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Development of an Assessment Tool for the Implementation of RA 6716 - Rainwater Collector and Springs Development Act of 1989 in Porac, Pampanga

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Abstract:

This study creates an assessment tool which will be used to evaluate the implementation of Republic Act 6716. The assessment tool is comprised of parameters, determining factors, data collection, site for data collection, grading, and remarks. This tool was utilized to test the suitability level of Porac, Pampanga in its implementation of rainwater collection systems (RWCS). The validity of the tool was established with the help of two professionals and was utilized by eighteen professionals in the City of San Fernando, Pampanga from different sections of the 1st District Engineering Office (DEO) of the Department of Public Works and Highways (DPWH). To ensure reliability, it was tested through Cronbach's alpha. The results confirmed the assessment tool's credibility to be used in Porac, Pampanga. The validated tool was handed to seventeen professionals of the 2nd DEO of DPWH. Using One-way Analysis of Variance (ANOVA), the findings indicate that each parameter of the PESTLE framework shows Low Suitability rating. With this, the researchers proposed recommendations that may help enhance the outcome. Furthermore, it can serve as a resource for other researchers who are interested in testing the suitability rate regarding the implementation of RWCS of a different locale.

Keywords **—assessment tool, PESTLE framework, Cronbach's alpha, one-way ANOVA.**

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I. INTRODUCTION

A legislation was enacted in 1987 to ensure safe water supply for all Filipinos due to significant shortages[1]. Rainwater collection emerged as a viable solution to augment water supply, combat flooding, and mitigate climate change impacts. Despite increased global freshwater demand driven by population and economic growth, distribution remains uneven, exacerbated by factors like pollution and politics. By 2022, two billion people lacked access to clean water, a number expected to rise with population growth and climate change[2]. Regions in the Philippines facing declining rainfall will likely experience water stress, impacting forestry, agriculture, health, and settlements negatively [3]. Senator Angara noted in 2019 that since 1989, the government already had a legislation aimed to assist barangays during droughts, emphasizing rainwater collection as a practical solution[4]. However, RA 6716 lacks comprehensive criteria for implementation. To address this, a PESTLE analysis was applied, assessing political, economic, social, technological, legal, and environmental factors.

Rainwater collection systems offer a decentralized water supply solutions, crucial for sustainable development in both urban and rural areas. They enable the capture, storage, treatment, and distribution of rainwater from impermeable surfaces, reducing runoff and enhancing local water security[5]. Studies indicate significant cost savings and environmental benefits associated with rainwater harvesting, highlighting its potential to alleviate expenses on water processing and transportation[6].

Studies conducted in various countries demonstrate the significant benefits of rainwater collection systems both for human consumption and environmental conservation. In Jordan, research indicates the potential to harvest 14.7 million of cubic meters of rainwater annually from rooftops[7]. In Italy, studies suggest that multi-story structures could capture 30% to 50% of rainwater, particularly in areas like Lipari[8]. In the United States, the Environmental Protection Agency suggests that capturing rainwater can significantly reduce household water bills and alleviate pressure on public water supplies, particularly for outdoor activities and irrigation[9]. Similarly, studies in Bangladesh [10]and Palestine [11]confirm that with proper treatment, collected rainwater can meet quality standards for human consumption, offering a vital resource in regions vulnerable to drought and water scarcity.

Furthermore, rainwater collection systems offer environmental benefits as demonstrated in South Africa, where they contribute to reducing the demand for drinking water, sewage services, and overall water conservation efforts[12]. A 10% decrease in drinking water demand, according to US research, could lead to substantial energy savings and reduced carbon emissions[9]. In densely populated cities like those in Israel, rainwater collection is preferred and has a significant impact on local and regional hydrological cycles, helping to lower runoff, erosion, and flood risks[13]. Overall, studies globally underscore the importance of rainwater collection in addressing water scarcity challenges and promoting sustainable water management practices.In spite of the Philippines' abundance in rainfall, averaging from 960 to 4000 mm annually, it protrudes to suffer water stress in 2040 [14].

RA 6716, otherwise known as the Rainwater Collector and Springs Development Act of 1989, is a nationwide initiative to improve every Filipino's quality of life by providing enough social services, such as supplementary water that is readily accessible in every barangay across the nation. In addition, the DPWH shall build water-wells and rainwater harvesters, develop springs, and recondition existing water-wells in every barangay in the country in such quantities that may be necessary and feasible. Furthermore, to make sure the correct usage of the facilities, the Barangay Waterworks and Sanitation Association (BWSA) has to be established and constituted to serve as the body that maintains the said facilities [1].

Water has a vital role in the development of the country, as stated in the Presidential Degree (PD) No. 1067, generally known as the Water Code [15]. In order to improve the management of water resources, the government must commit a more active role [15]. As Rep. Angelo Palmones noted, the constitution states that the state's goal is to improve the welfare of all Filipinos by guaranteeing that every barangay in the country has access to basic social services such as an instantly available adequate water supply [16]. However, since the passing of RA 6716 on March 17, 1989, no more than four rainwater collectors were established to the extent of January to June 2009 as issued by the Global Legal Action on Climate Change or GLACC. It was considerably incompatible to the 100,000 marked number of water-wells, rainwater harvesters and springs to be developed as mentioned in the law as mentioned by Rep. Angelo Palmones [17].

