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- Assessment of program quality, institutional services and student satisfaction;
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# Analysis of Income Smoothing Practices in PROPER Companies

<sup>1</sup>Baiq Sarah Fitria Febriani, <sup>2</sup>Muhammad Ali Fikri & <sup>3</sup>Nurabiah

## Abstract

This study aims to find out and analyze whether income smoothing practices exist in companies with the Corporate Performance Rating Program in Environmental Management (PROPER). The research sample consisted of 57 PROPER companies in the Indonesia Stock Exchange (IDX) from 2017 to 2021. The data were measured by the Index Eckel using quantitative descriptive analysis. The findings of this study reveal that several PROPER companies show signs of manipulating their revenue figures to create a smoother financial picture. Most companies that obtained a blue rating on PROPER indicated income smoothing whereas the green rating, not many companies indicated income smoothing. Conversely, no company with a gold PROPER rating indicates income smoothing. It can be concluded that the higher the PROPER rating obtained by a company, the lower the possibility of companies performing income smoothing. This research implies a conflict of interest and information asymmetry between the agent and the principal which motivates management to perform income smoothing. Therefore, with this theory, an equal distribution of interests between management and stakeholders will be obtained. The novelty of this research is the use of quantitative descriptive analysis for a more in-depth analysis of income smoothing by PROPER companies as compared to previous studies. Hence, this study showed empirical evidence on the difference between PROPER companies that carry out and do not carry out income smoothing.

**Keywords:** *income smoothing, Index Eckel, PROPER companies, smoothing practices*

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## 1. Introduction

Profitability is information on the income statement that gets the main attention in determining the company's performance and accountability to shareholders. In fact, external parties such as investors will tend to pay more attention on profit information of a company (Septia et al., 2013). This is used as a tool to find out the company's financial condition at the present and in the future. Hence, to attract investors' interest, companies are often motivated to take unwise actions to generate rising or stable profit information. Earnings management is one of the unwise actions that can be taken by a company, which can be in the form of efficient performance to increase estimated profits that interests external parties (Wali et al., 2019). One strategy of earnings management is the practice of income smoothing, the most popular and frequently practiced form (Ekadjaja et al., 2020). By doing income smoothing, the company will be between the minimum profit and maximum profit so that it remains at a stable profit level. Income smoothing can provide perceptions to investors regarding the stability of the profits obtained by the company so that the profits reported by the company are as expected by investors. This can mislead external parties in making decisions because the financial statement information provided does not reflect the actual condition of the company.

In addition to paying attention to the financial performance of the company, environmental performance is also an important consideration by the stakeholders. According to Dzikir (2020), investors will be more likely interested in investing in companies that maintain environmental sustainability and still prioritize the interests of stakeholders. Stakeholders have a favorable view of companies that have good environmental management and comply with applicable regulations. One way to assess company's environmental management is through its ranking in the Corporate Performance Rating Assessment Program in Environmental Management (PROPER). PROPER is a government policy that aims to improve corporate governance in sustainably managing the environment. The higher the company rating, the better the image of an environmentally friendly company to the public. However, the existence of a good company image through PROPER does not rule out the possibility for companies to practice income smoothing. In fact, PT Kimia Farma Tbk, a PROPER registered company, was proven to practice income smoothing (Maotama & Astika, 2020).

Several cases of income smoothing occur in companies in Indonesia such as PT Waskita Karya in 2009, PT Kimia Farma Tbk in 2002, PT Bank Lippo in 2002, PT Indofarma Tbk in 2004 and PT Ades Alfindo in 2001-2004. Evaluating these public cases provides notion that there are still many companies in Indonesia that practice income smoothing for several years. The alarming fact is that PT Kimia Farma Tbk is a company registered in PROPER. Hence, it is always possible for companies registered as PROPER to practice income smoothing.

In addition to the cases, several previously conducted studies provide the same findings. For instance, Setianingsih et al. (2018) showed that from the three sample companies, PT BMI practiced income smoothing, Vidiyanto et al. (2016) found Hotel X Solo to practice income smoothing, Fatimah et al. (2019) discovered 6 companies of the 10 sample companies to practice income smoothing and Septia et al. (2013) disclosed that 22 of the 73 sample companies practiced income smoothing. It is evident that conducted studies related to the practice of income smoothing focused on associative approach: find out the relationship between variables. There is still few research conducted on descriptive analysis to evaluate income smoothing practices and test empirically whether there is a difference between PROPER companies that carry out and do not carry out income smoothing. Of the previously conducted studies, Ladistra (2017), Tasman and Mulia (2019), Ekadjaja et al. (2020), Octisari et al. (2021), and Safira et al. (2022) provide evidence that financial leverage affects income smoothing. However, research by Suhartono and Hendraswari (2020), Susmitha and Zulaikha (2021) and Angelista et al. (2021) argued that financial leverage does not affect income smoothing. In addition, profitability can also influence the existence of income smoothing practices as supported by research conducted by Ladistra (2017), Tasman and Mulia (2019), Ekadjaja et al. (2020) and Sumani et al. (2021). However, Octisari et al. (2021) and Angelista et al. (2021) showed that profitability does not affect income smoothing. In addition, company size also influences income smoothing as evidenced by the studies of Tasman and Mulia (2019), Suhartono and Hendraswari (2020), Ekadjaja et al. (2020), Susmitha and Zulaikha (2021), Burhan and Malau (2021) and Sunetri et al. (2022). However, Desiyanti and Desaputra (2018) and Octisari et al. (2021) argued that company size does not affect income smoothing.

