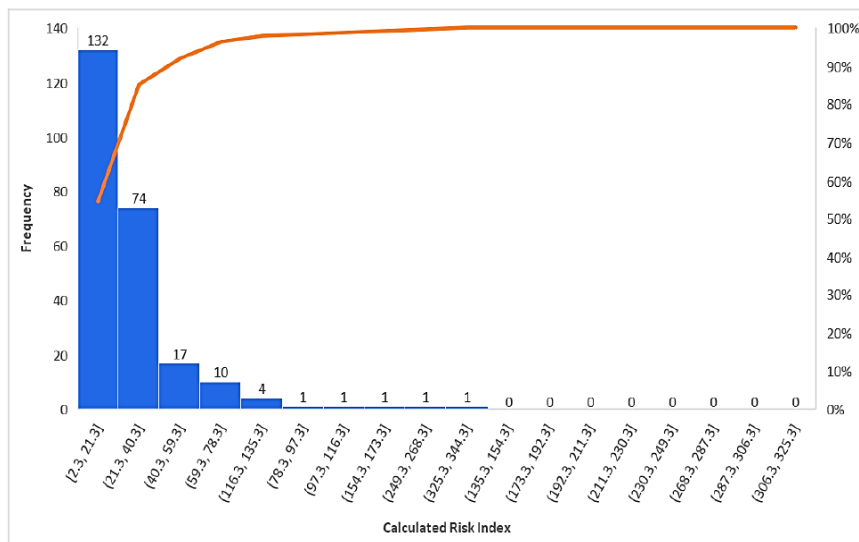
Out of 242 contractors evaluated:

Low Risk = 201 (83.06%)

Moderate Risk = 16 (10.33%)

High Risk = 16 (6.61%)

CONCLUSIONS AND RECOMMENDATIONS

It is envisioned by the researchers that the PE, HoPE, BAC, end-user unit in Region V, through the adoption of the developed REACT risk indexing system, be capacitated and empowered to rapidly assess eligibility of contractors in correspondence to the urgency while ensuring transparency and integrity of awarded government construction and infrastructure tenders necessitated by the COVID-19 situation in the country. With the established evidences as discussed in the previous sections, the following recommendations are derived:

- The PE, through the HoPE, BAC, End-user unit, or any authorized and delegated procuring unit, is suggested to adopt the REACT risk indexing system as described in this report to supplement the present system being used to assess the eligibility of a contractor in Negotiated Procurement (Emergency Cases). The REACT risk index is calculated using the equation:

Average Contract Amount (million PHP) (3rd) → X_3

Average Lack in CPES Rating (Completed) → X_4

Approximate NFCC (million PHP) (2nd) → X_6

$$RRI = 0.0375X_1 + 0.1876X_2 + 0.4430X_3 + 0.0317X_4 + 0.0312X_5 + 0.1932X_6 + 0.0758X_7$$

Average Contract Duration (Calendar Days)

Average Negative Slippage (1st)

Average Lack in CPES Rating (On-going)

Total Number of Projects
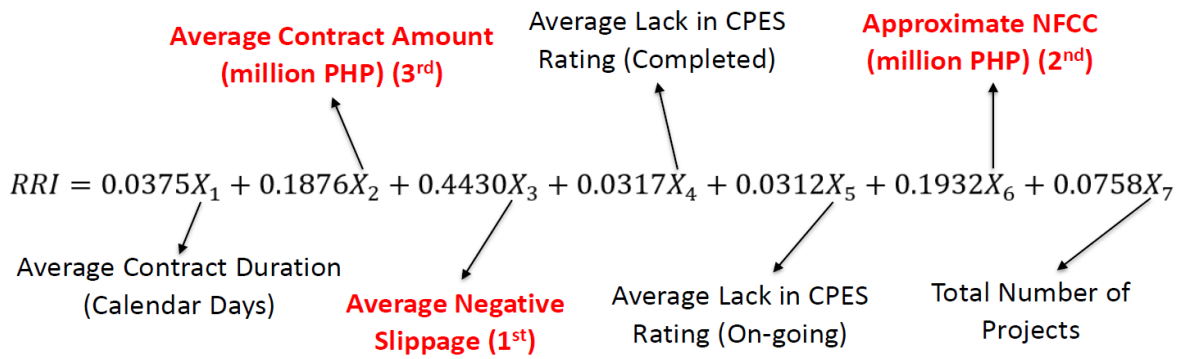
where RRI is the REACT risk index, X1 is the average contract duration in calendar days, X2 is the average contract amount, X3 is the average negative slippage, X4 is the lack in average CPES rating for completed projects, X5 is the lack in average CPES rating for on-going projects, X6 is the approximate NFCC, and X7 is the total number of projects.

- The PE, through the HoPE, BAC, End-user unit, or any authorized and delegated procuring unit, is suggested to maintain a database of contractors who were previously awarded with construction and infrastructure contracts since CPES reports published by GPPB only cover periods prior to the current fiscal year. The data frame format of the published CPES reports (Philippine Domestic Construction Board [PDCB], 2019a, 2019b) are also suggested to be adopted.

- To further fast track the processing of Negotiated Procurement (Emergency Cases) and ensure takers of such bids, it is also suggested to limit ABCs of posted construction and infrastructure tenders to PHP39 million since historical data show that majority of locally available contractors (about 170) were reported have experience in both horizontal and vertical projects equivalent to this amount.

- It is also recommended that scrutiny in accordance to GPPB guidelines be further exercised to those contractors that will be classified under "Moderate" and "High" risk categories since such contractors were historically found to incur negative slippages beyond the maximum allowable limit of 15%.

In conclusion, this project provided data-driven evidences that highlight the applicability of the developed REACT risk index system as a supplemental tool to possibly hasten awarding of contracts in times of an emergency while ensuring integrity of the public procurement process implemented to award such contracts. Through the classi_cation of eligible contractors into "Low", "Moderate", and "High" risk categories, PEs could be forewarned with the capacity of a contractor to faithfully deliver its contractual obligations.

COMMENT AND READ MORE ABOUT THIS STUDY: https://www.ocdex.tech/a-proper-reaction-in-securing-integrity-on-the-public-bidding-of-construction-and-infrastructure-tenders-amidst-the-covid-19-pandemic/

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SUC EATING PATTERNS: CRUCIAL INDICATORS FOR AN EFFECTIVE IMPLEMENTATION OF ONLINE MODES OF LEARNING

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The delivery of education was heavily impacted by the onset of the COVID-19 pandemic in the Bicol Region. To mitigate the impact of the COVID-19 crisis to the continuity of delivering quality tertiary education in the region, it was proposed that State Universities and Colleges (SUC) transition to online modes of learning to replace face-to-face and on-site interactions of faculty, administrative staff, and students. However, this proposed shift to online classes was heavily met with resistance from various stakeholders in the region and tagged as "anti-poor" due to present circumstances of the students and additional costs to be incurred upon its full implementation. To provide insightful strategies in handling the present situation, this work looked into both the capacity of students and SUCs in the region to cope with the proposed online transition. Collected survey data revealed that students primarily rely on cellular data for internet connectivity; hence, synchronous online classes could prove to be highly disadvantageous to the less privileged students. While assessed procurement data for the period January 2016 - May 2020 revealed that majority of the SUCs in the region are capable of the proposed online transition, it is worth noting that heavy investments were not made for the acquisition of learning resources vital for the conduct of online classes starting this 1st Semester Academic Year (AY) 2020 - 2021. As the findings of this work suggested, it is imperative that the deficiencies of the SUCs and stakeholders in the region be carefully considered prior to the implementation of the proposed online transition on the opening of tertiary classes this August 2020.

