LAYER _TECH

PROCUREMENT BUSINESS INTELLIGENCE: IDENTIFYING TIME COMPLIANCE, BOTTLENECKS, IN PHILIPPINE PROCUREMENT STAGES

A COMPARATIVE ASSESSMENT: NUMBER OF DAYS FOR EVERY PROCUREMENT STAGE AS RECOMMENDED BY GPRA - IRR vs ACTUAL PROCURING ENTITY DATA, USING STATE UNIVERSITY PROCUREMENT DATA

OCDex

This report is made in support to the international open data movement, and to generate insights from open procurement data to help procuring entities identify bottlenecks and inefficiencies in procurement stages, to make their procurement process faster, compliant to the procurement laws, and more efficient.

Please note that **Layertech is not giving any conclusive statements about the agencies and organizations mentioned in this report. Layertech will NOT be accountable for any action taken by an individual, or organization, using this report.** We highly encourage that additional research and validation be conducted when using the information stated in this report.

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Kindly take time to read the notes, recommendations and delimitations mentioned in this report.

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RECOMMENDED TIMELINE

Republic Act 9184, also known as the Government Procurement Reform Act (GPRA) of 2002 provides for the 'modernization, standardization, and regulation of the procurement activities' of the Philippine Government, from National Government Agencies, to Local Government Units, and State Universities (GPPB, 2019). The 2016 Implementing Rules and Regulations (IRR) of the GPRA law sets minimum, maximum, and recommended days for every procurement stage, depending on procurement classification (GPPB, 2019).

Procurement line items are generally classified into either Infrastructure, Goods and Services, and Consulting Services.

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 the recommended timelines for Infrastructure/Civil Works, Goods and Services, and Consulting Services, as stated in the Annexes of the GPRA-IRR 2016:

FOR THE PROCUREMENT of GOODS and SERVICES

Min CD Recommended: 1 CD
Max CD Allowed: 7 CD

Issuance of Notice to Proceed

Min CD Recommended: 1 CD
Max CD Allowed: 30 CD

Approval of Contract by Higher Authority

Min CD Recommended: 1 CD
Max CD Allowed: 10 CD

Contract Preparation and Signing

Min CD Recommended: 1 CD
Max CD Allowed: 15 CD

Approval of Resolution/ Issuance of Notice of Award

Min CD Recommended: 2 CD
Max CD Allowed: 45 CD

Post-Qualification

Min CD Recommended: 1 CD
Max CD Allowed: 7 CD

Bid Evaluation

Min CD Recommended: 1 CD
Max CD Allowed: 45 CD

Deadline for Submission and Receipt of Bids / Bid Opening

Min CD Recommended: 1 CD
Max CD Allowed: Whenever Necessary

Pre-Bid Conference (Optional for ABC <1M)

Min CD Recommended: 7 CD
Max CD Allowed: 7 CD

Posting of Invitation to Bid

Min CD Recommended: 1 CD
Max CD Allowed: Whenever Necessary

Pre-Procurement Conference (Optional for ABCs < 2M)

FOR PROCUREMENT OF INFRASTRUCTURE PROJECTS

Min CD Recommended: 1 CD
Max CD Allowed: 7 CD

Issuance of Notice to Proceed

Min CD Recommended: 1 CD
Max CD Allowed: 30 CD

Approval of Contract by Higher Authority

Min CD Recommended: 1 CD
Max CD Allowed: 10 CD

Contract Preparation and Signing

Min CD Recommended: 1 CD
Max CD Allowed: 15 CD

Approval of Resolution/ Issuance of Notice of Award

Min CD Recommended: 2 CD
Max CD Allowed: 45 CD

Post-Qualification

Min CD Recommended: 1 CD
Max CD Allowed: 7 CD

Bid Evaluation

Min CD Recommended: 1 CD
Max CD Allowed: 50CD/65 CD

Deadline for Submission and Receipt of Bids

Min CD Recommended: 1 CD
Max CD Allowed: Whenever Necessary

Pre-Bid Conference (Optional for ABC <1M)

Min CD Recommended: 7 CD
Max CD Allowed: 7 CD

Posting of Invitation to Bid

Min CD Recommended: 1 CD
Max CD Allowed: Whenever Necessary

Pre-Procurement Conference (Optional for ABCs < 2M)

Min CD Recommended: 1 CD
Max CD Allowed: 7 CD

Issuance of Notice to Proceed

Min CD Recommended: 1 CD
Max CD Allowed: 30 CD

Approval of Contract by Higher Authority

Min CD Recommended: 1 CD
Max CD Allowed: 10 CD

Contract Preparation and Signing

Min CD Recommended: 1 CD
Max CD Allowed: 15 CD

Approval of Resolution/ Issuance of Notice of Award

Min CD Recommended: 2 CD
Max CD Allowed: 30 CD

Post-Qualification

Min CD Recommended: 1 CD
Max CD Allowed: 10 CD

Negotiation

Min CD Recommended: 1 CD   Min CD Recommended: 1 CD
Max CD Allowed: 2 CD   Max CD Allowed: 3 CD

Approval of Ranking by the HoPE / Notification for Negotiation

Min CD Recommended: 1 CD
Max CD Allowed: 21 CD

Bid Evaluation

Min CD Recommended: 1 CD
Max CD Allowed: 75 CD

Deadline for Submission and Receipt of Bids

Min CD Recommended: 1 CD
Max CD Allowed: Whenever Necessary

Pre-Bid Conference (Optional for ABC <1M)

Min CD Recommended: 1 CD
Max CD Allowed: 20 CD

Eligibility Check and Shortlisting

Min CD Recommended: 7 CD
Max CD Allowed: 7 CD

Posting of Request for Expression of Interest

Min CD Recommended: 1 CD
Max CD Allowed: Whenever Necessary

Pre-Procurement Conference (Optional for ABCs < 2M)

FOR THE PROCUREMENT OF CONSULTING SERVICES

Internal Compliance Monitoring System

Having an internal process monitoring system is helpful for procuring entities both in the government and private sector. It is critical for any business process to have a means of knowing which specific stages need improvement, analogous to how doctors use tools to immediately diagnose which specific parts of the client's body is causing the discomfort.