The evidence on the existence of income smoothing practices in many companies in Indonesia and the inconsistency of the results of previous research related to the factors that

influence income smoothing are contributing factors for researchers to examine more deeply the practice of income smoothing in PROPER companies. The good company image through the PROPER rating does not rule out the possibility income smoothing practice. As compared to the previous studies, this research used descriptive approach to provide in-depth description and analysis not the causal relationships between variables (associative research). Hence, this study aims to analyze income smoothing practices in PROPER companies and test empirically difference between PROPER companies with or without income smoothing practices.

## **2. Literature review**

### ***2.1. Agency Theory***

Agency theory is a contractual relationship between the principal and the agent to perform some services on their behalf and by giving decision-making authority to the agent (Jensen et al., 1976). Agency theory explains that both agents and principals have their interests in the company. In this case, the principal or stakeholder has an interest in getting the greatest benefit as quickly as possible for the investment he is making. Meanwhile, managers have an interest in getting incentives as big as they can get. To get these incentives, management sometimes takes unethical measure. In addition, the existence of information asymmetry between the company and stakeholders makes it difficult for management's actions to be monitored by stakeholders so that management can take unwise actions to get a good assessment of the performance carried out in managing funds and making decisions.

One of the unwise actions often used is income smoothing. With such good performance, stakeholders tend to provide incentives or bonuses to management. In practice, management must provide correct information on the condition of the company so that stakeholders know the actual condition of the company and can make decisions accordingly. Therefore, with the existence of agency theory, it is expected that management can carry out its responsibilities properly and stakeholders get correct information about the condition of the company to make the right decisions.

### ***2.2. Income Smoothing***

Income smoothing is a practice that reflects the efforts made by company management to reduce abnormal variations in earnings based on good accounting and management principles (Belkaoui, 2012). The practice of income smoothing is still mostly carried out by companies in Indonesia. This is evident from the existence of income smoothing cases carried out by companies such as PT Kimia Farma Tbk, which was proven to have carried out income smoothing in 2002, one of the PROPER companies. This is also supported by studies conducted by Setianingsih et al. (2018) with three sample companies and PT BMI indicated to do income smoothing. Similarly, Vidiyanto et al. (2016) disclosed Hotel X Solo to practice income smoothing. Fatimah et al. (2019) analyzed income smoothing in food and beverage industry companies showing 6 of 10 companies performed income smoothing, and Septia et al. (2013) performed analysis of income smoothing on non-manufacturing companies resulting to 22 out of 73 companies into income smoothing actions.

Several studies showed factors that encourage companies to practice income smoothing such as financial leverage (Ladistra, 2017; Tasman & Mulia, 2019; Ekadjaja et al., 2020; Octisari et al., 2021; Safira et al., 2022), and profitability (Ladistra, 2017; Tasman & Mulia, 2019; Ekadjaja et al., 2020; Sumani et al., 2021). While there are many studies on income smoothing analysis, there is still few that conducted an in-depth analysis of the income smoothing carried out by PROPER companies.

### ***2.3. Corporate Performance Rating Assessment Program in Environmental Management (PROPER)***

In addition to paying attention to the financial performance of the company, environmental performance is also an important factor considered by stakeholders. Dzikir (2020) argues that investors would be more likely interested in investing in companies that preserve the environment and still prioritize the interests of stakeholders. Issues on the environment such as concerns on reduced environmental resilience such as global climate change, sea level warming, loss of vegetation and biodiversity, environmental damage, ecosystem change and other impacts of pollution, encourage awareness of the importance of regulatory arrangements in environmental management. To increase awareness of environmental management by the public and to maintain sustainable development that pays attention to the environment and meets community needs without reducing the potential for

meeting the needs of the next generation, the government issued a policy Corporate Performance Rating Assessment Program in Environmental Management (PROPER).

According to the Regulation of the Minister of Environment and Forestry of the Republic of Indonesia Number 1 of 2021, the Corporate Performance Rating Assessment Program in Environmental Management (PROPER) is an evaluation of the performance of those in charge of businesses and/or activities in the field of environmental management. PROPER is a form of supervision of environmental management while still paying attention to transparency and social commitment to environmental management. This rating is then announced to the public regularly every year to measure the company's environmental management. The higher the rating of the company, the better the company's image to the public. This good image will increase the trust of the community resulting to a positive impact to the company. However, the good company image attained through PROPER does not rule out the possibility for income smoothing practices. This was best exemplified by the PT Kimia Farma Tbk proven to practice income smoothing although registered as a PROPER company (Maotama & Astika, 2020).

#### ***2.4. Conceptual Framework***

This study aims to analyze income smoothing practice in PROPER companies. It uses Agency Theory, which explains the contractual relationship between the agent and the principal. The agent in this study is the management of the PROPER company while the principal is the company's stakeholders. This research is based on the existence of a conflict of interest between the agent and the principal and the existence of information asymmetry between the agent and the principal.