The Present Challenge of the Shift to Online Modes of Learning

Driven by urgency to safely continue education, it has been widely suggested that face-to-face classes be shifted to online modes of learning amidst the on-going COVID-19 crisis (Li& Lalani, 2020;Toquero, 2020). This push for virtual classes, however, has been met with resistance many students. Under the banner "#NoStudentLeftBehind", online modes of learning has been branded as "anti-poor" and "schooling solely for the privileged" (Ornedo, 2020). As data supplements this fact, only 17% of Filipino students have the capacity to connect to the internet, 3.74% of these students own a cellular phone which can access the internet. Furthermore, only 5% of these Filipino students have stable internet connections (Ornedo, 2020). Shifting to online modes of learning therefore, can be unfeasible, given the current circumstances of majority of Filipino students.

Research Objective and Questions

The objective of this work is to benchmark the procurement behavior of SUC that implemented online learning and translate this behavior into data-driven recommendations which could be adopted by SUCs in Bicol Region identified to be struggling to shift into online modes of learning amidst the COVID-19 crisis. To provide data-driven solutions to the described issue at hand, this work investigated the following research questions:

- In terms of internet connectivity, how ready are institutions and its students to shift into online modes of learning?

- What are the attributes of an educational institution that can demonstrate educational delivery resiliency amid the COVID-19 pandemic?

- What are the attributes of an educational institution that is most vulnerable to the consequences in education delivery brought by the COVID-19 pandemic?

- What is the most crucial attribute of an institution that primarily indicates resiliency (or vulnerability)to the consequences in education delivery brought by the COVID-19 pandemic?

- What procurement strategies can be derived and adopted from the institution identified to be most resilient in delivering education amid the COVID-19 pandemic?

Procurement Data Source

The most recent PhilGEPS datasets (PhilGEPS, 2020) including bid and award notices posted for Alternative Modes of Procurement from January 2016 until March 2020 were used as the primary source of procurement data on IT related tenders (e.g. subscription to online databases and internet connectivity) posted by SUCs in Bicol Region. The most recent Government Procurement Policy Board (GPPB) data on awarded contracts published on its online portal (Government Procurement Policy Board, 2020) was also considered. The GPPB data, however, was dropped since no procurement data was found for SUCs in Bicol Region. Collectively, the data was found to be more than sufficient for the applied analysis as the collated data frame consisted of about 7383 IT related tenders.

Survey Data

To correlate the feedback of students to the internet connectivity provided in their respective institutions, an online survey was sent to various students through colleagues working the nine (9) SUCs in the region. In consideration to the data collection policies stipulated in the Data Privacy Act of 2012 (Data Privacy Act, 2012), the online survey was conducted on the premise that respondents willingly and voluntarily agreed to answer the questionnaire. Upon deployment of the online questionnaire, only 266 responses were collected in correspondence to the online consent asked by the proponents of this work.

Data Preparation

The collected PhilGEPS data (PhilGEPS, 2020) was found to contain minimal trivial data; hence, this procurement data was subsequently filtered to extract IT related tenders posted by SUCs in Bicol Region upon checks for typographical errors and potential double entries. To properly merge the SUC procurement data with the collected student feedback, responses were first assessed in terms of validity and usability for analysis. Cross-examination of the questionnaire data led to the removal of 22 responses which contained invalid and inconsistent answers. Hence, only 242 responses which represented feedback on internet connectivity from _ve (5) out of nine (9) SUCs in the region were considered for analysis. Student feedback on internet connectivity provided by the remaining SUCs was then _lled through data imputation using simulated data. While potential biased was induced with this technique, this was still considered since the collated questionnaire data as a whole was able to demonstrate su_cient reliability for analysis (Xu et al.,2020).

Defining a Resilient Education System

Resilience of education systems in maintaining its capacity to deliver quality of education in times of emergencies could be derived from three (3) key recommendations as described in literature (Winthrop & Mendenhall,2006):

- Governments should perceive delivery of education in times of emergencies as an opportunity to strengthen their present education system in order actively support those affected by the crisis.

- Governments should establish exible and proactive policies so that education in times of emergencies can be delivered in the most appropriate way.

- Governments should provide and commit the necessary financial resources to educational institutions in order to guarantee delivery of quality education not only during an emergency but over a long-term in accordance to the Education For All (EFA) movement and Millennium Development Goals (MDG).

With these established definitions, it is therefore essential to consider financial investments made by an SUCs as one of the factors that would primarily determine its capacity to still deliver quality education amidst the COVID-19 situation in the region. Hence, a mathematical model defining resiliency of education systems was formulated in this context. The criterions used to collate these derived resiliency definitions are detailed as follows:

- Overall Feedback Score (O, Output): This is the arithmetic average of the ratings given by the respondents on Internet Quality, Internet Speed, and Satisfaction on the internet connectivity provided by an SUC.

- Number of IT Related Tenders (I1, Input): This is the total number of IT related tenders posted by an SUC from January 2016 - March 2020.

- Total Approved Budget Contract (I2, Input): This is the total Approved Budget Contract (ABC) for IT related tenders from January 2016 - March 2020.

- Average Contract Duration (I3, Input): This is the arithmetic average of the contract duration (in calendar days) for IT related tenders from January 2016 - March 2020.

- Number of Suppliers Tapped (I4, Input): This is the total number of suppliers tapped for the IT related tenders posted by an SUC.

The input criterions selected were used to relate the procurement activity of each SUC in acquiring IT-related tenders to the student feedback collated from the questionnaire data. In contrast, the collected feedback (defined in O) was used as the output criterion in accordance to the adopted de_nition of resilient education systems. The mathematical model built out of these input and output criterions were then used to calculate the efficiency scores for each identified SUC in Bicol Region as described in literature (Thanassoulis et al., 2017; Zavadskas et al., 2016).