With an automated procurement compliance monitoring system, procuring entities can immediately inspect their compliance with the procurement law (or with company procurement policies, for the private sector), flag potential bottlenecks and immediately address them, preventing potentially adverse effects to the process and the process output (e.g. minimize cost of delay).

Process bottlenecks can be challenging to detect as the cause of these bottlenecks can vary over time, and over several factors. However, with Business Intelligence and Analytics, flagging of potential bottlenecks may be easier, faster, and more precise.

The Philippine Government E-Procurement System (PhilGEPS) publishes official government procurement data of all procuring entities in the Philippines, on a quarterly basis, in excel format[1]. In this paper, official PhilGEPS data is used to extract information of Bicol University's procurement activities from 2016-2018, and compared the actual process timeline to the timeline prescribed in the Government Procurement Reform Act's Implementing Rules and Regulations of 2016. **This paper explores how Philippine procurement open data can be used to monitor procurement timeline, identify process bottlenecks, and provide another layer of decision support to procuring entities, to optimize their procurement process.**

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[1] Philippine Government E-Procurement System - https://www.philgeps.gov.ph/

Case Introduction: Bicol University

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.

BU 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.

Bicol University 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.[2]

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

Data Source and Processing Methodology

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 E-Procurement 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.
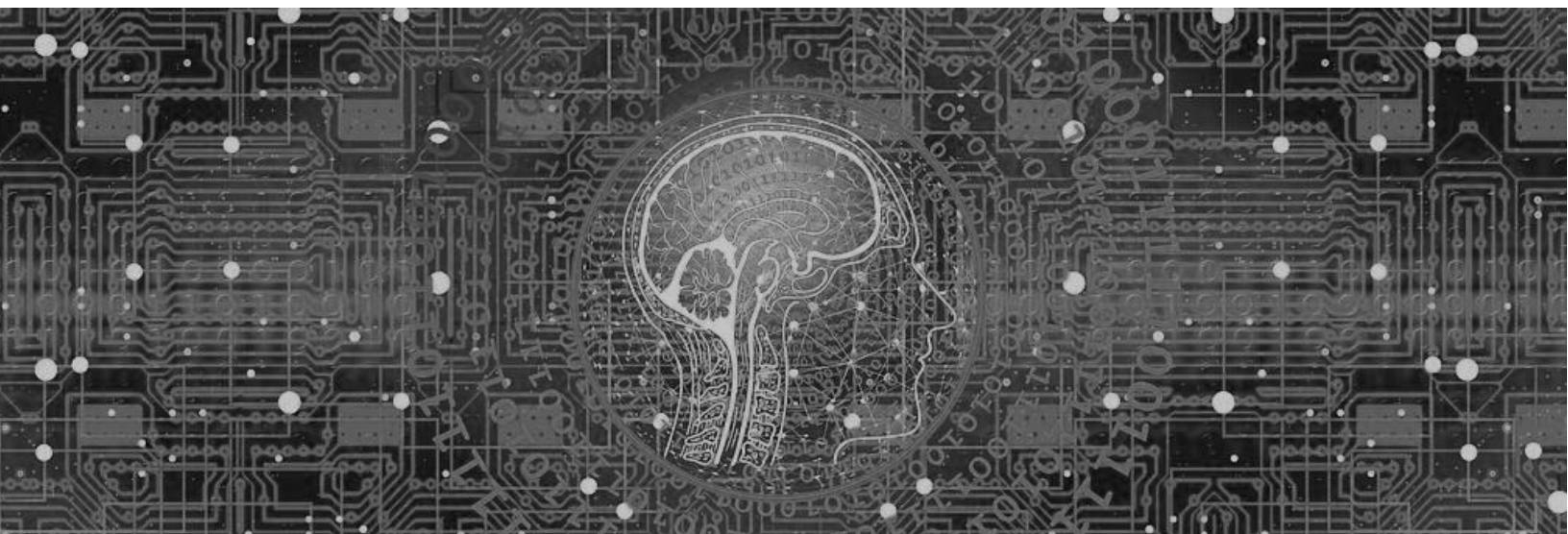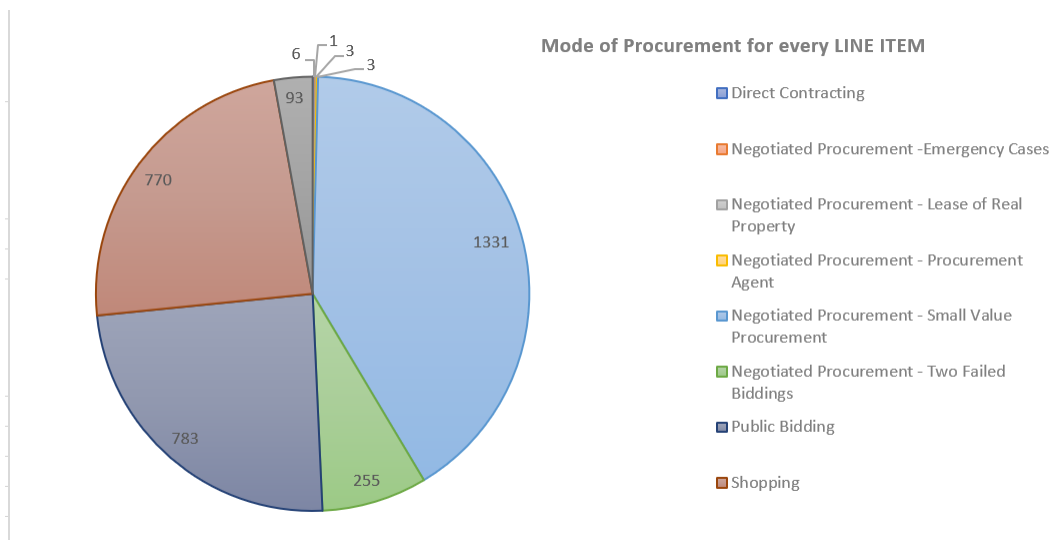
Figure 1: Mode of procurement for all line items in the Bicol University dataset from 2016-2018