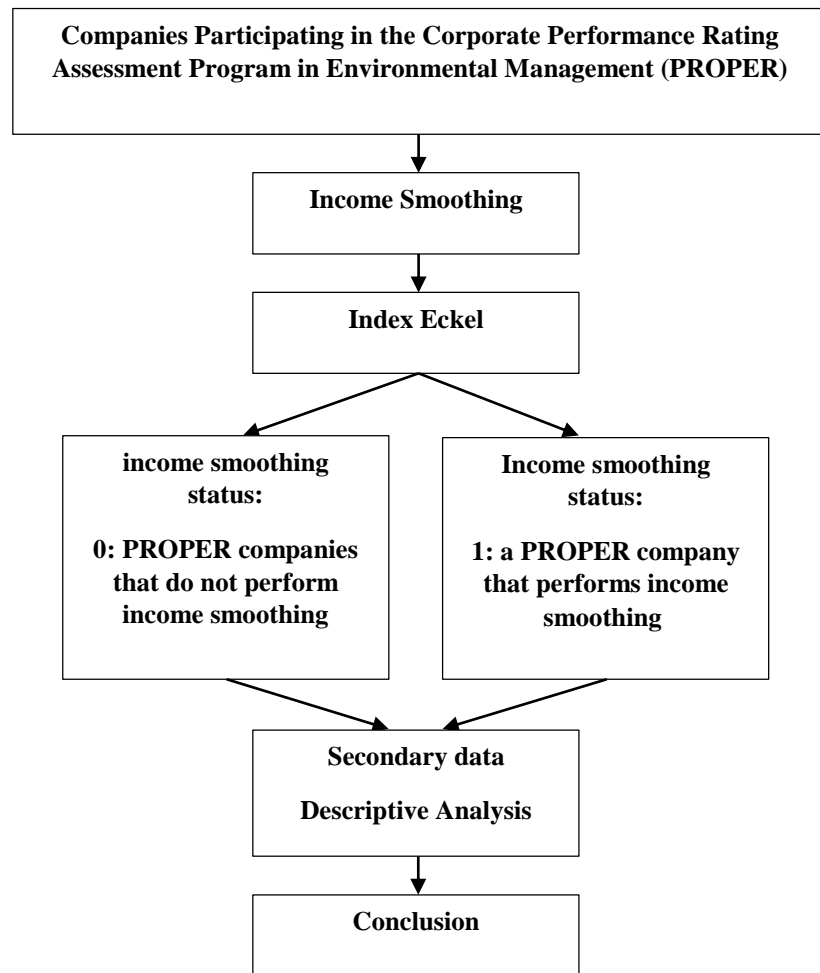
The existence of conflicts of interest and theoretical asymmetry between agents and principals can encourage unwise actions, especially those carried out by company management. Company management, which is an agent, has more information about the company's internal conditions compared to the principal. This can motivate company management to take earnings management actions. One of the earnings management practices that is often used by companies is the practice of income smoothing. In Agency Theory, it is expected that agents are always transparent in carrying out their duties and it is hoped that this theory will create an equal distribution of interests between agents and principals.



To determine whether a company practices income smoothing or not, the study used the Index Eckel calculation. The Index Eckel is the most widely used measuring tool in determining and analyzing income smoothing practices in companies. This is based on previous researches conducted by Septia et al. (2013), Kustono and Lasado (2015), Vidiyanto et al. (2016), Setianingsih et al. (2018), Desiyanti and Desaputra (2018), Manukaji and Juliana (2018), Tasman and Mulia (2019), Fatimah et al. (2019), Suhartono and Hendraswari (2020), Ekadjaja et al. (2020), Sumani et al. (2021), Octisari et al. (2021), Susmitha and Zulaikha (2021), Burhan and Malau (2021), Angelista et al. (2021), Abogun et al. (2021), Safira et al. (2022), and Sunetri et al. (2022). In analyzing the practice of income smoothing in PROPER companies using Index Eckel, coefficient of variation of changes in profit and the coefficient of variation of changes in sales were compared. The Index Eckel value for companies that do not perform income smoothing is  $\geq 1$ , while the Index Eckel value for companies that do income smoothing is  $< 1$ . Based on these premises, the conceptual framework used as a guide as well as the research direction in this study is shown in figure 1.

**Figure 1**

*Conceptual Framework*



### **3. Methodology**

#### ***3.1 Research design***

This study used descriptive research method and quantitative approach to describe the phenomenon or events of income smoothing practices in PROPER companies. Quantitative data in the form of PROPER company financial reports are collected through the official websites of the Indonesia Stock Exchange (IDX), the Ministry of Environment and Forestry, and the official websites of 57 PROPER companies.

#### ***3.2 Sample size***

The sample in this study included 57 PROPER companies listed on the Indonesia Stock Exchange (IDX) for 2017-2021 with a total of 285 data observations. This sample includes company with complete data following the criteria that provide information about the company's financial condition and environmental management to support research results. The sampling method was carried out using a purposive sampling by determining certain criteria needed in the study. The sample criteria determined in this study are:

- 1) All companies registered as PROPER companies in 2017-2021
- 2) PROPER participating companies registered on the IDX in 2017-2021
- 3) PROPER participating companies that publish complete financial reports consecutively in 2017-2021.

#### ***3.3 Dataset***

The data used in this research is in the form of PROPER company financial statements for 2017-2021 and the PROPER rating of each company. Data were obtained from the official website of the Indonesian Stock Exchange (IDX), the official website of the Ministry of Environment and Forestry of the Republic of Indonesia, and the official website of each PROPER company. The components of the financial statements used are the company's net profit and sales for 2017-2021, which are used to measure whether the company is doing income smoothing or not. Meanwhile, the company's PROPER rating is used to analyze the company's performance in carrying out environmental management.