Respondent Demographic Profile

160 (66.11%) out of the 242 who willingly respondents from 5 different SUCs in the Bicol Region were reported to have a monthly household income below PHP25,000.
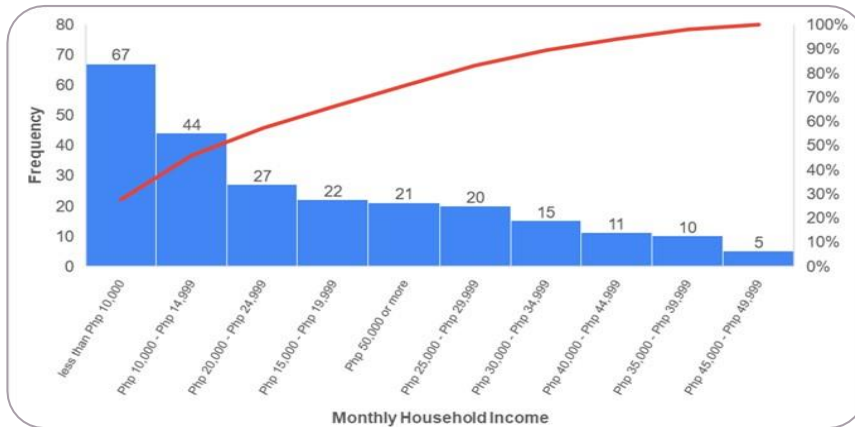
Majority (about 60%) of the students were reported to largely rely on cellular phones and cellular data to accomplish academic tasks given by their respective institutions.
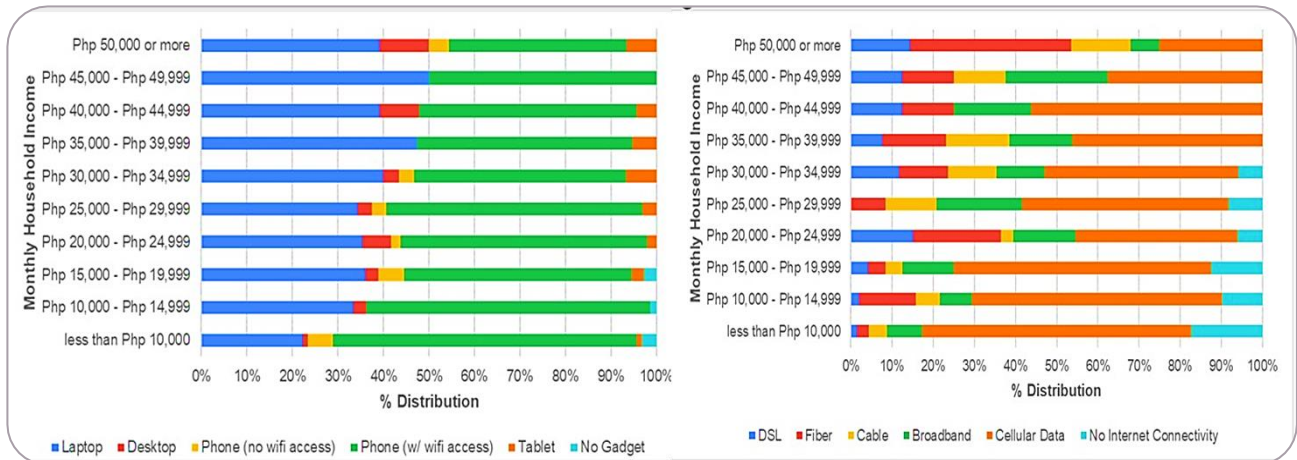
Internet Connectivity Provided by SUCs

Internet connectivity within SUC main campuses were reported to be primarily provided at the main libraries, classroom hallways, and computer laboratories. A significant number of respondents also claimed that both main and extension campuses did not generally provide internet connectivity.

Figure 77: Internet Connectivity within SUC Campuses

Average Internet Speed Provided by SUCs

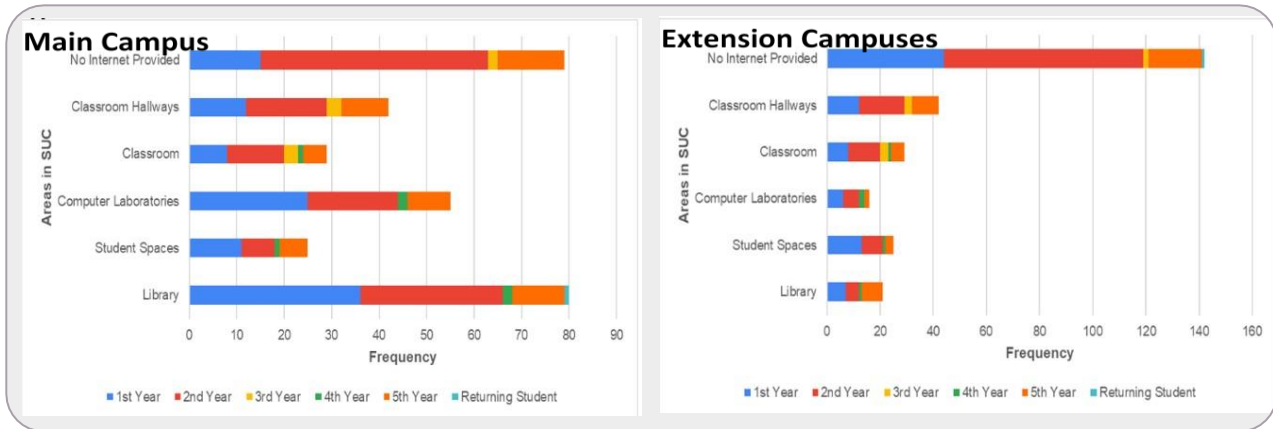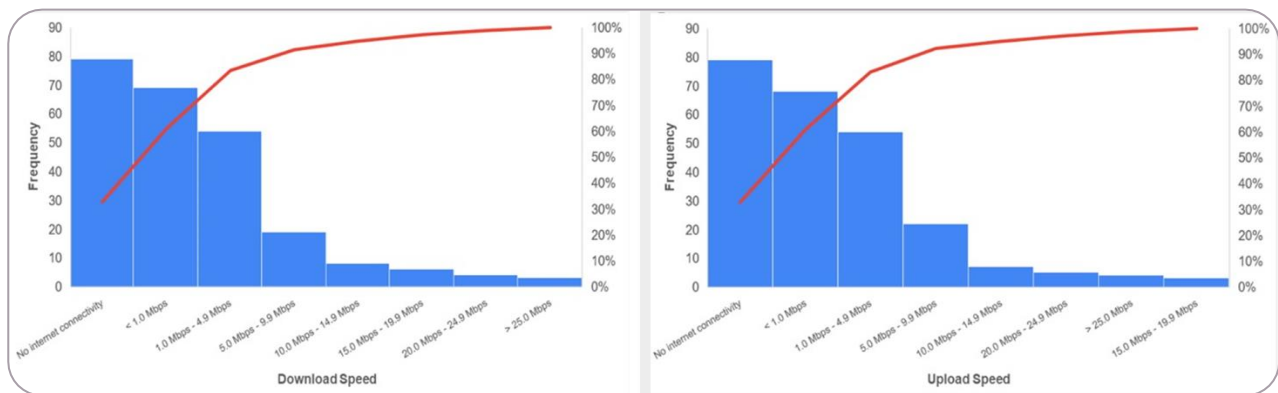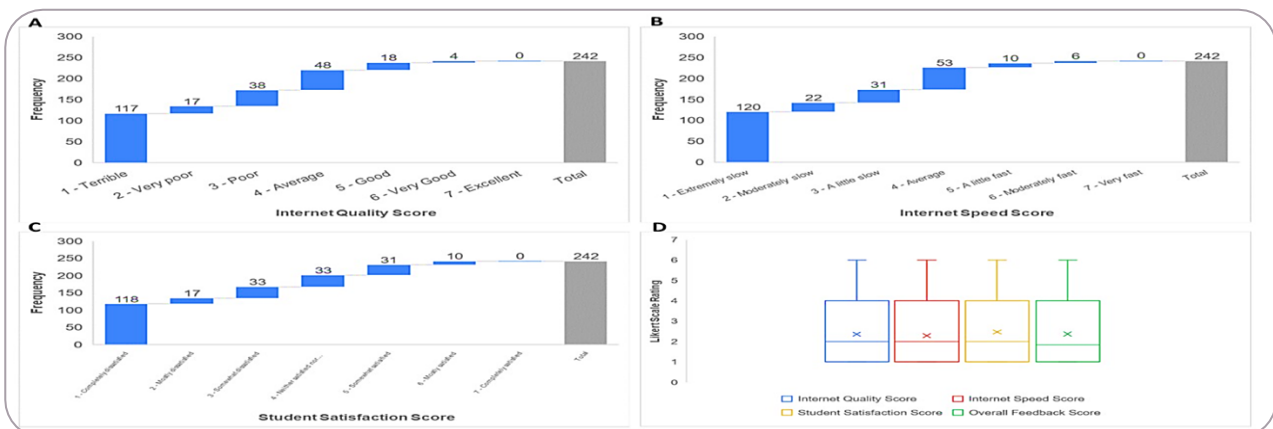Average internet download and upload speeds provided by SUCs as experienced by the respondents were reported be **below 5.0 Mbps**, with **majority of the respondents experiencing average speeds below 1.0 Mbps**.