As rainwater collection is projected to be an alternative water source, the RWCS in the Philippines lacked in research with regards to the guidelines or standards, design, construction, operation and maintenance.The considerations set by RA 6716 include the residents, hydrological conditions, project development cost and project operations cost, financial factors, economic factors and arrangements in the institutions.These set

considerations can be broadly classified under the following factors:

Political Factor

Political factors are the first in the PESTLE category which has to do with how government entities behave and carry out their duties in ways that could affect legislation and, eventually, business decisions. A proactive strategic approach is to prepare in advance in reaction to political situations. Because utilities have a monopolistic market structure by nature, they are subject to strict governmental regulation, which greatly affects how they operate. There are numerous political theories that can be applied to the control over water resources and the requirements for the supply of water.

Economic Factor

Economic factors play a significant role in the implementation of rainwater collectors particularly when it comes to budget considerations. Economic considerations evaluate the feasibility and financial viability of the execution of the rainwater collection system on different scales. This category includes the financial aspects of the implementation of RA 6716, such as the amount of budget the government is willing to allocate on rainwater collectors. This also involves the processes related to management like costs in maintenance and operation.

Social Factor

Social factor is the third to be considered in the PESTLE category. This topic covers cultural obstacles, trends in society, demographic data, attitude and lifestyle qualities, and statistics. When determining potential fresh merchandise and services, sociocultural changes should be taken into consideration. Understanding demand changes is made simpler by being informed of sociological and cultural advancements. The expansion of the water sector has been significantly influenced by urbanization, a long-term phenomenon. Increasing public awareness in sustainable water management strategies is another aspect of this process, as it can potentially reduce water shortage. Social elements include cultural norms, values, and beliefs which affect the perception of people in the rainwater collection methods.

Technological Factor

Technological factor is another aspect to be considered because the existence and development of technology directs the performance of rainwater collection systems. By adopting innovative water treatment technologies, contaminants can be efficiently removed, and safe drinking water can be provided to vulnerable population. Moreover, the presence of detailed maps and technical expertise facilitates the strategic installation, maintenance, and optimization of rainwater collector systems, fostering sustainable water management practices. Additionally, advances in technology in awareness and education campaigns are essential for establishing a culture of water conservation and encouraging the utilization of rainwater collection as a viable alternative to traditional water sources. At the moment, one force dragging the improvement of rainwater collection systems is the use of old technologies. Innovations exist but local governments could have a hard time adapting or implementing them.

Legal Factor

Legal factor refers to the external factors related to the legal environment in which an organization operates. In accordance with the rainwater collection, it involves analyzing the laws, regulations, and legal considerations that can contribute in the implementation of the RA 6716. Politics and legal factors might be connected with each other; however, legal factors are more focused on the legislations, rules, and regulations. These will always affect the implementation of rainwater collection systems, as it is the RA 6716 that promulgates its application.

Environmental Factor

Environmental factors are the last in the PESTLE category. In terms of the effectiveness and environmental impact of rainwater collection systems, environmental factors play an important role. The amount, quality and sustainability of rainwater generated are affected by the type and extent of land cover, and water quality. Environmental factors include topics like weather and climate, which have a big impact on sectors including tourism, farming, agriculture, and

insurance. One of the water industry's biggest ecological concerns is climate change.

II. METHODOLOGY

A. Phase 1: Creation of a validated and reliable assessment tool using PESTLE Framework

The study utilized an assessment tool including all aspects of the PESTLE Framework. Political, economic, social, technological, legal, and environmental issues were taken into consideration for a rounded approach in the collection of data.

The initially created assessment tool has been tested for validity and reliability by recruiting professionals in a location with currently existing rainwater collectors, the City of San Fernando in Pampanga.

Research survey approach has been utilized which is helpful to the researchers in surveying professionals with expert knowledge and experience in each factor of the PETSLE analysis.The participants were chosen by convenience sampling technique.

This study has thirty-seven respondents in total, two of which are for validation, and eighteen for reliability test, all from the City of San Fernando, and seventeen from the Municipality of Porac. With their knowledge and expertise, they validated the Assessment Tool by following the grading criteria set by the Instrument Validation Form. Different factors in the Assessment Tools were tested for reliability by grading the sub-factors in each parameter of PESTLE Analysis from 1 (indicating the lowest level of suitability) to 5 (denoting the highest level). To establish the level of coherence and reliability of the assessment tool, the results have been subject to Cronbach's alpha.

B. Phase 2: Evaluation of the implementation of RA 6716 using the developed assessment tool

1) ***Stage 1: Data Collection Methods***: *A* mixed-methods approach comprising qualitative and quantitative strands was utilized to gather data for this study. The fundamental concept behind mixed-method research is to establish the strengths of each data point along with neutralizing their infirmity *[18]*. The qualitative portion of the research consisted of observations and investigations evaluating the study locale's community regarding the water-related issue. These qualitative approaches helped researchers to appraise preferences and key challenges in relation to the implementation of rainwater collection systems. On the other hand, the study quantified data based on specific criteria, and the interpretations of the data served as parameters in administering the assessment on the implementation of a rainwater collection system in Porac, Pampanga.