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?
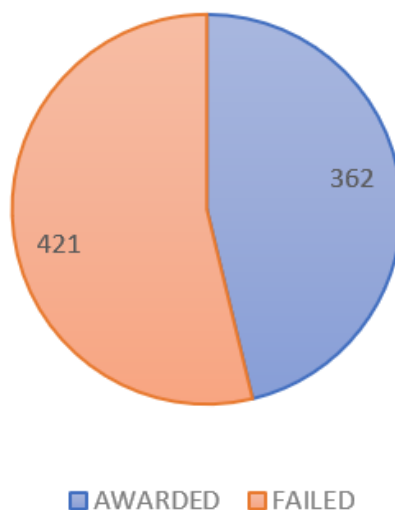

All PUBLIC BIDDING Line Items: Awarded vs Failed

Figure 2: All Public Bidding line items- 362 awarded items versus 421 not awarded

Failed Line Items - Public Bidding

- Failed Civil Works
- Failed Consulting
- Failed Goods
- Failed Goods - General Support Services
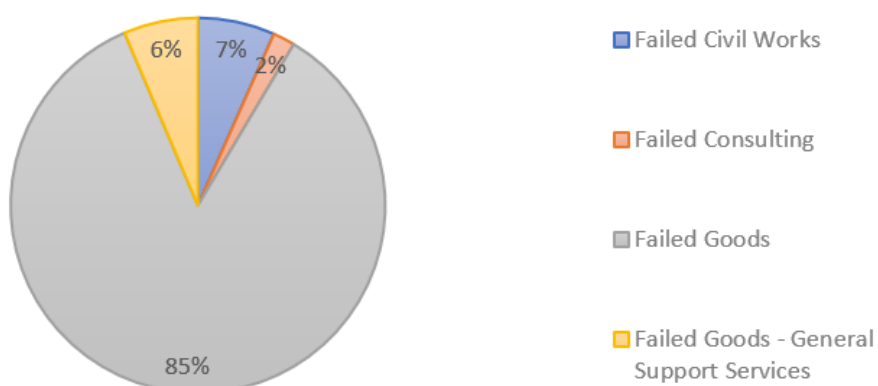
Figure 3: Classification for the line items that have not been awarded thru Public Bidding

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 4 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.

PROCESSING METHODOLOGY

Figure 5 shows the general processing schematic used in this study. Bicol University data is extracted from PhilGEPS, pre-processed and processed using R Environment[3]. 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:

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.**

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

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.

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.
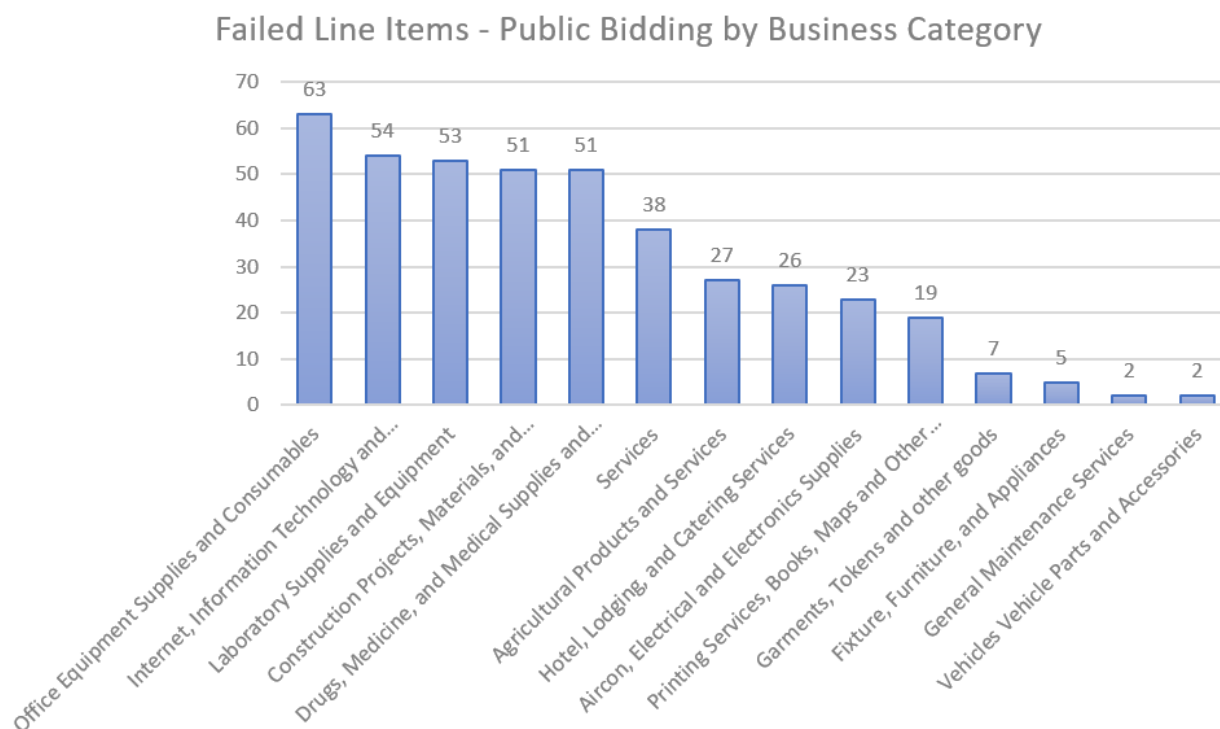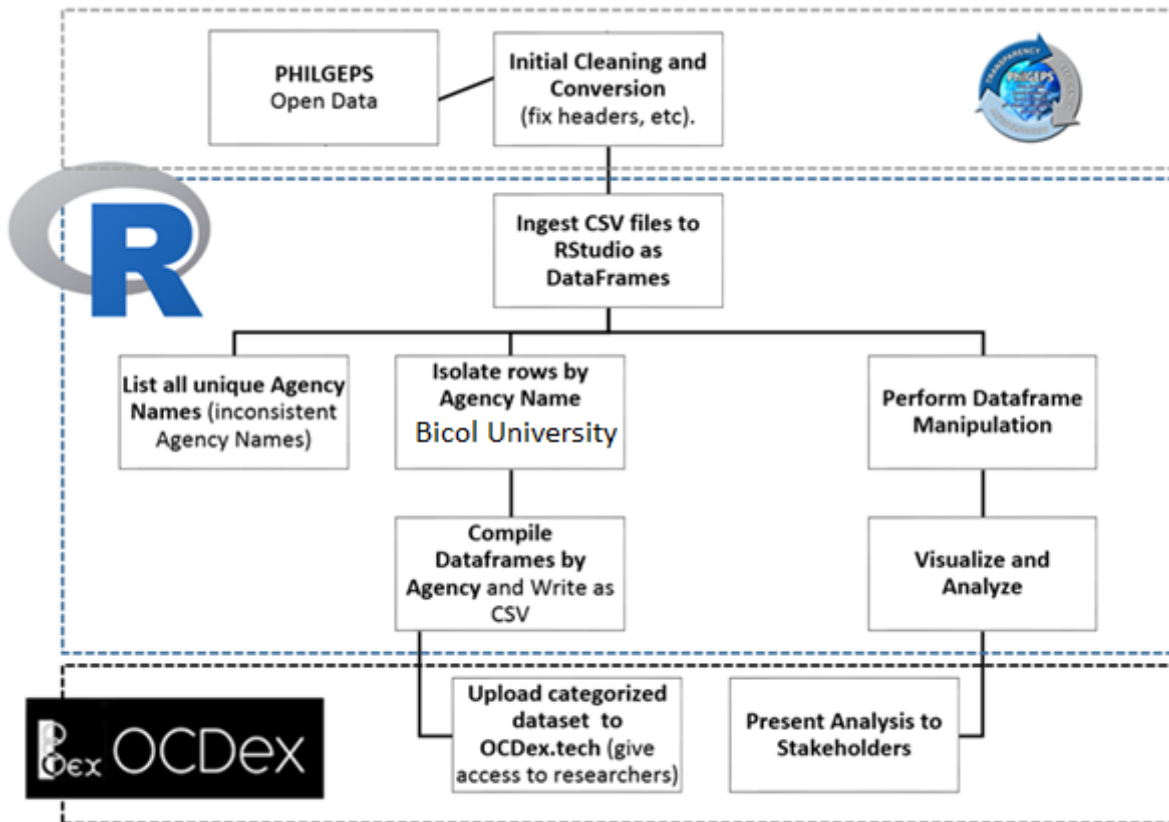
Figure 4: Failed Bidding Items by Business Category