Overall Feedback Score Given by Respondents

Likert Scale Ratings Given by Respondents on SUCs' Internet Connectivity

Crucial SUC Attributes

Criterion Name	Criterion Code	Type	Weight (Overall)	Rank (Overall)	Weight (Input)	Rank (Input)
Overall Feedback Score	O	Output	0.1834	5th	-	-
Number of It Related Tenders	I1	Input	0.2116	2nd	0.2592	2nd
Total Approved Budget Contract	I2	Input	0.2156	1st	0.2640	1st
Average Contract Duration	I3	Input	0.1888	4th	0.2313	4th
Number of Suppliers Tapped	I4	Input	0.2005	3rd	0.2456	3rd

Table 17: Ranking of SUC Attributes

It was found that the "**Total Approved Budget Contract**" and "**Number of IT Related Tenders**" SUC attributes were crucial in determining the capacity of the SUC to effectively transition into online modes of learning.

Assessment of SUC EATing patterns – The Case of Bicol Region

Enabling college students to undertake the proposed online transition would then largely rely on the capacity of SUCs to deliver quality education through the said modes of learning this August 2020.

With the goal of assessing the nine (9) SUCs in the Bicol Region within the context of Education Access in Tenders (EAT), the same group of researchers from BUCENG looked closely into the information technology (IT) related procurement activities of such SUCs from the period 2016-2020. Upon a comprehensive evaluation of the collected contracts, these researchers reported two categories classifying the capacity of SUCs in Bicol Region to successfully implement the proposed online transition, namely "fully capable" and "partially capable". "Fully capable" SUCs were reported to have largely invested on computer servers, internet coverage and bandwidth, library and learning managements systems, subscription to online databases, and acquisition of software for research and instructional use. These capabilities, as reported by these researchers, corresponded to an equivalent investment amounting to PHP241.19 million.
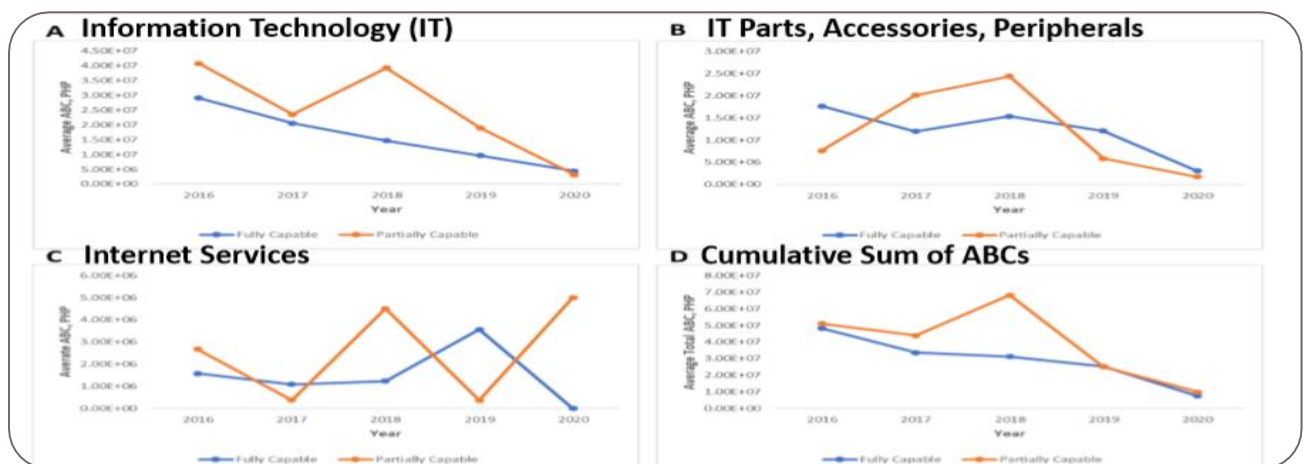

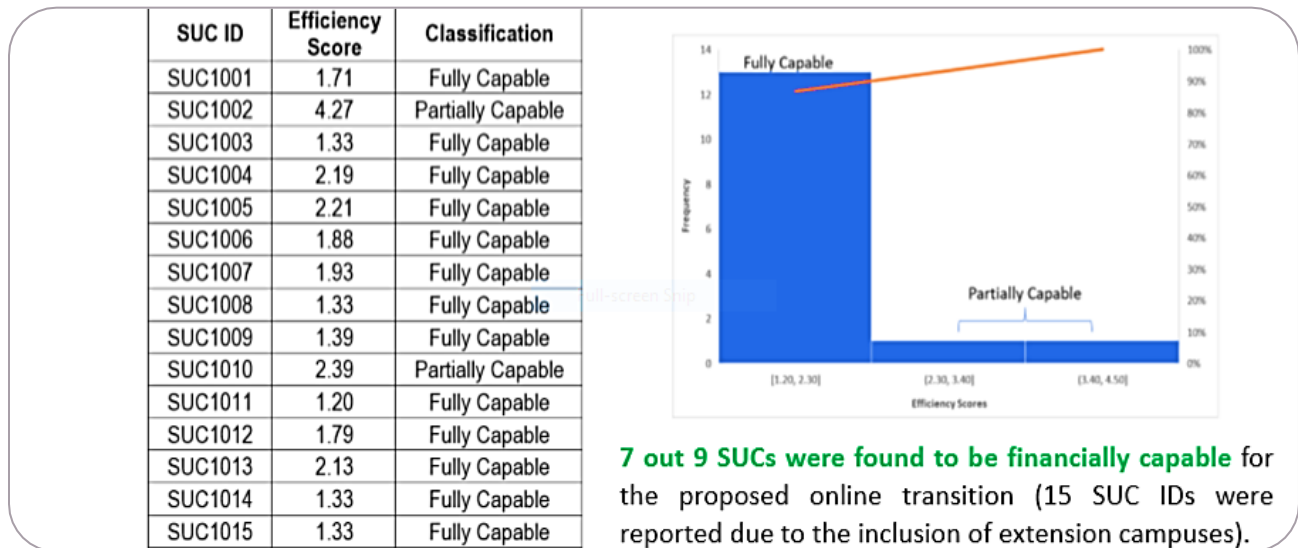Figure 78: Total Approved Budget Contract for Year 2016-2020