2) ***Stage 2: Data Analysis:***To determine the presence of statistically significant difference between the population means, means of three or more independent groups shall be compared through a one-way ANOVA *[19]*. For statistical significance, ANOVA uses the F test. This means that an error is calculated for a whole set of comparisons instead of each two-way comparison, which would occur with a t-test, making it possible to compare multiple methods at once *[20]*. Following the analysis of variance, the researchers calculated average scores for every factor, and the overall evaluation mean score in order to evaluate the suitability of Porac Pampanga's implementation of RWCS using the assessment tool.

C. Phase 3: Discussion for enhancements or recommendations with regards to the satisfaction level of the factors based on the assessment:

After the evaluation of each factor in the Municipality of Porac, Pampanga, and obtaining in-depth understanding, the researchers shall create a proposal containing a comprehensive instruction of how the assessment tool would have been used, the interpretation of the data and a detailed discussion of the recommendations based on the assessment's resulting level of satisfaction. It is important to equally consider both ends as possible results, which could include outcomes reaching below average and the satisfactory rate. This extensive approach enables the researchers to provide essential insights based on the gathered data and related literatures. In conclusion, this shall serve the purpose of a guide for a progressive implementation of RA 6716.

III. RESULTS AND DISCUSSIONS

A. Creation of the Assessment Tool

1) ***Stage 1: Assessment Tool***: The succeeding table displays the assessment tool used in the study, which served as a guide to determine the suitability of RWCS in Porac, Pampanga. Included in the table are the parameters recognized in the study as important factors. The table also specifies the required data evidences and its corresponding site for collection.

Table 1.*Assessment Tool*

PARAMETER		DETERMINING FACTOR	DATA COLLECTION (EVIDENCE/S)	SITE FOR DATA COLLECTION	GRADING	REMARKS
POLITICAL FACTOR	1.1	Ascertain the disposition of the government towards building rainwater collector systems.	Implementation of Rainwater collectors system (RWCS) in Public Facilities • Guidelines on the Identification of Project Beneficiaries for Construction of Rain Water Collectors System (RWCS) in Public Facilities FY 2024. Page 2. 4.a Guidelines • Rainwater Listing Porac Only	Department of Public Works and Highways		
	1.2	The prioritization of target beneficiaries in the installation of rainwater collector systems	Implementation of Rainwater collectors system (RWCS) in Public Facilities • Guidelines on the Identification of Project Beneficiaries for Construction of Rain Water Collectors System (RWCS) in Public Facilities FY 2024. Page 2. 4.b Guidelines • Rainwater Listing Porac Only	Department of Public Works and Highways		
	1.3	Application of the government policies and regulations towards rainwater collector, especially in the local government level.	Guidelines on the Identification of Project Beneficiaries for Construction of Rain Water Collectors System (RWCS) • Annex B: Guidelines on the Identification of Project Beneficiaries for Construction of Rain Water Collectors System (RWCS) in Public Facilities FY 2024 • RWCS Approved Plan	Department of Public Works and Highways		
	1.4	The plans and programs of the government in persuading public and private sectors in adapting rainwater collector systems	Social programs raising public awareness to rainwater harvesting	Office of the Municipal Planning and Development Coordinator (MPDC)		
	1.5	Review for collaboration between the public, private sectors, and government that supports the implementation of rainwater collector project.	Memorandum of Agreement (MOA) between local government and private sector	Office of the Municipal Planning and Development Coordinator (MPDC)		

PARAMETER		DETERMINING FACTOR	DATA COLLECTION (EVIDENCE/S)	SITE FOR DATA COLLECTION	GRADING	REMARKS
ECONOMIC FACTOR	2.1	Budget allocations for improvement and increase of water supply in the Municipality	Budget report or Certificate from the local Government detailing the budget allocations for water supply in the Municipality.	Municipal Budget Office		
	2.2	Budget allocations for implementing rainwater collector systems	Implementation of Rainwater collectors system (RWCS) • Implementation of Rainwater collectors system (RWCS) in Public Facilities - FY 2023. page 3, Central Luzon	Department of Public Works and Highways		
	2.3	Initial cost of installation of rainwater collector systems	Bill of Materials or Quantities, or Detailed Unit Price Analysis for RWCS • Cabetican Elementary School Rainwater Facility Total Amount	Department of Public Works and Highways		
	2.4	Budget for operation of constructed rainwater collector systems	Operation procedures for Rainwater Collector Systems	Department of Public Works and Highways		
	2.5	Budget for maintenance of constructed rainwater collector systems	Maintenance procedures for Rainwater Collector Systems	Department of Public Works and Highways		
	2.6	Water Cost Reductions with Operational Rainwater Collector Systems	Budget report or Certificate from the Local Government detailing the Annual Budget for Rainwater Collector Systems	Municipal Budget Office		