Figure 5: 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.

RECOMMENDED VS. ACTUAL PROCUREMENT TIMELINE
RESULTS AND VISUALIZATION

For this analysis, we only consider <u>all AWARDED line items from 2016 to 2018.</u> 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 1 below:

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

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

Table 2: 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 2, 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.
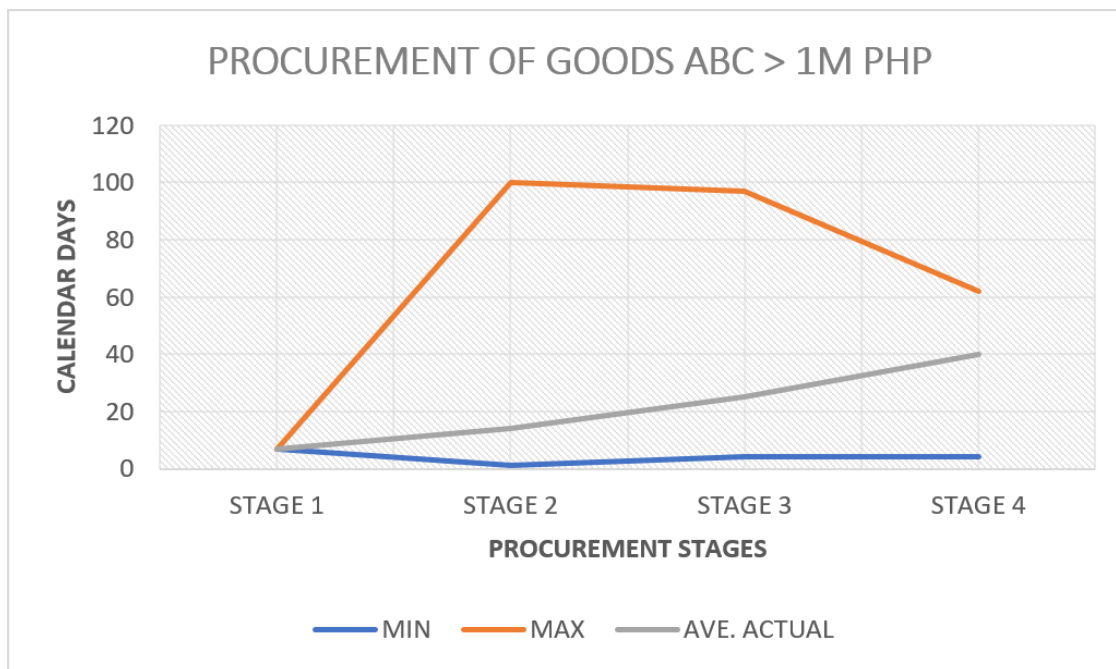
Procurements with ABC > 1M: GOODS