### 3.4 Data analysis

This study used descriptive data analysis. The data collected is in the form of financial statements of participating PROPER companies, which include components of net profit and sales as well as the PROPER rating of each company for 2017-2021. Firstly, the PROPER ratings obtained from each company during 2017-2021 was assessed to evaluate the company's environmental performance. Afterwards, the Index Eckel was calculated to find out whether the company is practicing income smoothing or not by using the following formula:

$$\text{Index Eckel} = \frac{CV \Delta I}{CV \Delta S} \quad (1)$$

where:

$\Delta I$  : Change in profit in one period

$\Delta S$  : Change in sales in one period

CV : The coefficient of variation of the variable is the standard deviation divided by the expected value

The formula used to determine the value of CV  $\Delta I$  or CV  $\Delta S$  is as follows:

$$CV \Delta I \ \& \ CV \Delta S = \sqrt{\frac{\sum(\Delta X_i - \bar{X}\Delta)^2}{n-1}} : \bar{X}\Delta \quad (2)$$

where:

CV : The coefficient of variation of the variable is the standard deviation  $\Delta I/\Delta S$

$\Delta I$  : Change in profit in one period (income)

$\Delta X_i$  : Change in profit (I) or change in sales (S) in a period (income)

$\Delta S$  : Change in sales in one period (sales)

$\Delta \bar{X}$  : Average change in sales in a period (sales)

N : The number of years observed

After the calculations using the Index Eckel, an analysis is performed to determine whether the participating PROPER companies indicate practice of income smoothing or

not. According to Eckel (1981), (1) Eckel's index for companies with no indication of income smoothing practices is  $\geq 1$ . Companies that do not practice income smoothing are given a score of 0; (2) the Index Eckel for companies that are indicated to practice income smoothing is  $< 1$ . Companies that carry out income smoothing actions are given a score of 1.

This study also conducted an average difference test (t-test) to find out the difference between PROPER companies that perform income smoothing and PROPER companies that do not perform income smoothing.

## 4. Findings and Discussion

### 4.1 Findings

**Descriptive Statistics.** This study conducted data analysis using descriptive method to provide an overview and description of the data processed. The descriptive statistical test was carried out through the IBM SPSS 25 application program. Through statistics, information was obtained regarding the minimum value, maximum value, mean (mean) and standard deviation of the research components. Descriptive statistical data from the research components can be seen in table 1.

**Table 1**

*Descriptive Statistics Test*

	N	Minimum	Maximum	Mean	Std. Deviation
Profit	285	-4.E12	3.E14	4.14E12	2.247E13
Sale	285	6.E10	3.E15	5.81E13	3.147E14
Valid N (listwise)	285				

*Source: SPSS Output Results*

Table 1 shows that the lowest value of PROPER company profit is -4.E12 or a loss of IDR 4,000,000,000,000, the highest value is 3.E14 or IDR 300,000,000,000,000, the average PROPER company profit is 4.14E12 or equal to IDR 4,140,000,000,000 with a standard deviation value of 2,247E13. As for the PROPER company's minimum sales value of 6.E10 or IDR 60,000,000,000, the maximum sales value is 3.E15 or IDR 3,000,000,000,000,000,

the average sales value is 5.81E13 or IDR 58,100,000. 000,000 with a standard deviation value of 3.147E14.

**Mean Difference Test (t-test).** The mean difference test (t-test) is used to empirically test whether there is a difference between PROPER companies that perform income smoothing and PROPER companies that do not. With H1, there is a difference between PROPER companies that carry out income smoothing and PROPER companies that do not carry out income smoothing.

**Table 2**

*Mean difference test (t-test)*

Levene's Test for Equality of Variances						t-test for Equality of Means		95% Confidence Interval of the Difference	
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Equal variances assumed	1.106	0.298	1.882	55	0.065	-11.47469	6.09699	-23.69332	0.74395
Equal variances not assumed			2.333	38.723	0.025	-11.47469	4.91921	-21.42701	1.52236

*Source: SPSS Output Result*

Based on the results of the average difference test, the Sig. (2 tailed) has a value greater than 0.05, which is equal to 0.065, which means that there is no significant difference between companies that perform income smoothing and companies that do not perform income smoothing.

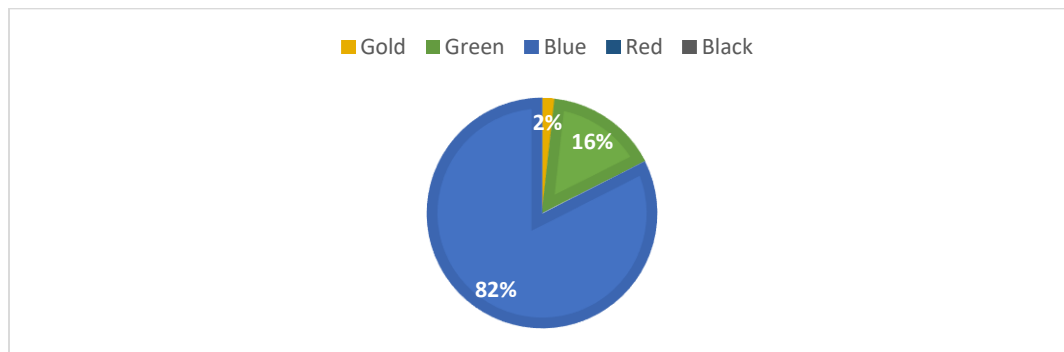
**PROPER Rating Analysis.** The Corporate Performance Rating Program in Environmental Management (PROPER) has 5 levels of ratings from the highest to the lowest, namely gold, green, blue, red and black. Every company has its ranking every year. In this study, the company's PROPER rating for 2017-2021 was averaged by giving a score to each PROPER rating. The company's PROPER rating for 2017-2021 is depicted in figure 2.

Based on Figure 2, it is disclosed that of the 57 companies as study samples, the highest percentage of PROPER ratings that most companies got was PROPER ratings in blue, which was 82% or as many as 47 participating PROPER companies. In addition to the blue rating, of the 57 PROPER participating companies sampled, 16% of the companies received a green PROPER rating, comprising 9 companies. The 2% or 57 companies had

PROPER rating in gold, which was only obtained by 1 company. There were no companies that received PROPER ratings in red and black.