PARAMETER		DETERMINING FACTOR	DATA COLLECTION (EVIDENCE/S)	SITE FOR DATA COLLECTION	GRADING	REMARKS
SOCIAL FACTOR	3.1	Sufficiency in the water supply	a. Population with access to water supply. b. Total population • The Porac Clup (2021-2031) Vol. 1 - Page 34 - 36 @ c.) water	Office of the Municipal Planning and Development Coordinator (MPDC)		
	3.2	Presence of water related diseases	Number of cases due to water-borne diseases • Attack Rate of Diarrheal Case per Barangay	Municipal Health Office		
	3.3	Assess the socio-economic status of the residents in the Municipality by acquiring necessary information and utilizing official census data to evaluate the demographics of the residents	Socio-economic status of the residents in the Municipality • The Porac Clup (2021-2031) Vol. 1 - Page 2 - 9 @ B. Demographic Profile	Office of the Municipal Planning and Development Coordinator (MPDC)		
	3.4	Awareness and understanding of the community about Rainwater collector systems	Municipal survey on the awareness of the population to Rainwater collector systems	Office of the Municipal Planning and Development Coordinator (MPDC)		
	3.5	Technological advancement for awareness and education promoting the adoption of rainwater collector in far municipality	Online rainwater harvesting campaign programs	Office of the Municipal Planning and Development Coordinator (MPDC)		

PARAMETER		DETERMINING FACTOR	DATA COLLECTION (EVIDENCE/S)	SITE FOR DATA COLLECTION	GRADING	REMARKS
TECHNOLOGICAL FACTOR	4.1	Level of water treatment technology for improved water quality	a. Rainwater Collection System Blueprint b. Actual type of water treatment used • RAINWATER COLLECTOR 2021. • DPWH RO - RWCS Approved Plan.	Department of Public Works and Highways		
	4.2	Map identifying strategic locations in the Municipality for building rainwater collectors in terms of precipitation	Amount of rainfall in the Municipality • Pampanga River Basin Flood Forecasting & Warning Center: Compendium of AHDS 2009 to 2020 • PRFFWC: 2021 to 2022	Philippine Atmospheric Geophysical and Astronomical Services Administration		
	4.3	Technical expertise for installation and maintenance	Certifications / Seminars / Trainings / Assessment of expertise	Department of Public Works and Highways		
	4.4	Maintenance schedule guidelines	Regular maintenance procedures (Based from WHO Guidelines)	Department of Public Works and Highways		
	4.5	Durability of Rainwater Harvesting System Development Relative to Design Specifications	a. Bill of Materials b. Rainwater Collection System Blueprint • Memo 097.7_05/03/23 - Page 10 - 17 @ ANNEX C.	Department of Public Works and Highways		

PARAMETER		DETERMINING FACTOR	DATA COLLECTION (EVIDENCE/S)	SITE FOR DATA COLLECTION	GRADING	REMARKS
LEGAL FACTOR	5.1	The compliance of the Municipality with the design of rainwater collector system based on the DPWH standard.	Municipal design of rainwater collector systems	Municipal Disaster Risk Reduction Management Office		
	5.2	The water quality testing procedures as essential information for compliance with health and safety regulations in the use of collected rainwater.	Municipal water quality testing procedure for collected rainwater • Annex B - Guidelines on the Identification of Project Beneficiaries for Construction of Rainwater Collectors System (RWCS) in Public Facilities FY 2024, page 3, F	Municipal Environmental and Natural Resources Office		
	5.3	A legislative framework to mandate the construction of rainwater harvesting facilities in various establishments including new subdivisions, malls, and government institutions.	An act in the Philippines requiring to construct rain harvesting facility and for other purposes • An Act Requiring All New Subdivisions, Condominium Communities, Malls, Government Institutions, Central Business Districts And Information Technology Parks In The Philippines To Construct Rain Harvesting Facility And For Other Purposes, page 3	Office of the Municipal Engineer		
	5.4	The flexibility and effectiveness of rainwater collector systems' rules and	Guidelines on the Identification of Project	Department of Public Works and Highways		
		regulations in responding to changing circumstances.	Beneficiaries for Construction of Rainwater Collectors System (RWCS) in Public Facilities • Annex B - Guidelines on the Identification of Project Beneficiaries for Construction of Rainwater Collectors System (RWCS) in Public Facilities FY 2024, page 3, F			
	5.5	The limitations associated with the implementation of RA 6716 in terms of its location.	Guidelines on the Identification of Project Beneficiaries for Construction of Rainwater Collectors System (RWCS) in Public Facilities • Annex B - Guidelines on the Identification of Project Beneficiaries for Construction of Rainwater Collectors System (RWCS) in Public Facilities FY 2024, page 2, A	Department of Public Works and Highways		