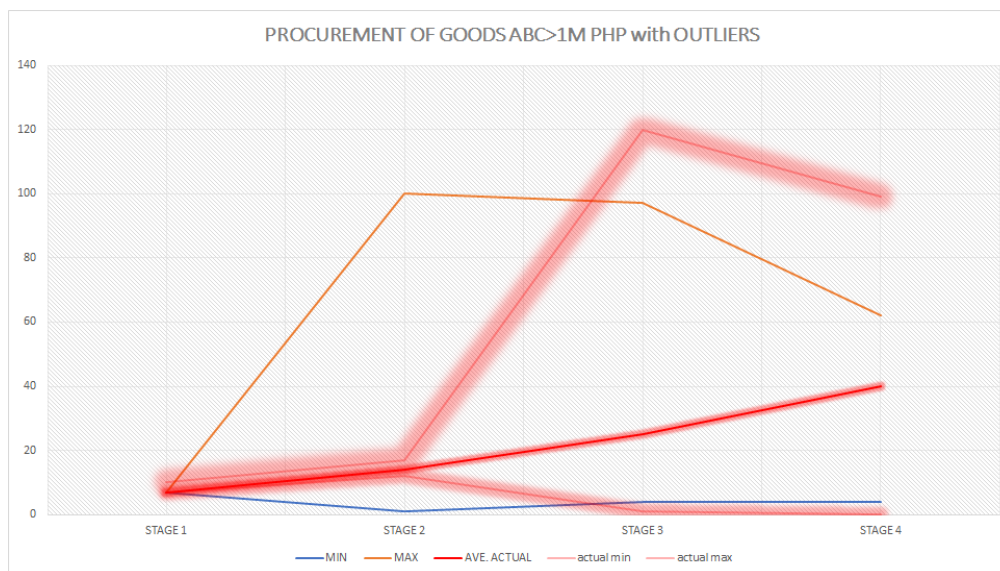Figure 6: Procurement of Goods with ABC > 1 M PHP (Average Trend)

Figure 7: Procurement of Goods with ABC > 1M PHP (Outliers Included)

As shown in Figure 6, ✔ **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 7.
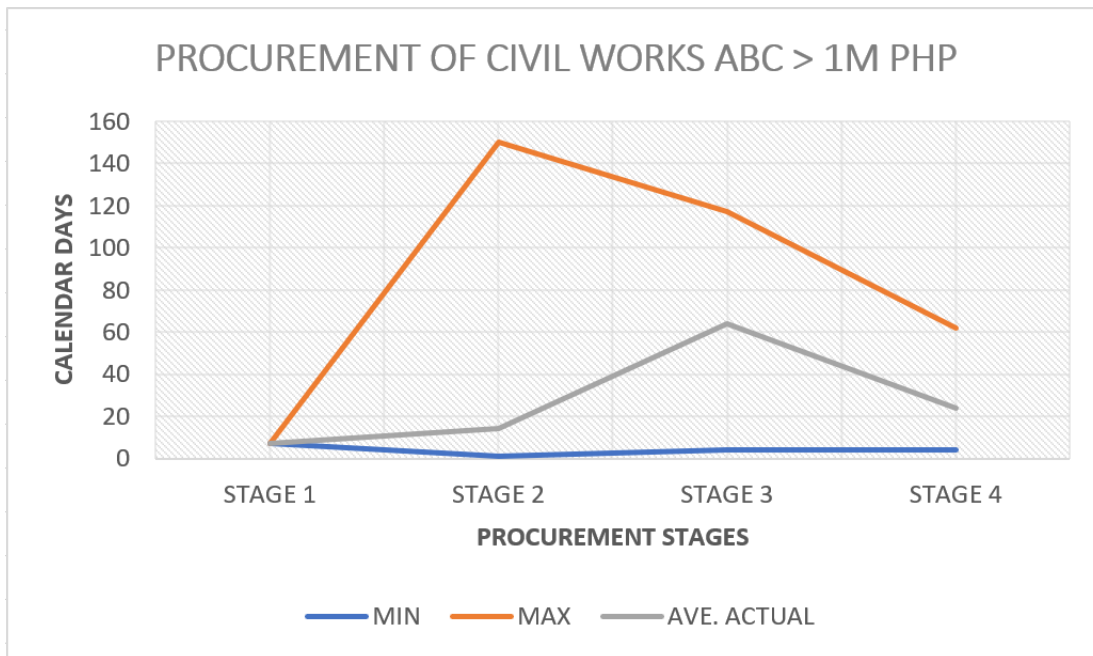
Procurements with ABC > 1M: CIVIL WORKS

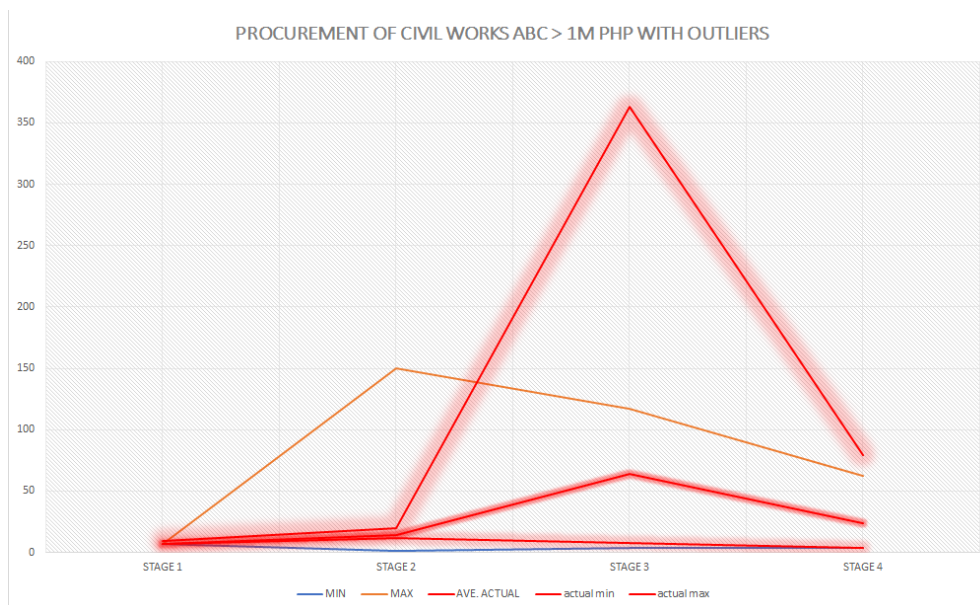Figure 8: Procurement of Civil Works with ABC > 1 M PHP (Average Trend)