**Figure 2**

*PROPER Rating*

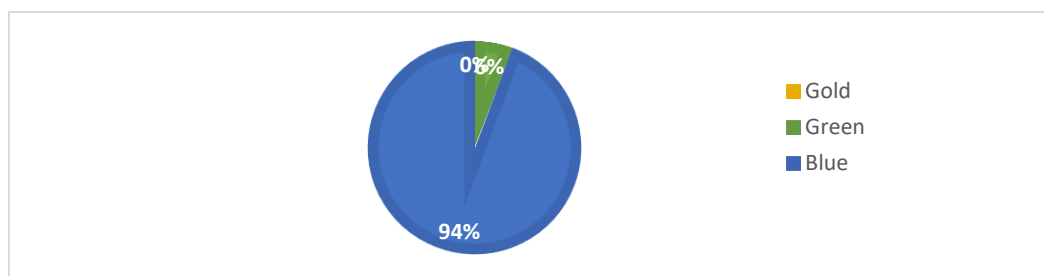


*Source: Research processed data (2022)*

**Income Smoothing Analysis.** To find out whether a company is indicated for income smoothing or not, this study used the Index Eckel measurement. The components of the financial statements used to measure the Index Eckel are the company's net profit and sales. Based on the results of the calculation of the Index Eckel, it was revealed that 61% of companies have an Index Eckel value of less than 1, which means that 61% of companies are indicated to practice income smoothing, while 39% of companies have an Index Eckel value of more than 1, which means 39% of companies are not indicated to practice income smoothing. This means that several PROPER companies are still indicated to practice income smoothing so that reported profits are not too volatile or uniform every year. Meanwhile, when viewed from the PROPER rating of each company, the description is shown in figure 3.

**Figure 3**

*PROPER rating of each company*



*Source: Research processed data (2022)*

Based on figure 3, it is evident that of the 61% (35 companies) that practice income smoothing, 94% of them are with blue PROPER rating and 6% of them are labelled with a PROPER rating of green. Meanwhile, PROPER companies with gold ratings do not indicate income smoothing practices. When viewed from the PROPER rating obtained by each company, of the 57 PROPER participating companies, 82% of the companies or the equivalent 47 PROPER participating companies had a blue rating during 2017-2021. Of these companies with a blue PROPER rating, 70% indicated that they were doing income smoothing during 2017-2021, which is equivalent to 33 companies. In terms of the green PROPER rating, out of the 57 companies, 16% of the companies or the equivalent 9 companies had a green PROPER rating. Of the 9 companies with a green PROPER rating, 22% indicated that they were doing income smoothing, which is equivalent to the 2 companies with a green rating. In the gold PROPER rating, there are as many as 2% or the equivalent of 1 company that has a gold PROPER rating but has no indication of income smoothing practices.

#### ***4.2 Discussion***

PROPER is a government program conducted to evaluate a company's environmental management. Each rating reflects the company's performance level in managing the environment, which can determine the company's image in the society. The higher the rating obtained by the company, the better the company's image in society, and vice versa. The results of the analysis show that of the 57 PROPER companies, there are no companies with red and black PROPER ratings. This shows that each company has carried out environmental management following the requirements in accordance with the applicable regulations. Of the 57 companies as samples, 82% of them are with a blue PROPER rating, 16% with a green PROPER rating, and 2% with a gold PROPER rating. The blue rating is given to companies that have made environmental management efforts in accordance with the requirements and applicable laws and regulations. This means that the company with blue PROPER rating has implemented environmental management in accordance with the requirements but still within the existing minimum standard level. The 82% of companies is equivalent to 47 companies with blue rating during 2017-2021. Of the 47 companies with blue rating, 70% indicated that they were carrying out income smoothing during 2017-2021, which is equivalent to 33 companies. This provides argument that a company with a good

PROPER rating and has carried out environmental management in accordance with the requirements does not guarantee the absence of unethical practices in reporting its profits. Similarly, the PROPER rating is not an absolute assurance of ethical practices in the reporting of company income. With the data showing majority of the companies with minimum requirements achieved in the PROPER rating, the results provide additional argument that companies with lower ratings have higher tendencies of unethical practices such as income smoothing.

Out of the 57 companies as research sample, 16% of them or equivalent to 9 companies had a green PROPER rating. Of the 9 companies with a green rating, 22% indicated that they were doing income smoothing, which is equivalent to the 2 companies. In terms of the green rating, this indicates that as many as 16% of the PROPER participating companies have carried out environmental management beyond compliance through implementing an environmental management system and utilizing resources efficiently and carrying out social responsibility properly. This means that the company has carried out environmental management above the required minimum standard and already has aspects that support environmental management such as having an environmental management system, energy efficiency, and other aspects that support management, but this has not been carried out in a sustainable manner. However, 22% of the companies with a green PROPER rating still have indications of practicing income smoothing in 2017-2021.

Moreover, there are as many as 2% or equivalent to 1 company that has a gold PROPER rating. This indicates that the company has consistently shown environmental excellence in production and service processes, as well as conducting business that is ethical and responsible to society. In terms of the results, only few companies have consistently implemented environmental management above the required minimum standard values and have also made efforts to develop communities sustainably.