PARAMETER		DETERMINING FACTOR	DATA COLLECTION (EVIDENCE/S)	SITE FOR DATA COLLECTION	GRADING	REMARKS
ENVIRONMENTAL FACTOR	6.1	An integrated water quality testing consideration of rainwater collector system	Municipal water quality testing considerations for collected rainwater	Municipal Environment and Natural Resources Office		
	6.2	Maps showing the areas of the land suitable for rainwater harvesting system installation.	Ground shaking hazard and Critical facilities risk map • Porac data - Munisipyo - Ground Shaking hazard x Critical facilities risk map	Office of the Municipal Engineer		
	6.3	The limitations associated with the implementation of RA 6716 in terms of its location.	Air quality index •	Department of Environmental and Natural Resources – Environmental Management Bureau		
	6.4	The amount of rainfall forecast in the chosen locale	Forecast rainfall in percent normal in the Municipality • Forecast Rainfall in Percent of Normal as of February 22, 2024	Philippine Atmospheric Geophysical and Astronomical Services Administration		
	6.5	Mitigation of flooding through rainwater harvesting systems	Impact of flood mitigating technologies • Porac data - Munisipyo - Annex 1 (Mainstreaming DRR-CCA to Porac CLUP) page 4	Municipal Disaster Risk Reduction Management Office		
	6.6	Conservation for local water resources through supplementary water system	Population using different Levels of water systems in the Municipality • Porac data - Munisipyo - Porac CLUP volume 1 - page 34-36 (Table 1.19-1.23)	Office of the Municipal Planning and Development Coordinator (MPDC)		

Table 1 is composed of several elements: the parameters which define the aspects in the implementation of RWCS in the locale; the determining factors identifying specific factors in the implementation of RWCS; site for collection of data specifying the agencies where the evidences can be gathered; the grading column which shows the score each determining factor received and the respective level of suitability; and the remarks column that consists of the comments and notes to be considered during the collection of data.

*2) **Stage 2: Statistical Analyses***: The following statistical indicators are employed to ascertain the internal consistency, reliability and means between the respondents:

Cronbach's Alpha

The internal consistency of each of the thirty-two items in the assessment tool will be evaluated in terms of this statistical measure. To verify that every item is internally consistent, the yielded Alpha (α) needs to be higher than 0.70. The following table displays the α-value for all of the thirty-two elements in the evaluation tool that was created:

Table 2.*Cronbach's Alpha*

Reliability Statistics	
Cronbach's Alpha	N of Items
.804	32

One-way ANOVA

A total of seventeen sets of responses have been gathered in order to conduct the One-way ANOVA. Included in these sets of responses is the respondents' grading in their evaluation of the collected data. The responses were compared in order to demonstrate that there is not a significant difference between each parameter. The tables below show the computation for each of the item included in the assessment tool by the respondents.

Table 3.*One-way ANOVA – Standard Deviation*

Respondent	N	Mean	Std. Deviation
1	32	2.63	1.45
2	32	2.03	1.58
3	32	3.06	1.78
4	32	1.91	1.23
5	32	2.63	1.45
6	32	2.63	1.45
7	32	1.91	1.25
8	32	2.03	1.58
9	32	2.09	1.33
10	32	2.56	1.46
11	32	2.78	1.66
12	32	2.66	1.66
13	32	2.41	1.36
14	32	2.34	1.38
15	32	2.38	1.34
16	32	2.53	1.44
17	32	2.81	1.69
Total	544	2.43	1.50

Table 4.*One-way ANOVA – Overall Significance*

	Sum of Squares	Df	Mean Square	F	F-crit	Sig.
Between Groups	59.305	16	3.707	1.683	1.663	0.046
Within Groups	1160.313	527	2.202			
Total	1219.618	543				

The table above displays data dispersion, variations within and between groups, degrees of freedom, and calculated "Mean Square" values for both "Between Groups" and "Within Groups." The F-statistic examined group mean variations, resulting in an F-value of 1.683 while the p-value had a result of 0.046, indicating that there is statistically significant difference in mean scores among the set of responses from the respondents (F (16, 527) = [1.683], p = 0.046).

B. Assessment of suitability of RA 6716 RWCS in Porac, Pampanga

Each data has been assessed by the respondents based on the level of suitability. Every item was evaluated separately and given a rating according to how closely it adhered to the standards laid out by the related literatures and studies. The grading that each item received, together with the matching sum for each parameter, and overall grading, are displayed in the table below.

Table 5.*Grading for Assessment Tool*

Parameter	**Determining Factor**	**Grading**
POLITICAL FACTOR	1.1	4.59
	1.2	4.06
	1.3	4.18
	1.4	1.00
	1.5	1.00
Political Factors Mean		**2.97 (Low Suitability)**
ECONOMIC FACTOR	2.1	1.00
	2.2	4.12
	2.3	3.88
	2.4	1.00
	2.5	1.00
	2.6	1.00
Economic Factors Mean		**2.00 (Low Suitability)**

SOCIAL FACTOR	3.1	3.59
	3.2	3.00
	3.3	2.94
	3.4	1.00
	3.5	1.00
Social Factors Mean		**2.31 (Low Suitability)**
TECHNOLOGICAL FACTOR	4.1	3.41
	4.2	3.53
	4.3	1.00
	4.4	1.00
	4.5	4.12
Technological Factors Mean		**2.61 (Low Suitability)**
LEGAL FACTOR	5.1	1.00
	5.2	2.53
	5.3	2.76
	5.4	3.59
	5.5	3.65
Legal Factors Mean		**2.71 (Low Suitability)**
ENVIRONMENTAL FACTOR	6.1	1.00
	6.2	2.82
	6.3	1.00
	6.4	2.35
	6.5	2.82
	6.6	2.94
Environmental Factors Mean		**2.16 (Low Suitability)**
Overall Mean		**2.46 (Low Suitability)**

A framework for appraising the suitability of RWCS in Porac, Pampanga, is shown in Table 5, with parameters classified into six categories: Political, Economic, Social, Technological, Legal, and Environmental factors. The mean of the grade assigned by the respondents for each determining factor was calculated. The aforementioned scores were then added together to determine the subtotal for every parameter, resulting in an overall Mean of 2.46. Assessing these factors may help determine the existing system's strengths and drawbacks, allowing for the development of plans to improve implementation. The table displayed below illustrates the average score for each factor as well as the overall assessment.