Figure 9: 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.
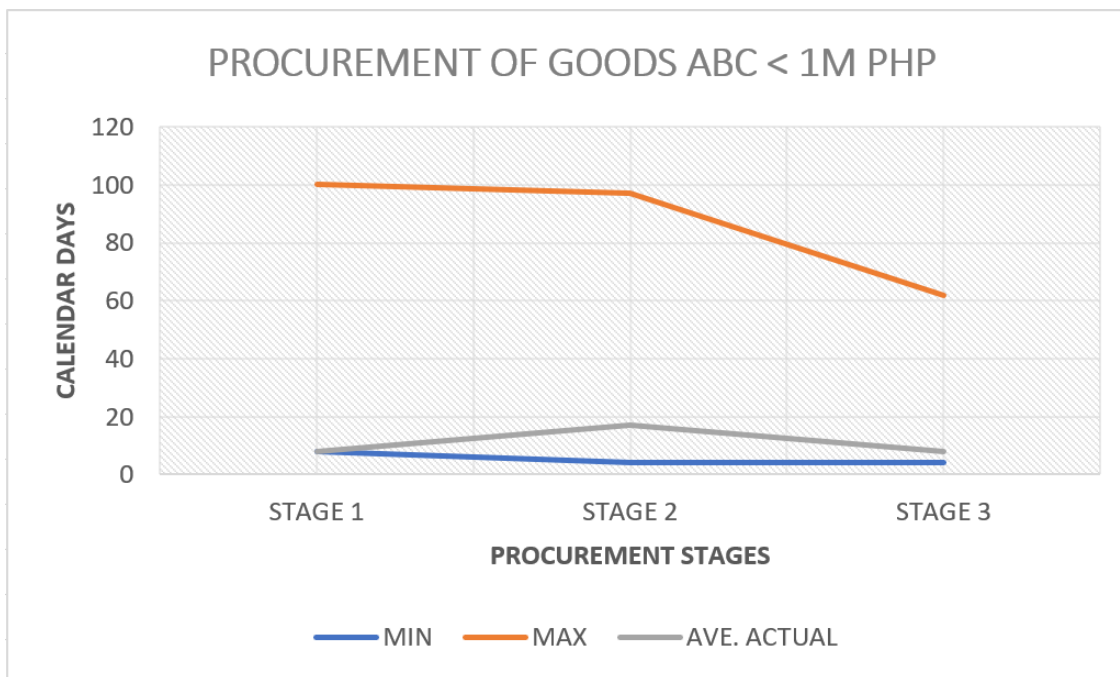
Procurements with ABC < 1M: GOODS

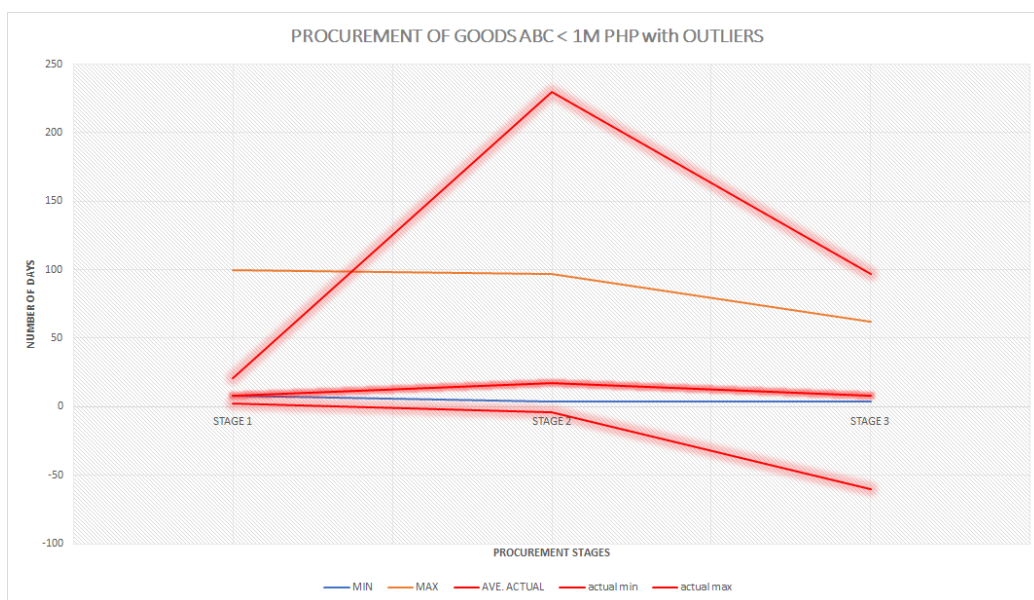Figure 10: Procurement of Goods with ABC < 1 M PHP (Average Trend)

Figure 11: 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.** Figure11 suggests inspecting stages 2 and 3 of this category to address outliers.

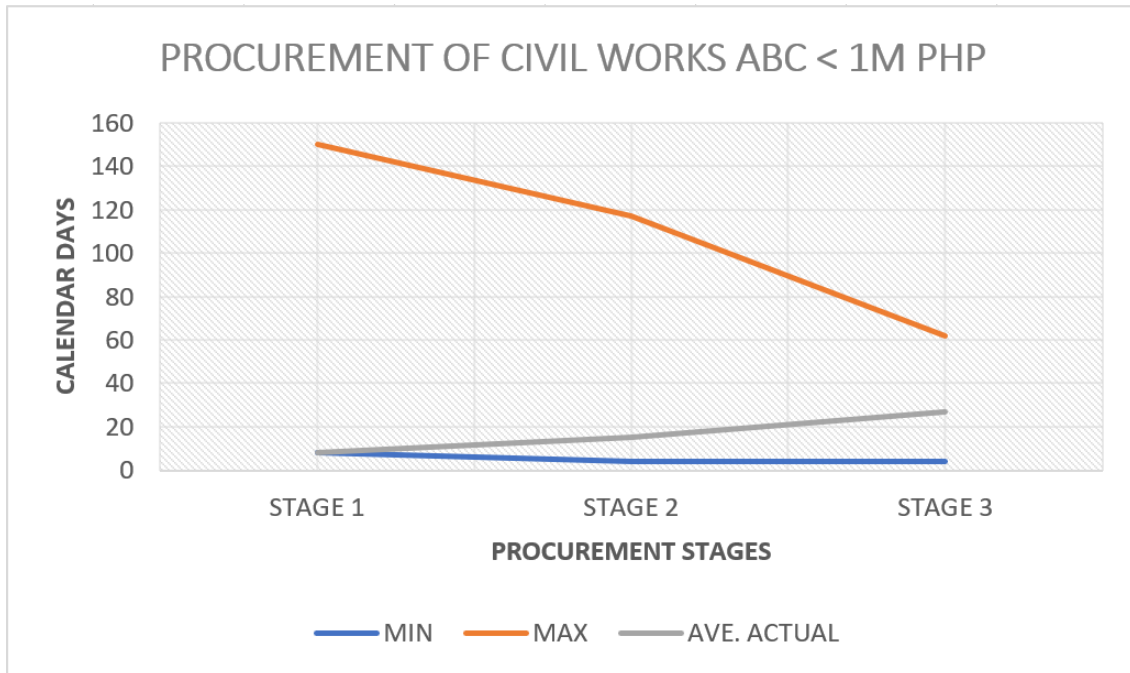## Procurements with ABC < 1M: CIVIL WORKS