The practice of income smoothing carried out by companies can be done through various possible strategies. These strategies are used by companies to keep profits looking stable by reducing fluctuations in company profits. Based on the numbers that seem abnormal, the study concludes that there are several possible strategies that management can implement to practice income smoothing, such as adjusting the useful life of fixed assets, reducing the cost of acquiring fixed assets, increasing or decreasing allowance for



impairment of receivables, conducting transactions in special relationships, shifting income and expenses between companies by transacting with companies in one holding company, charging amortization costs, acquiring profitable companies, not recording the allowance for inventory values, not recording the allowance for receivables, not estimating the value of inventories in process and carrying out a recording of investment in shares using the equity method. The practice of income smoothing, which is part of this earnings management, can be carried out by companies as an effort to minimize corporate tax payments (Wali, 2021).

Based on the results of the research, it can be concluded that the higher the PROPER rating obtained by a company, the lower the percentage of companies performing income smoothing. Similarly, the lower the PROPER rating, the greater the percentage of companies performing income smoothing. The results of this study are in line with research conducted by Vidianto et al. (2016) disclosing that Hotel X Solo performed income smoothing to reduce the variability of reported company profits. In addition, the results are congruent with that of Setianingsih et al. (2018), where 1 out of the 3 sample companies found to practice income smoothing measures to keep its profits looking stable. The results concur with the explanations of Fatimah et al. (2019) that companies normally take advantage of opportunities in transactions related to income and expenses.

## **5. Conclusion**

Based on the results of the study, it is evident that companies classified as PROPER show signs of manipulating their revenues to create a smoother financial picture. Most companies that obtained a blue rating on PROPER indicated income smoothing whereas only few companies in the green rating. Therefore, this study concluded that the higher the PROPER rating obtained by the company, the lower the possibility of practicing income smoothing. Similarly, the lower the PROPER rating, the greater the chances of companies performing income smoothing. Based on the results of the average difference test, there is no significant difference between companies that perform income smoothing and companies that do not perform income smoothing.

The results imply several decision-related action to both the company and stakeholders. As such, this can be used as input to and bases for evaluation on investment decisions to companies with PROPER rating. With the clear uncertainties as to the ethical

practices of companies on disclosure of profit and the potential misleading characteristics of companies due to PROPER rating, stakeholders need to be more cautious on choosing companies to invest in. Since the presentation of company income can be improper due to smoothing practices, stakeholders need crucial evaluations through various parameters. Similarly, investors and potential investors need to look at the ratings and figures disclosed and reported by the companies. However, a wise investor must not only look at the income figures but also evaluate the company's environmental management rating. Given the results of the study, stakeholders need to look beyond the rating to evaluate the company's performance.

This study only analyzed income smoothing that occurs in PROPER companies and does not examined in detail the factors that influence the income smoothing itself. Given the limitation of the study, further studies are encouraged on assessing income smoothing in PROPER companies including the factors influencing income smoothing practices such as company size, bonus plans, and financial leverage. In addition, this study considered income smoothing analysis carried out as a whole on dataset from 2017-2021 while companies have different PROPER ratings each year. Similarly, researchers also have difficulties in averaging the PROPER ratings obtained by companies during 2017-2021 because ratings are expressed in qualitative not quantitative form. Therefore, further research can provide a score for each rating obtained from the highest to the lowest and then look for the average PROPER rating of the company during the year of observation.

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# Satisfaction with and Challenges of Bank Remittance in Student Payments in the Philippines

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## Abstract

The education sector is one of many that has been affected by the digitization of payments and administrative processes. The study used a descriptive survey method to analyze the student payment process, focusing on the stakeholders' preferences, satisfaction, and challenges with bank remittance. The respondents included 422 undergraduate and graduate students, 13 parents, and 18 personnel in one University in the Philippines. The vast majority of respondents (63.68 percent - 95.86 percent) were aware of the university's cash payments, online fund transfers through banks, over-the-counter bank deposits, bill payments through banks, GCash, Paygate. Except for GCash, only 50% or less were aware that payments could be made through Remittance Centers and e-wallets. Payment preferences were influenced by the respondents' awareness on and the security, ease of use, and accessibility of payment platforms, resulting in a moderate level of satisfaction with the payment process. The study revealed that the student payment process requires improvement because the mode of bank remittances permitted by the University is not suited for immediate payment verification. There is a need to increase the number of bank partnerships that allow for the integration of the University's software facility for bill payment. In some areas, students do not have access to banks or bill payment services. E-wallet or digital wallet applications such as GCash can be used to pay University fees.

**Keywords:** *student payment process, bank remittance, satisfaction*

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## 1. Introduction

Before the advent of Internet technology, people used cash payment tools that involved physical money in the form of banknotes and coins (Jun et al., 2018). Then, information technology has facilitated economic developments with the emergence of non-cash transactions. These transactions do not use physical money when trading goods or services (Wulandari et al., 2016; Chaveesuk et al., 2019). Mobile users can use their smartphones to conduct transactions or make payments using applications installed on the phone, thanks to advances in information technology (Saraswat & Mehta, 2017). Several models are used to transform electronic payment transactions, including electronic payment cards, digital wallets, and electronic money used as a means of payment through devices in restaurants, supermarkets, and other payment locations (Saraswati & Mukhlis, 2018).

Payment systems have evolved into a near-cashless society, according to Solat (2017 as cited in Jumba & Wepukhulu, 2019). Since cash is difficult to manage and prone to human error and fraud, most people these days avoid paying in hard cash and prefer much more secure and instant modes of payments. Rapid advancements have aided cashless payment in ICT, federal laws, and the presence of public and private financial industry that provides monetary clearing services, such as banks, credit card companies, and automatic clearing houses. Credit cards, cheques, debit cards, and electronic money transfers are the most common forms of cashless payments (Balaji & Balaji, 2017). The introduction of cashless payment systems was intended to reduce the cost of money management, increase the effectiveness of the payment framework, and drive monetary consideration.