Table 6.*Average Grade per Parameter*

PARAMETER	AVERAGE	QUALITATIVE
Political	2.97	Low Suitability
Economic	2.00	Low Suitability
Social	2.31	Low Suitability
Technological	2.61	Low Suitability
Legal	2.71	Low Suitability
Environmental	2.16	Low Suitability
Overall	**2.46**	**Low Suitability**

3) ***Interpretations***: It was found that items 1.1, 1.2, and 1.3 under the Political factor generated scores of 4.59, 4.06, and 4.18, indicating high suitability. This implies that all necessary data is being delivered, including additional details and critical information that is valuable to the overall knowledge of the product. Items 1.4 and 1.5, on the other hand, received a score of one, indicating a very low level of suitability. The data/document required to support the assigned items is not provided. Consequently, it can be concluded that in spite of the fact that some of the items met the above suitable level but due to items which gained very low grade, then the criterion received an average score of 2.96 which denoted as low suitable grade. This result suggested that political aspect has been unsatisfactory, attaining the suitable level of the implementation which requires further improvement to acquire the standards of the assessment tool.

Economic Factors 2.1, 2.4, 2.5, and 2.6 were found to have a score of 1, indicating very low suitability. This showed up due to insufficient information in the data gathered or document, leading to a lack of essential details for assessments. Items 2.2 and 2.3, on the other hand, received 4.12 implies high suitability, and 3.88, with qualitative description of suitable, as the data contained all required information and additional details to enhance understanding. Consequently, the average score for the economic factor was calculated to be 2, indicating overall low suitability of the evaluated data. This suggests that while some areas meet guidelines, the majority do not, falling below expected levels of implementation.

The score for Social Factor 3.1 was 3.59, indicating a satisfactory level of suitability. The data or document gathered for these items included all of the required information for the

given item, as well as additional details to improve overall comprehension of the instrument. However, items 3.2 and 3.3 received scores of 3 and 2.94, indicating a description of suitable and low suitability, respectively. Finally, items 3.4 and 3.5 received a score of one, indicating extremely low suitability. The obtained data or document for this item lacked the required information for the provided item, resulting in insufficient information for the assessment. This calculation provides a mean score of 2.31, which falls inside the evaluation instrument's low suitability range. This score shows that the criteria are being implemented at a lower degree than expected, with some places fulfilling the requirements but the majority do not.

Item 5.1 was found to have a very low suitability score of 1 for the Legal Factor. There was insufficient information for the evaluation, since the gathered data or document was lacking for the item. However, the low suitability of Items 5.2 and 5.3 was indicated by their respective scores of 2.5 and 2.8. There was insufficient information for the evaluation because the gathered data or document did not provide the information needed for the assigned assignment. To guarantee a thorough and precise evaluation of the legal aspect, more data or information might be required for Items 5.2 and 5.3. Lastly, a score of 3.6 for Items 5.4 and 5.5 indicated a suitable grade. The gathered evidence or document provided sufficient details for the work at hand, including the evaluation of the legal aspect. Based on the average score of 2.71 obtained for the legal aspect, it is clear that the data under evaluation falls into the low suitability category. This score shows that the implementation of the criteria is not as good as it could be, with some areas following the rules while other areas do not.

Item 5.1 was found to have a very low suitability score of 1 for the Legal Factor. There was insufficient information for the evaluation, since the gathered data or document lacked the specifics needed for the assigned item. However, the low suitability of Items 5.2 and 5.3 was indicated by their respective scores of 2.5 and 2.8. There was insufficient information for the evaluation because the gathered data or document did not provide the information needed for the assigned assignment. To guarantee a thorough and precise evaluation of the legal aspect, more data or information might be required for Items 5.2 and 5.3. Lastly, a score of 3.6 for Items 5.4 and 5.5 indicated a suitable grade. The gathered evidence or document provided sufficient details for the work at hand, including the evaluation of the legal aspect. Based on the average score of 2.71 obtained for the legal aspect, it is clear that the data under evaluation falls into the low suitability category. This score shows that the implementation of the criteria is not as good as it could be, with some areas following the rules while other areas do not.

Items 6.2, 6.4, 6.5, and 6.6 in the Environmental Factor were scored at 2.82. 2.35, 2.82, and 2.94, respectively, indicate a poor level of suitability. The collected data is insufficient to support the claim for the assigned item. However, items 6.1 and 6.3 received a score of 1, implying a very low suitability level based on the evidence. It was found that the Environmental Factor had an average score of 2.16, signifying a low level of suitability in presenting the required information concerning the environment. This was demonstrated by the derived scores and accompanying suitability levels, which found that nearly all of the items received poor grades of suitability by failing to meet the average level, resulting in an unacceptable suitability finding for the Environmental Factors.