Figure 12: Procurement of Civil Works with ABC < 1 M PHP (Average Trend)
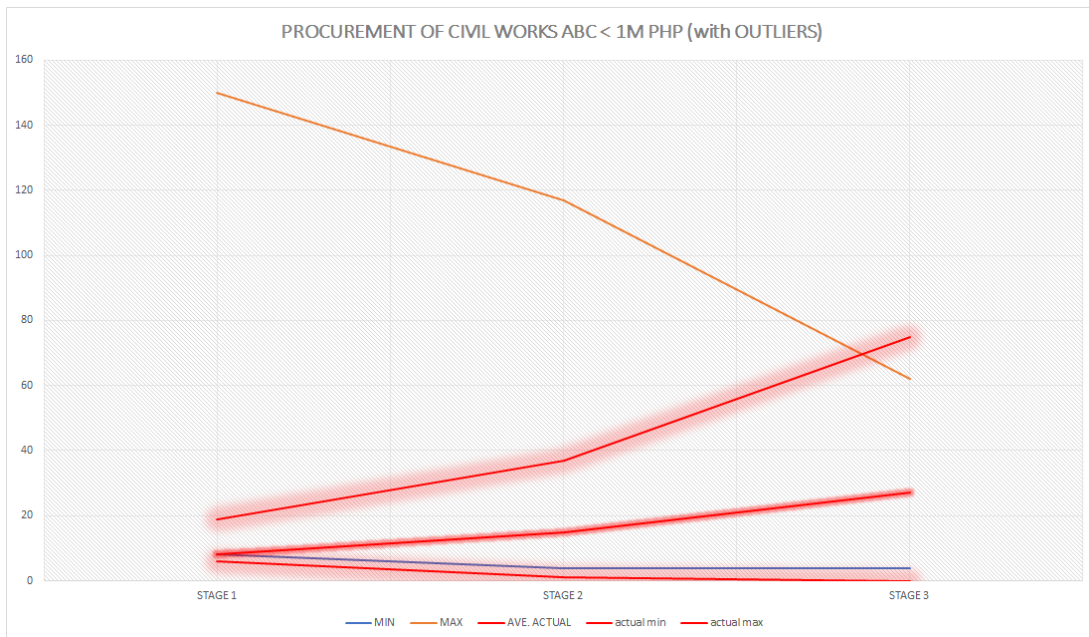

Figure 13: Procurement of Civil Works < 1M PHP (Outliers Included)

✔ **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.

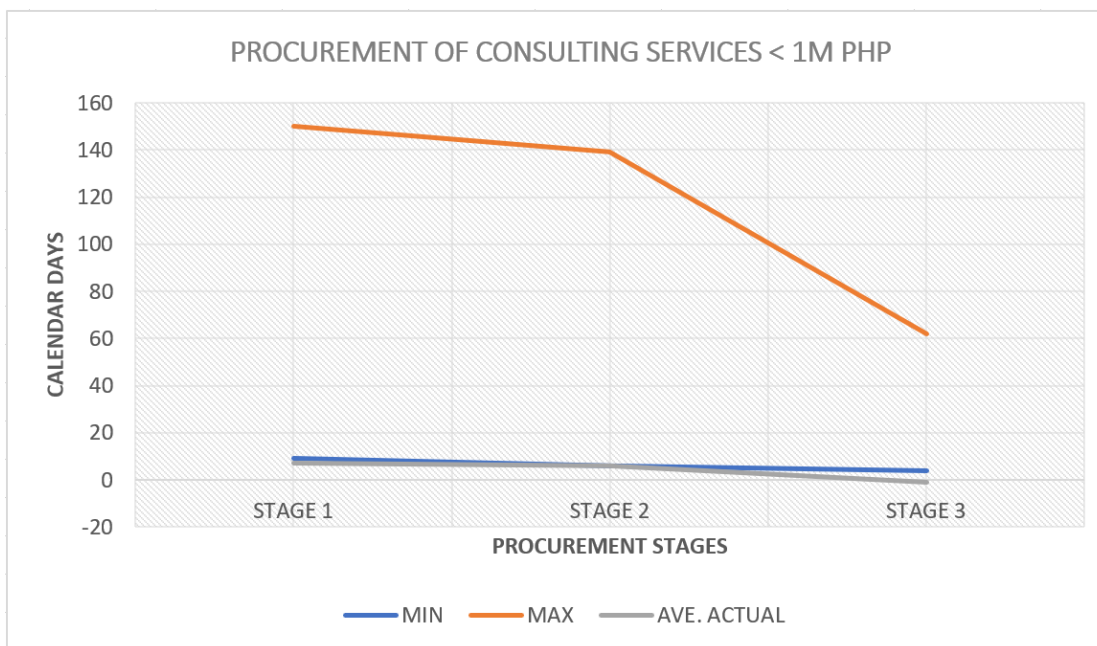## Procurements with ABC < 1M: CONSULTING SERVICES