According to Tee and Ong (2016), there is no conclusive evidence on how the adoption of bank remittance would positively affect the economy. However, Yakean (2020) emphasized that bank remittance transaction increases sales and expand business by providing convenient, safe, and faster services to customers in making payment for goods/services. It assists businesses in saving time and cost of cash management and reducing paperwork. In line with the studies of Fabris (2019) and Singh et al. (2020), bank remittance became the most preferred means of payment since it is faster, accessible, and convenient to the users. Similarly, the study by Wulandari et al. (2016) highlighted that bank remittance transactions eliminate queuing in stores. As further emphasized by Ramya et al. (2017), cashless transactions are faster, relatively easier, and safer because there is no need to

carry much cash. This cashless method is more transparent because transactions that occur while using cashless will be automatically recorded by the system to be easily tracked. Din and Rafee (2019) argued that having less cash leads to less crime, such as burglary. People who use alternative payment methods tend to carry less physical cash when they pay. As a result, it removes the incentive for robbers to commit cash-related crimes. The related studies highlight that organizations cannot disregard data innovation. Son and Kim (2018) assert that data innovation is imperative in keeping up an aggressive edge locally and comprehensively. Most organizations' money streams are complicatedly connected to their appropriation of data innovation.

The education sector is just one of the latest sectors impacted by the digitization of payments and administrative processes. For retailers or universities, some of the benefits of campuses to go cashless include saving businesses the trouble of insuring and managing their cash, reducing the risks of employees getting robbed, and reducing human error during transactions, which can lead to profit loss. Students can save themselves the trouble of withdrawing cash at odd hours when making purchases at non-peak hours, thus ensuring their safety or saving themselves the trouble of looking for an ATM during such times (Study International Staff, 2019).

A study by Deloitte (2017) indicated considerable benefit in digitizing parent/student-facing payments processes in the education sector. By digitizing transactions between schools and parents/students, the risk of errors is significantly reduced. Further, digitizing aids the sector in confronting the issues posed by funding challenges and cost pressures. Davies (2017) explored the attitudes and perspectives of university students regarding cashless transactions and examined the disadvantages of cashless. The results proved that the favored payment technique in society is deemed to be card payment with contactless payment. The study uncovered the particular inclination for the preference of payment methods due to convenience, ease of use, and efficiency.

In the United States of America, Harvard University contracted with Western Union and Flywire to provide international students with a convenient way to pay their student account charges by wire transfer. Each company offers various payment methods, a wide range of international currency options, competitive exchange rates, and the convenience of paying through a local bank. Western Union has contracted to expedite the process of student domestic wire transfers directly to Harvard. By using Western Union, Harvard can track a



student's payment and make sure it gets posted in his/her account after the university receives it. Also, other universities like the University of Houston accept cash, money order, cashier cheques, business cheques, and personal cheques. They also accept all credit and debit cards: Mastercard, Visa, Discover, and American Express (Harvard University, 2021).

In Asia, the National University of Singapore encourages its students to pay their fees through interbank GIRO, E-payment with an online credit card, debit card, AliPay, Internet banking, NETs, Cheksa, and telegraphic transfer (the National University of Singapore, n.d.). Nyu Shanghai in China accepts payments of school fees through online banking, Epay, and Flywire, which offers multiple payment options and currencies. Students and payers can track their payments from start to finish and save on bank fees and exchange rates (Nyu Shanghai, 2021). Moreover, the City University of Hongkong accepts payments thru CityU Pay, a one-stop integrated online payment portal of the university, using popular mobile wallets like Faster Payment System (FPS), Alipay (Hong Kong and Mainland China), and WeChat Pay. Payments made by mobile wallets on CityU Pay will update student account balances instantly. For international students, CityU Pay, integrated with Flywire and Western Union, the two most popular global student fees payment networks, provides a convenient way to pay for their student account charges through a wide range of payment methods at competitive exchange rates in their home currency. The student account balance will be updated automatically once the University receives the payments, which may take a couple of days (City University of Hong Kong, 2019).

In the Philippines, De La Salle University accepts payment of school fees by cash, personal or manager's check, over-the-counter collection facility with any UCPB, Union Bank and Metrobank Branch, a credit card like MasterCard or Visa, and Debit card (De La Salle University, 2012). Also, Adamson University accepts cash, personal or manager's check, and credit card like master cards, JCB, AMEX or Visa, Gcash, and Debit cards (Adamson University, 2019).

Despite the significant benefits of using cashless payments, some consumers find it difficult to use bank remittance services due to lack of knowledge and digital readiness. Gaba and Nagpal (2017) concluded that a cashless society's main disadvantage is privacy issues and accounts hacking. Prevailing poverty, backwardness, and illiteracy, a largely unorganized sector cannot switch to a cashless economy so easily. As presented in an article by Study International (2021), going cashless could mean excluding individuals from lower-

income households who may not have a bank account, credit card, or debit card. Despite the availability of technology, some businesses and universities haven't embraced cashless transactions due to concerns about investment, supplier selection, and system implementation/management.

In addition, Maken and Shekhar (2017) revealed that mobile wallet companies are imposing about 1% to 4% charges for transactions to bank accounts which lay hindrances in readily accepting the bank remittance services. Moreover, the bank remittance services also impose a limit on money transfers. Hence, it could be cited that the restrictions laid down by the cashless payment services impose challenges for the consumers to use them wisely.