The assessment showed that the average score for the overall of PESTLE factor was 2.46, falling between 2.00 and 2.99. This score suggests that there is room for improvement in the government's suitability in considering external variables. Despite the fact that data/documents were obtained, they did not match the assigned or required data completely, which left a less thorough grasp of the outside influences on its operations. This might have a detrimental effect on how the government makes decisions and functions as a whole. As a result, it is advised that further efforts be made to guarantee that the required data is gathered and that PESTLE factor suitability is enhanced.

C. Proposal for the Implementation of RWCS in Porac, Pampanga

*1) **Political Factors:**The assessment shows strengths and areas for improvement in the political aspect of rainwater collection projects. The local government's assistance in installation is strong, but targeting beneficiaries and enforcing policies need improvement. Persuading public and private sectors to adopt these systems is lacking. Enhancements could include better outreach, incentives, and collaboration. Formal partnerships and knowledge-sharing platforms are also necessary. Addressing these areas can improve the effectiveness of rainwater collection initiatives.*

*2) **Economic Factors:** Based on the assessment, it is clear that there is a need for improvements in economic factors related to water supply within the Municipality. To address this, efforts should be made to enhance the clarity and accessibility of budget allocations, particularly by providing detailed breakdowns of expenditure; allocating additional funds for rainwater collector systems to ensure sufficient water availability, possibly through promoting participation or offering financial assistance; exploring strategies to reduce the initial cost of installing rainwater collector systems, such as bulk purchasing or streamlining installation processes, and offer financial support where necessary; developing user-friendly operation and maintenance manuals along with training programs to ensure effective upkeep of rainwater collector systems; and highlighting the cost-saving benefits of utilizing rainwater, aiming to encourage its widespread adoption and subsequent water conservation. These proposed measures aim to optimize resource utilization, foster environmental sustainability, and enhance overall stakeholder satisfaction with implemented projects.*

*3) **Social Factors:** Based on the assessment for social factors, several key areas can be targeted for improvement. Firstly,*

while sufficiency in water supply is commendable, investing in infrastructure maintenance and water conservation measures can ensure long-term sustainability. Secondly, disease prevention and health education can be enhanced through regular awareness campaigns and improved access to sanitation facilities. Thirdly, efforts to uplift the socio-economic status of residents should include implementing targeted poverty alleviation programs and creating economic opportunities. Moreover, enhancing community awareness can be achieved through educational initiatives and engagement strategies, while technological advancements can promote rainwater collection through innovative digital platforms and partnerships with technology companies. By focusing on these enhancements, the municipality can achieve a higher level of suitability and improve the overall well-being of its residents.

4) ***Technological Factors:*** *The assessment highlights varying levels of suitability across different factors related to rainwater collection systems. Enhancements could include investing in advanced water treatment technologies for better water quality, continuously updating mapping resources for precise location identification, providing comprehensive training programs for technicians to improve technical expertise, developing standardized maintenance protocols and user-friendly guides for easier implementation, and investing in high-quality materials and construction techniques to ensure the durability of rainwater collection systems. By implementing these enhancements, the municipality can optimize water quality, system longevity, and overall performance, ultimately meeting or exceeding expectations for rainwater collection initiatives.*

5) ***Legal Factors:*** *To enhance the legal aspect, it is imperative to gather comprehensive data on building codes, health and safety regulations for rainwater use, and zoning laws. These rules need to be followed carefully to ensure compliance. Additionally, ensuring that the regulatory frameworks can adapt flexibly to changing circumstances is essential. By prioritizing these areas, stakeholders can ensure that projects or plans meet legal requirements effectively and have the potential for long-term success*

6) ***Environmental Factors:*** *The assessment of the Environmental Factor reveals several areas for potential enhancement to improve its satisfactory level. Firstly, integrated water quality consideration for rainwater collection could be improved through comprehensive testing and the implementation of filtration systems. Secondly, mapping suitable areas for rainwater collection would benefit from advanced GIS technology and detailed surveys. Thirdly, monitoring air quality to understand its impact on rainwater quality requires ongoing surveillance and pollution mitigation measures. Additionally, enhancing data collection methods for rainfall measurement, implementing flood mitigation measures in rainwater collection systems, and promoting water conservation practices among local communities are crucial steps toward improving the overall suitability level of the Environmental Factor.*

D. Turnover of Assessment Tool to the Implementing Office of the Local Government Units

To implement the assessment tool effectively, herewith is the planning proposal, which can be presented to the local government unit for approval. The contents of the proposal are as follows:

1) Summary: This formulated assessment tool evaluates the availability and quality of data needed for the development of an assessment tool for the implementation of RA 6716, Rainwater Collector and Springs Development Act of 1989, in Porac, Pampanga. The main objectives of this tool are to develop an assessment tool based on PESTLE analysis, to evaluate the implementation of RA 6716, and to assess Porac, Pampanga.

The assessment criteria include political, economic, social, technological, legal, and environmental factors. The criteria are assessed using a suitability rating system that ranges from very low to high. The results of the evaluation shall be analyzed and presented as a comprehensive report, identifying areas that are suitable and areas that need improvement.