SUC ID	Efficiency Score	Classification
SUC1001	1.71	Fully Capable
SUC1002	4.27	Partially Capable
SUC1003	1.33	Fully Capable
SUC1004	2.19	Fully Capable
SUC1005	2.21	Fully Capable
SUC1006	1.88	Fully Capable
SUC1007	1.93	Fully Capable
SUC1008	1.33	Fully Capable
SUC1009	1.39	Fully Capable
SUC1010	2.39	Partially Capable
SUC1011	1.20	Fully Capable
SUC1012	1.79	Fully Capable
SUC1013	2.13	Fully Capable
SUC1014	1.33	Fully Capable
SUC1015	1.33	Fully Capable

7 out 9 SUCs were found to be financially capable for the proposed online transition (15 SUC IDs were reported due to the inclusion of extension campuses).

Table 18: Efficiency Scores Calculated for Identified SUCs in Bicol Region

In contrast, while "partially capable" SUCs were reported to be to financially secure such investments, no relevant awarded IT tenders from 2016-2020 necessary to ensure effective implementation of the proposed online transition were found for such SUCs.

Collectively, seven (7) of the nine (9) SUCs in Bicol Region were seen to be "fully capable" of implementing online classes this August 2020. Though these reported findings implied that the Bicol Region as a whole is seen to effectively implement the proposed online transition, the EATing patterns of the remaining two (2) SUCs which cater to the majority of at least 3000 enrolled college students in the region indicated that much still needs to be done to ensure all college students, regardless of privilege, be given a fair and equal access to quality tertiary education. The researchers then strongly recommended that SUCs classified as "partially capable" benchmark on the IT related procurement strategies that of "fully capable" SUCs.

Possible Reasons for Low Likert Scale Ratings

- Only four (4) contracts amounting to **PHP1.49 million** for procuring computer servers from January 2016 – May 2020 were reported.

- No procurement activity specifically designated for expanding the capacity of their present servers in anticipation of the increased network traffic for online classes was observed for the 1st quarter of the fiscal year 2020.

- Only four (4) contracts amounting to **PHP11.52 million** for securing internet connectivity within SUC campuses were found for the period January 2016 – December 2019. No contract in the 1st quarter of the fiscal year 2020 was found for internet bandwidth expansion in anticipation of the heavy traffic to be induced by online classes.

- Only three (3) contracts amounting to **PHP2.58 million** for improving library capacity were found for the period January 2016 – May 2020. No awarded contracts were found for acquiring learning management and library management systems, and subscription to online databases.

- No contracts for purchase of software for research and instructional purposes were found.

- Majority of the contracts found were designated for procuring "Information Technology Parts and Accessories and Peripherals". Procurement of USBs, hard drives, and printers were amongst the most commonly awarded contracts.

Adopting Best Procurement Practices for IT

- Allocate at least **PHP7.56 million** for procuring computer servers to accommodate network traffic in the system.

- Allocate at least PHP3.0 million in the 2nd quarter of the fiscal year 2020 for procuring additional computer servers in anticipation of the increased network traffic induced by online classes.

- Allocate at least PHP41.0 million to increase internet bandwidth and coverage within SUC campuses (including extension campuses).

- Allocate at least PHP14.0 million for securing a reliable backup internet connectivity in times of emergencies or disasters.

Adopting Best Procurement Practices for IT

- Allocate at least **PHP120.91 million** for acquiring learning management systems, e-library, library management systems, and online subscriptions to electronic databases (e.g. Elsevier) which allowed full access to the most recent e-books and journal articles.

- Allocate at least **PHP54.72 million** to specifically procure various licensed software (e.g.

- MATLAB) for research and instructional use either on-site or online.

✓ Students were generally reported to rely on cellular phones and cellular data for accomplishing their respective academic tasks. Hence, it is strongly recommended that synchronous and asynchronous learning activities with low data consumption be implemented.

✓ A budget allocation of at least PHP241.19 million was observed to establish a robust IT infrastructure fully capable of implementing online modes of learning (i.e. online learning made available by University of the Philippines).

✓ Since no significant investments necessary for the conduct of online modes of learning were observed, it is strongly recommended that SUCs in the region include in their Annual Procurement Plan (APP) acquisition of online learning management and library management systems, and subscription to online databases.

✓ Parallel to what has been observed for the procurement of learning and library management systems and subscription to online electronic databases, it is also strongly recommended that SUCs in the Bicol Region prioritize procurement of software for research and instructional use.

✓ SUCs in the region are financially capable of the proposed online transition; however, realignment of their appropriations specifically for improving their present IT infrastructure is strongly recommended.

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CAN THE LGUS RESPOND TO LSIs?
A CLASSIFICATION SYSTEM TO QUALIFY CAPACITY OF LOCAL GOVERNMENT UNITS (LGU) TO ACT ON ARRIVING COVID-19 POSITIVE LOCALLY STRANDED INDIVIDUALS (LSI)

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In response to the recent observed surge in confirmed COVID-19 cases, a resiliency rating system was developed for local government units (LGU) reported to have been widely affected by the arrival of asymptomatic COVID-19 positive locally stranded individuals (LSI). The developed resiliency system classified LGUs in these regions as "Low", "Moderate", and "High". LGUs categorized in the "Low" group were observed to be least capable of absorbing the influx of suspected COVID-19 positive LSIs into their presently struggling healthcare systems while "Moderate" and "High" LGU groups were found capable of accommodating the influx of said individuals. Analysis of the data showed that the capacity of an LGU to properly manage the arrival of such individuals are largely dependent on the number of hospitals situated within the boundaries of an LGU. As the findings of this work suggested, LGUs with the least number of COVID-19 dedicated hospitals are most vulnerable to health system shocks and paralysis.

Testing of Locally Stranded Individuals

Due to the public outcry on the reported deaths of LSIs who were not able to return to their hometowns (Tan, 2020; Petinglay, 2020), the urgency promulgated by the sensualization of these accounts could have resulted to the omission of negative COVID-19 test results as one of the primary criteria for allowing LSIs to travel to their home provinces. As detailed in the National Task Force (NTF) Against COVID-19 Order Number 2020-02 (NTF, 2020), COVID-19 tests prior to travel of LSIs are not mandatory. Parallel to what WHO has recently observed (WHO, 2020b), this relaxed requirement could also be one of the significant factors that possibly induced the recent surge in COVID-19 cases in the country.