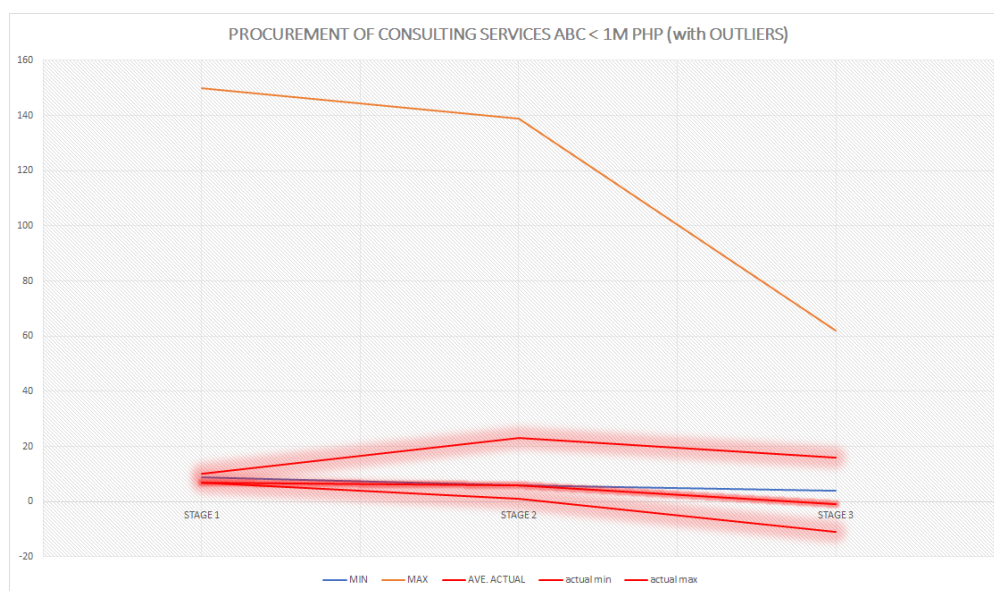Figure 14: Procurement of Consulting Services < 1M PHP (Average Trend)

Figure 15: 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[4].) Many times, the BAC staff had to post/update tender information at 12 midnight when the system's response is relatively faster.[5]

- 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 occassional setbacks.

- BU has de-centralized procurement system that gives more fiscal autonymy 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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[4] Legazpi city's geographical location makes it prone to typhoons and rising sea levels.
[5] 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 2 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 continous 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[6]:

1. Approved Budget of the Contract (ABC) – continuous variable
2. Procurement Classification – factor of 4 levels (Goods, Civil Works, Consultation, and
3. Business Category – factor of 5 to 32 levels (further Classified into 14 levels ~ 5 levels, from 32 levels)[7]

What did the Logit model show?

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[6] 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.

[7] 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.

Table 3 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 3: Significant Coefficients in the General Logistic Model – Run 1

What does Table 3 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[8] 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

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

not given the predictor variables) using the decision boundary predicted value > 0.5. The model resulted in the following confusion matrix on table 4:

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

Table 4: 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%
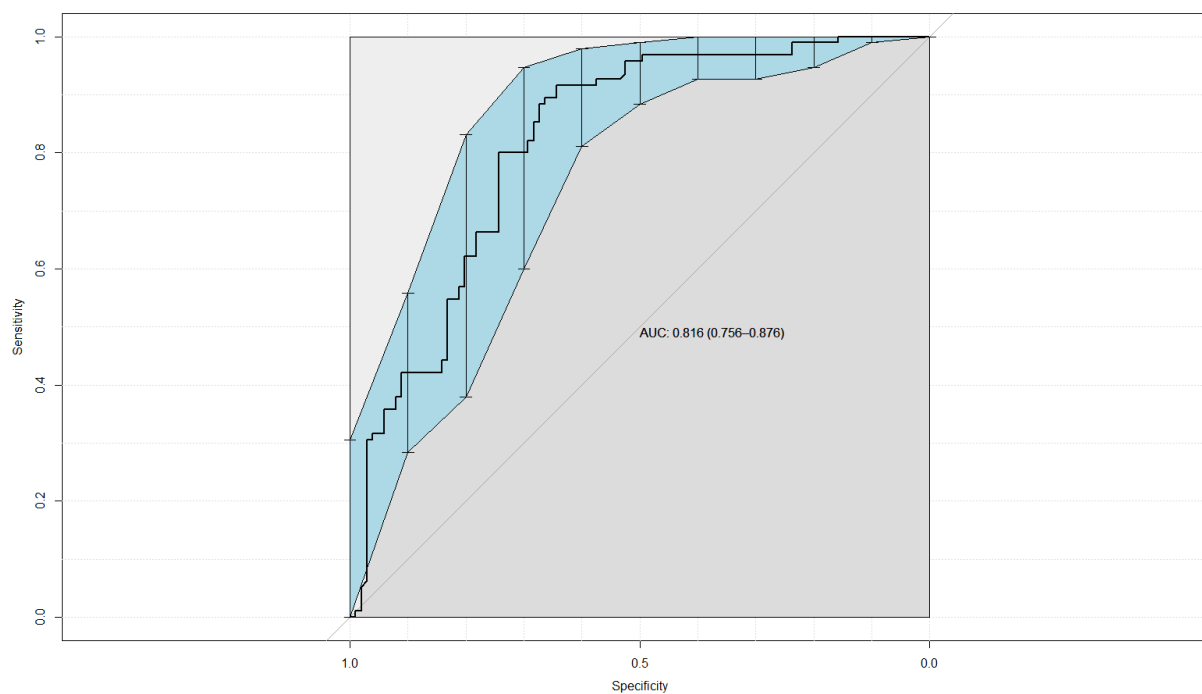Specificity or True Negative Rate: 67.33%
Precision: 71.3%

Figure 16: ROC Curve for the General Model

NOTE for V1! The specifics of the methodologies used are available separate research papers. We will be releasing an update of this report, as soon as the DOI is available. Please follow OCDex.tech and our social media pages for updates!

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[9], 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 agrees 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.**

Recommendation and Final Notes

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 paper 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[10] terminology.

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[9] 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.
[10] Popular set of tools and techniques to constantly improve business processes, used by companies worldwide.

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