This tool will be used as a guide in determining whether Porac, Pampanga, is suitable for implementing RWCS. It focuses on parameters identified by the study as determining factors and the required data evidence that was collected. Hence, the tool is a vital resource in determining the suitability and validity of the required political, economic, social, technological, legal, and environmental factors for RWCS implementation. The tool is useful for local governments that are practiced in implementing rainwater collectors.

2) Goals and Objectives: To provide an assessment tool that examines the availability and quality of data needed for the construction of rainwater collector systems, as well as to determine whether the locale has sufficient data to transition to the implementation of RWCS.In order to accomplish this, the following factors must be considered:

- To identify the political, economic, social, technological, legal, and environmental data required for the implementation of RWCS.
- To provide a user-friendly interface for the assessment tool that would help policymakers and other planners in assessing data from their locality.
- To make recommendations to improve the quality and completeness of the data required for the RWCS implementation.
- To encourage data-driven decision-making by allowing local policymakers to make knowledgeable choices based on accurate and reliable data

3) General Provisions:

1. The assessment tool was accompanied by the PESTLE framework, which underlies the various determining factors. The necessary data's identification and the site of the government agency from which it can be obtained are also specified. In addition, a grading and remarks section was also included for the part where the assessors will be interpreted through their individual responses.
2. The subsequent documents are some of the general data that needs to be gathered in order to effectively utilize this tool.
   a. Guidelines on the Identification of Project Beneficiaries for Construction of Rain Water Collectors System (RWCS) in Public Facilities
   b. Bill of Materials or Quantities, or Detailed Unit Price Analysis for RWCS
   c. Socio-economic status of the residents in the Municipality
   d. Rainwater Collection System Blueprint
   e. An act requiring all public and private buildings to comply with constructing of RWCS
   f. Forecast rainfall in percent normal in the Municipality
3. As the compilation of necessary documents and data takes over, the separation of each document based on their respective determining factors will be undertaken.
4. After the isolation of each document, use the rubrics below to identify the level of each determining factor in accordance with the provided document in order to assess their respective suitability levels.

Rating	Interpretation
5.00	Very High Suitability
4.00 - 4.99	High Suitability
3.00 - 3.99	Suitable
2.00 - 2.99	Low Suitability
1.00 - 1.99	Very Low Suitability

5. As the grading of each determining factor of the assessment tool has been accomplished, compute the average score for each parameter (political, economic, social, technological, legal, and environmental) together with their overall average by utilizing the formula below:

$$\bar{X} = \frac{\sum_1^n Xi}{n}$$

Where:

$\bar{X}$ = Average of Score
Xi = Value of Score
n = Number of Items

6. After tabulating the data values, in order to better understand the outcome, create an interpretation based on the respective results of each parameter. This approach will serve as a basis for certain locales to consider the possible enhancements that they can offer in order to improve portions of the PESTLE framework.
7. Considering those results that attained a satisfactory or even a very high suitable level, this is an indication of the good availability of data resulting from the effective implementation of the Rainwater Collection System (RWCS) in the locale. It highlights the idea that achieving a good implementation of the system requires strict data procedures to fill the necessary gaps in order to gain long-term success.

IV. CONCLUSION

In order to better evaluate the effectiveness of the implementation of rainwater collection systems, this study has developed an assessment tool that incorporates a variety of necessary factors. The data gathered from Porac, Pampanga, underwent grading analysis and was used to examine and determine the degree of suitability of the study locale with respect to each factor by utilizing the assessment tool.

To attain the credibility of the tool, it was validated by two validators, and utilized in the City of San Fernando, where it was answered by some professionals in different fields in San Fernando, such as planning, construction, and maintenance. With the help of Cronbach alpha, the results were determined, and it shows that the assessment tool is reliable to use in the chosen locale. The tool was answered by 17 professionals who have knowledge and connections in the implementation of rainwater collectors in Porac, Pampanga. The results of this survey were tested for their significance via one-way ANOVA, and it shows that each PESTLE factor shows a low suitability rate on the evaluated data. This means that the score does not meet the expected level. To improve the results, the researchers provide numerous possible recommendations that will help the Municipality achieve the satisfactory level for the implementation of the system. These recommendations are mentioned above, where there is a section intended for the proposals for the rainwater collection system (RWCS) in the study locale in order to improve its implementation. Some of the key outlines of these proposals are the following: for the political factor, the municipality needs to improve its enforcement policies with

regards to implementation and develop public-private relationships. On the other hand, the economic factor requires detailed breakdowns of expenses in order to attain efficiency in budget allocations. Social factors necessitate water conservation measures; to attain water sustainability, they must be practiced. Meanwhile, technological factors need to focus on advanced water treatment procedures that will make quality water safe for drinking purposes. In order to enhance the legal factor, the municipality can conduct strict compliance with the public buildings to construct RWCS. And for the environmental factor, considering the quality of the air can mitigate water pollution and achieve water sustainability, which is a key factor for the long-term success of RWCS's implementation.

The connection between individual factors such as Political, Economic, Social, Technological, Legal and Environmental dictated the results of the assessment. Considering the outcome, it concluded that the Porac, Pampanga's rainwater collection system (RWCS) was not yet fully adequate to implement due to gaps on which there are some further considerations need to improve.

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