The Challenge of Accommodating Locally Stranded Individuals

Handling the arrivals of such individuals who are suspected to be COVID-19 positive would certainly be very challenging. There have already been instances where local government units (LGU) have already been reported to be "panicking" due to the necessary testing, isolation, and proper management of arriving LSIs while under the dilemma of ensuring non-discrimination of these individuals upon entry to their home provinces (CNN Philippines Staff, 2020). This has been specifically observed to those LGUs who were reported to be "COVID-free" prior to the implementation of the "Hatid Probinsya" initiative (CNN Philippines Staff, 2020). With these presented arguments, it is therefore necessary to consider the capacity of an LGU to successfully manage arrivals of these LSIs parallel to the on-going review of the said program(Desacada, 2020).

Proposed Measure

In order to propose data-driven recommendations for the described issue, this analyzed "resiliency" of LGUs in Region V and Region VII – regions where most LSIs have been reported to be COVID-19 positive – in the context of historical government procurement data merged with recently published COVID-19 data. Through the use of a multi-criterion objective approach, a total of 25 LGUs were identified to capably absorb the influx of LSIs who would turn out to be COVID-19 positive while a total of 7 LGUs were perceived to struggle in effectively managing such LSIs due to the very high numbers of active COVID-19 cases in their respective areas.

Research Objective and Questions

The objective of this proposal is to collate and analyze information on COVID-19 related procurement activities and data of LGUs from Region V and Region VII and subsequently use this information to categorize these areas in accordance to their observed "resiliency" to the inux of possible COVID-19 positive LSIs. In this premise, recommendations could be drawn out from the implemented analysis.

The research questions are as follows:

- In terms of the targeted resiliency attributes, what are the characteristics of an LGU that has been found to demonstrate low resiliency especially to the inux of COVID-19 positive LSIs?

- In terms of the targeted resiliency attributes, what are the characteristics of an LGU that has been found to demonstrate high resiliency especially to the inux of COVID-19 positive LSIs?

- What is the most crucial resiliency attribute of an LGU that defines its capacity to be resilient especially to the inux of COVID-19 positive LSIs?

- What insights can be drawn from the developed resiliency classification to help in recommending a decision to whether accommodate arriving LSIs?

METHODOLOGY

Procurement Data Source

The most recent standard and open Philippine Government Electronic Procurement System (PhilGEPS) dataset (PhilGEPS, 2020) which contained the details on bid award notices (including bid details on Alternative Modes of Procurement) for the period January-March 2020 was used as one of the primary sources procurement data for the identi_ed LGUs of Region V and Region VII with high cases of COVID-19 positive LSIs. This collected data was further supplemented with COVID-19 awarded contracts (accessed on June 25, 2020) recently published by the Government Procurement Policy Board [GPPB] (2020). In its totality, the collected data represented procurement activities of the identified LGUs from January-May 2020.

COVID-19 Data Source

The Philippine COVID-19 data, officially published through the DOH COVID-19 tracker (DOH, 2020), was used to identify the number of confirmed COVID-19 cases, recoveries, and COVID-19 related deaths. With the purpose of maintaining consistency in building the data frame merging the collected procurement data, analysis was purposely limited to the COVID-19 data published as of June 14, 2020. Though this data did not include the most recent reported COVID-19 sources, initial screening of the data as required by the implemented multi-criterion objective approach revealed that the volume of the collected data is already sufficient for data processing and analysis.

Data Preparation and Transformation

While the PhilGEPS January-March 2020 data (PhilGEPS, 2020) were found to contain minimal trivial entries, the GPPB data (GPPB, 2020) was restructured due to the inconsistencies of this data frame. As no consistent pattern in errors was found, assessment of the suitability of each entry in the GPPB data for analysis was manually assessed row wise. After rebuilding the GPPB data (GPPB, 2020) into a format similar to that of the collected PhilGEPS data (PhilGEPS, 2020), both of these datasets were merged into a single data frame for further analysis.

The published COVID-19 data (DOH, 2020) was generally found to have missing entries. As of June 14, 2020, about 7909 entries were found not to be useful due to the lack in critical information such as the patient residence, case classification, and date tested. To ensure robustness of the applied analysis, such entries were omitted from the cleaned COVID-19 data frame. This cleaned data frame containing about 18021 COVID-19 case information was fitered represented 3507 confirmed cases for a variety of LGUs in Region V and Region VII. Similar data preparations were done to align the structure and format of the Region V and Region VII filtered COVID-19 data to the cleaned procurement data.

Assumption of LSI Data

Due to the inavailability of LSI data, an assumption was made to include this as one parameter for analysis. As consistently cited by several reports (Guadalquiver, 2020; Estabillo, 2020; Ostria, 2020; Barcia, 2020), COVID-19 cases confirmed for the month of June 2020 and 1st week of July 2020 could mostly be attributed to returning LSIs in these regions. this data was then assumed to be equal to the number of active cases reported by Region V and Region VII for the entire month of June 2020 and 1st week of July 2020. This assumed data consisted of about 5185 confirmed cases. Cross-validation through random sampling for a number of this assumed data from press releases made by Department of Health Center for Health Development (DOH-CHD) Region V through its official Facebook page (DOH-CHD, 2020) further supported this assumption.

Cross-validation for assumed LSI data for Region VII could not be made, however, no LSI related data could be extracted from its official press releases. While statistical power is lost due to possible introduction of unwarranted biases with this data imputation applied, this was still considered since this was still seen to demonstrate suficient reliability for analysis (Xu et al., 2020).

Contextualizing LGU Resiliency in Terms of Properly Managing Positive COVID-19 Cases Taking into consideration definitions of COVID-19 resilient systems made by Legido-Quigley et al. (2020), the LGU resiliency being contextualized in this study can be described by the following key points:

- Immediate proactive actions were made through the readjustment of surveillance systems for contact tracing.

- All concerned areas adapted financial measures to allow government agencies to shoulder costs for treating patients.

- Concrete plans were made to sustain routine health-care services.

- Critical care treatment and drugs were made available for patients diagnosed with COVID-19.

- Personal protective equipment (PPE) in hospitals and other related facilities were readily available.

- Capacitating health personnel through trainings and adherence to infection prevention and control measures in hospitals was done.

- Information systems were available, appropriately managed, and used daily for meetings between health managers and key government officials.

Collectively analyzing these statements point towards the financial capacity of an LGU to faithfully perform such tasks which would enable it to proactively mitigate the impacts of COVID-19 to its people. With this established definition, a multi-criterion objective approach was implemented as described in literature (Thanassoulis et al., 2017; Zavadskas & Podvezko, 2016). The following criterions was used to build the model in accordance to the derived definition of LGU resiliency:

- Internal Revenue Allotment (IRA) (I1, Input): This criterion pertains to the share of revenues an LGU will receive from the Philippine National Government.

- Total Approved Budget Contract (ABC) (I2, Input): This criterion pertains to the sum of ABCs of all COVID-19 related tenders made by an LGU.

- Total Number of Contracts (I3, Input): This criterion corresponds to the total number of COVID-19 related tenders made by an LGU.

- Number of Active Cases (I4, Input): This criterion corresponds to the total number of active COVID-19 cases reported per LGU as of June 14, 2020.

- Approximate Number of COVID-19 Positive LSI (I5, Input): This criterion corresponds to the estimated number of LSIs that are con_rmed to be COVID-19 positive in each LGU.

- Recovered (O1, Output): This criterion corresponds to the total number of recovered COVID-19 patients for each LGU.

- Total PPE (O2, Output): This criterion corresponds to the sum of all head, hand, shoe, and body PPE made available in hospitals for each LGU.

- Total Bed (O3, Output): This criterion corresponds to the sum of ICU units, isolation beds, bed wards, and mechanical vents dedicated for COVID-19 positive patients for each LGU.

- Number of Hospital (O4, Output): This criterion pertains to the total number of hospitals within the area of scope of each LGU.

Focus for input criterions was given to the financial capacity of an LGU and the number of LSIs that are estimated to be COVID-19 positive. In contrast, output criterions were assigned to the number of COVID-19 recovered patients, PPEs, and hospital capacity as derived from the resiliency de_nition of Legido-Quigley et al. (2020). Finally, the model built out of these identi_ed input and output criterions were used to determine the resiliency scores for each identified Region V and Region VII LGUs.
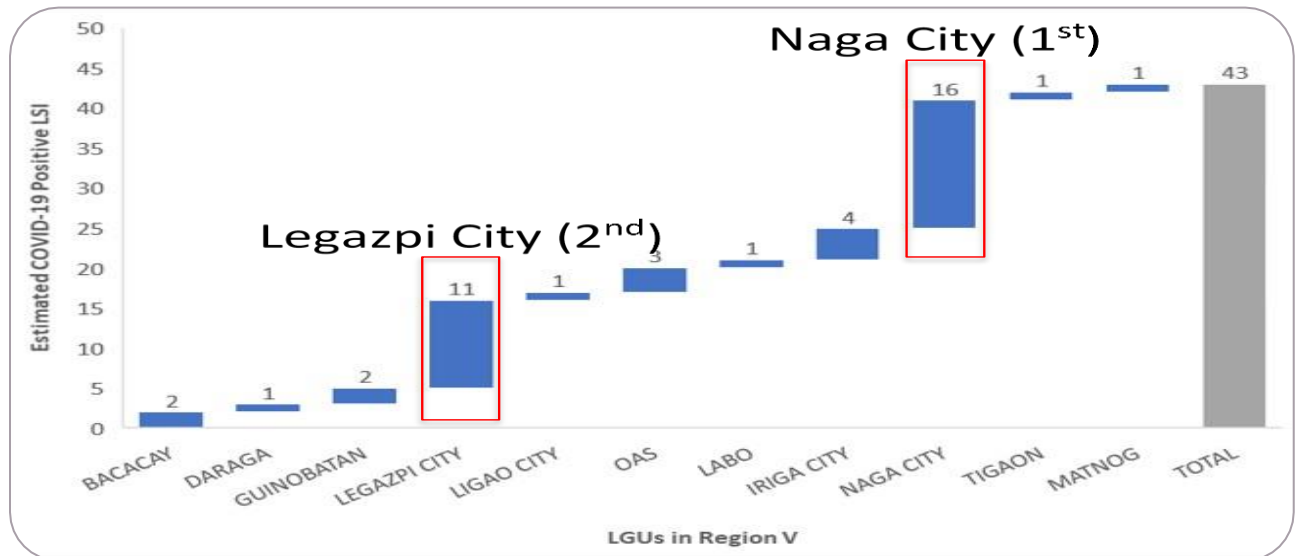
Classification of COVID-19 Cases in Region V
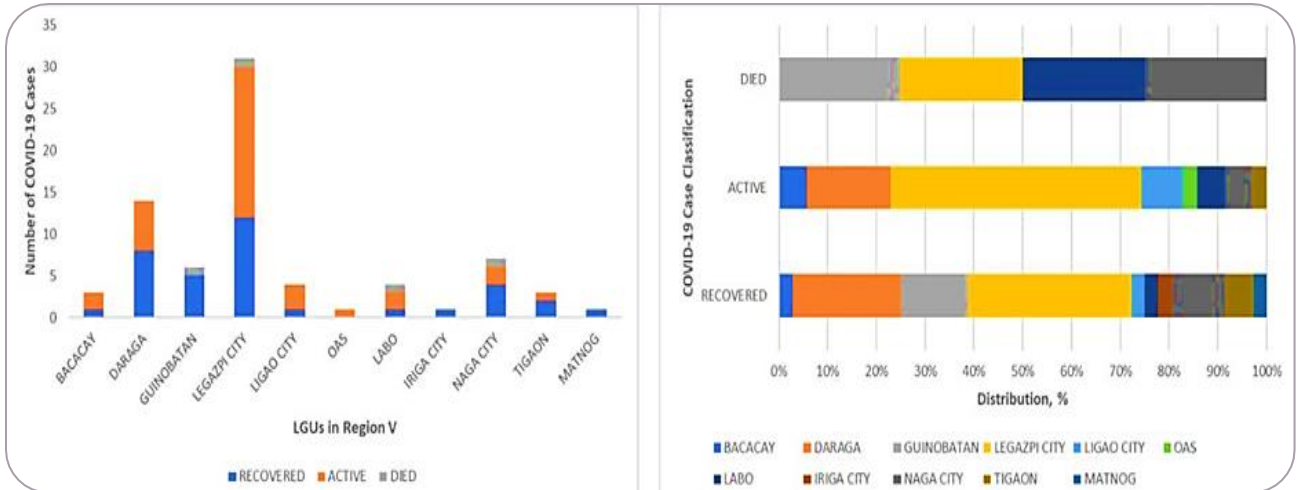
Note: This visualization represents COVID-19 data as of June 14, 2020. This was purposely done to maintain consistency with the collected procurement data.

Estimated LSI Data for Region V

Note: This visualization represents extracted LSI data as of July 8, 2020.

Classification of LGUs in Accordance to Calculated Resiliency Scores

As described in literature (Thanassoulis et al., 2017; Zavadskas & Podvezko, 2016), an LGU with a resiliency score closest to unity (i.e. 1.0) is considered to be most resilient. Hence. based on the capacity of an LGU to finance (i.e. I1, I2, and I3) their fight against the on-set of the COVID-19 pandemic, the resiliency classification for each LGU could be grouped into three (3) general categories, namely "High", "Moderate", and "Low". The ranges for the classification are further shown in Figure 79.
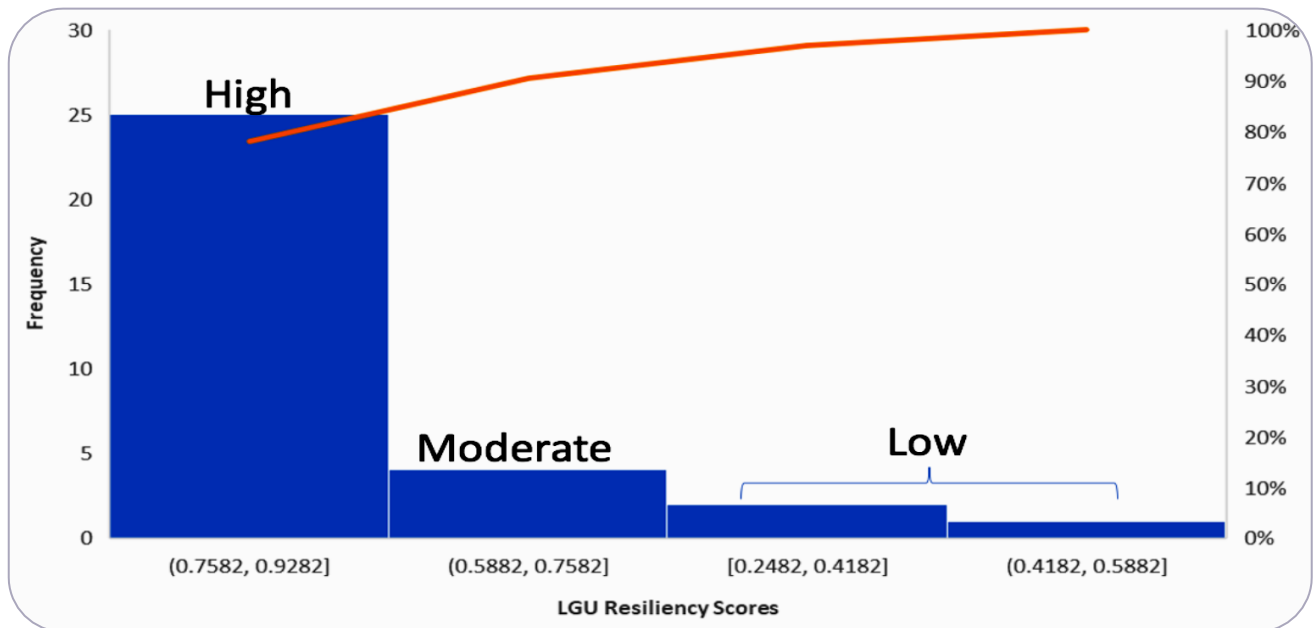
Figure 79: Ranges for the Classification of LGUs

Crucial LGU Attributes

Criterion Name	Criterion Code	Weight (Overall)	Overall Rank	Weight (Output)	Output Criterion Rank	Weight (Input)	Input Criterion Rank
Recovered	O1	0.1405	2nd	0.3159	1st	-	-
Total PPE	O2	0.1151	4th	0.2587	2nd	-	-
Total Bed	O3	0.1090	5th	0.2451	3rd	-	-
Number of Hospital	O4	0.0802	8th	0.1803	4th	-	-
Internal Revenue Allotment	I1	0.0765	9th	-	-	0.1377	5th
Total Approved Budget Contract	I2	0.0947	6th	-	-	0.1706	3rd
Total Number of Contracts	I3	0.0938	7th	-	-	0.1689	4th
Number of Active Cases	I4	0.1549	1st	-	-	0.2790	1st
Approximate Number of COVID-19 Positive LSIs	I5	0.1353	3rd	-	-	0.2438	2nd

Table 19: Ranking of LGU Attributes

Area	Province	Region	Resiliency Score	Resiliency Classification
Bacacay	Albay	Region V	0.8417	High
Daraga (Locsin)	Albay	Region V	0.8422	High
Guinobatan	Albay	Region V	0.8384	High
Legazpi City	Albay	Region V	0.8376	High
Ligao City	Albay	Region V	0.8453	High
Oas	Albay	Region V	0.5956	Moderate
Labo	Camarines Norte	Region V	0.8373	High
Iriga City	Camarines Sur	Region V	0.8377	High
Naga City (Camarines Sur)	Camarines Sur	Region V	0.8368	High
Tigaon	Camarines Sur	Region V	0.8421	High
Matnog	Sorsogon	Region V	0.8374	High

Capacity of LGUs in Region V to ACT on LSIs

High
High recovery rate
>3 hospitals in vicinity
Mod-High no. of LSIs
Mod-High no. active COVID-19 cases

Moderate
Low recovery rate
1-2 hospitals in vicinity
Low no. of LSIs
Low no. active COVID-19 cases

Low
Low recovery rate
Mod-High no. of LSIs
1-2 hospitals in vicinity
Mod-High no. active COVID-19 cases

Table 20: List of LGUs and their Resiliency Scores

The resilience classification suggested in this work can be summarized as follows:

- LGUs categorized with "Low" resiliency was generally reported to have a significant number of active COVID-19 cases and approximate COVID-19 positive LSI cases. The limited number of hospitals situated in these LGU suggested that additional inux of arriving COVID-19 positive LSIs would likely cause a paralysis in their health system (Legido-Quigley et al., 2020; Hanefeld et al., 2018).

- LGUs categorized with "Moderate" resiliency was generally reported to have a relatively low number of active COVID-19 cases and approximate COVID-19 positive LSI cases. While these LGUs could still accommodate arriving COVID-19 positive LSIs, the maximum capacity and limited number of hospitals situated in these LGUs should be taken into consideration to prevent health system shocks (Legido-Quigley et al., 2020; Hanefeld et al., 2018).

- LGUs categorized with "High" resiliency was generally reported to have a relatively low number of active COVID-19 cases and approximate COVID-19 positive LSI cases. There is a signi_cant number of hospitals situated within these LGUs and this strongly suggested that arriving LSIs could be accommodated by their current health system. However, strategic planning and adherence to stringent health protocols are still necessary to prevent instances of health system shocks (Legido-Quigley et al., 2020; Hanefeld et al., 2018).

CONCLUSIONS AND RECOMMENDATIONS

✓ It is suggested that LGUs who would fall under the classification of **"Low"** to limit the entry of LSIs into their area if the LGU do not have the capacity to immediately conduct COVID-19 tests on-site to these arriving individuals.

✓ It is also suggested that LGUs with resilience categorized as **"Low"** to include in their budgets, measures for resiliency in the next procurement cycle. review the implementation of their Annual Procurement Plan (APP). The greatest number of COVID19 related tenders with ABCs observed to be significantly larger than that of **"Moderate"** and **"High"** groups were observed in these LGUs.

✓ To prevent further spread of COVID-19, LGUs classified as **"Moderate"** and **"High"** are strongly suggested to implement stringent health protocols while ensuring that arriving LSIs are not discriminated.

✓ As a long-term solution to sustain resiliency of the health system of an LGU, it is further suggested that those LGUs grouped as **"Moderate"** and **"Low"** invest heavily in their present health system to **increase the number of hospitals located within their boundaries to at least three (3)**.

COMMENT AND READ MORE ABOUT THIS STUDY: https://www.ocdex.tech/suc-eating-patterns-crucial-indicators-for-an-effective-implementation-of-online-modes-of-learning/

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