The acceptance of technology by the community in terms of the use of non-cash transactions can be linked to the Technology Acceptance Model (TAM). This information system theory involves the decision-making process whether a technology can be accepted or not accepted by users, and also as a consideration for applying new technology (Folkinshteyn & Lennon, 2016). Technology acceptance model (TAM) states that users tend to use a system when the system is easy to use and useful for them (He et al., 2018). TAM is the result of the development of the Theory of Reasoning Action (TRA), which functions to evaluate the acceptance of user technology, measured based on intention and its effect on attitudes, perceived usefulness, perceived ease-of-use on intention to use (Ofori & AppiahNimo, 2019). TAM explains that information systems can improve organizational performance, and makes it easier for users to complete one's work (Tarhini et al., 2017). TAM focuses on the characteristics of the use of information technology by users as seen from the level of convenience and benefits of technology (Maqbool Ahmad, 2018).

Over the decades, several studies have been undertaken by various researchers to study the factors affecting consumer satisfaction with various products and services. Understanding customer satisfaction is extremely important in today's business scenario as it helps devise strategies and methods to increase market share through repeat purchases and referrals. Customers' satisfaction is influenced by perceived value, image, price, quality, reliability, and comfort. Knowing the relative importance of service quality dimensions can help the universities focus on what satisfies customers the most. According to Husain et al. (2019) and Kar (2020), the convenience, merchandising, site design, usefulness, trust, social influence, credibility, and information security privacy of cashless transactions influence user satisfaction. If bank remittance is properly implemented as a mode of payment in

universities, it will increase customer satisfaction and give universities a competitive advantage. This implies that if a school can provide safe, convenient, and dependable options for paying school fees to their customers, this will influence students' decision to enroll.

In line with these, the study involved an analysis of the University's mode of payments, focusing on students' and parents' awareness, preferences, satisfaction and challenges encountered on the bank remittance mode of payment.

## **2. Methodology**

The research adopted a descriptive survey method in conducting an empirical inquiry on the university's student payment process. The study was conducted in one of the Autonomous Universities in the Philippines and included 422 undergraduate and graduate students enrolled during the first and second semesters of the school year 2021-2022, 13 parents and 18 university personnel. The number of respondents in the survey met the minimum sample size required from a population of more than 12,000 students based on Cochran's formula. The random selection of the samples was accomplished by forwarding the Google form links to the Dean's offices with the approval of the Research and Development Center. The Dean's office then forwarded the links to the faculty members, sharing them with their respective classes. Purposive sampling was employed in identifying university personnel and bank remittance personnel to be interviewed.

Survey questionnaires, interview guides, the university website, the university's Accountant's Office's Policies Procedures and Guidelines, and reports were utilized to gather the needed data. The survey consisted of close-ended questions wherein the respondents were asked to choose as many items as applicable on payment options they were aware of. In addition, to determine the most and least preferred mode of payments, the respondents were asked to rate the following choices from 1 to 6, 1 being the MOST preferred mode of payment and 6 as the LEAST preferred mode of payment: Cash payment thru university's cashier's office, Bank Transactions (Online, Over-the-counter, Bills payment), Remittance Center (Western Union, Cebuana, Palawan, Bayad Center, etc), E-wallet (Gcash, Paypal, Cliqq or 7/11, etc.), Academic Management System Portal (Paygate) and Others. Furthermore, based on the most and least preferred mode of payments, the respondents were asked to check as many items as applicable as to the factor/s affecting their preferences. The last part of the survey was for the respondents to indicate their level of satisfaction on the bank remittance process as mode of payment in the university. The interview guide on the

other hand captured the challenges or difficulties the university personnel have encountered in assisting students and parents/guardians in paying the tuition fee through bank remittance and how the bank remittance process affected their efficiency.

Before the actual data gathering, the questionnaire was administered to 30 university students for reliability testing. Students who were part of the reliability testing were excluded from the final data analysis. The reliability test revealed a Cronbach alpha equal to 0.779, which implies that the questionnaire has a good internal consistency.

From the data collected through the survey questionnaire, frequencies, percentages and ranks were computed to describe the awareness and preferences of the students and parents/guardians on the mode of payment in the university. Frequencies and percentages were likewise computed to identify the factors influencing the students' and parents/guardians' bank remittance preferences. The following scales were used to determine the satisfaction of the students and parents/guardians with the bank remittance process adopted by the university. On the other hand, the data gathered through interviews and the university website were analyzed using content analysis.

**Table 1**

*Likert scale used to describe the level of satisfaction on the bank remittance process adopted in the University*

<b>Likert Scale</b>	<b>Range</b>	<b>Interpretation</b>	<b>Descriptions</b>
4	3.26 – 4.00	Very Satisfied	Very much easy to use/Accessible all the time/ Very much secure
3	2.51 – 3.25	Moderately Satisfied	Easy to use/ Accessible most of the time/secure
2	1.76 – 2.50	Slightly satisfied	Slightly easy to use/ slightly accessible/slightly secure
1	1.00 – 1.75	Not satisfied	Difficult to use/Not easily accessible/has security problems

### **3. Results and Discussion**

#### ***3.1. Preferred Mode of Payments Among University Students and Parents and Factors Influencing their Preferences***

Before the COVID-19 pandemic in March 2020, the university students preferred to pay their school fees directly to the Cashier's office. Bank remittances, however, have replaced cash

payments as the primary mode of payment for students and parents during the peak of the COVID-19 pandemic in 2020 and 2021. Bank remittances have become a convenient method of paying tuition fees due to health and safety protocols imposed in various parts of the country. Due to the COVID 19 pandemic, cash transactions at the Cashier's office were reduced to 10% to 20% in 2020 and 2021, with the remaining 80% to 90% going to bank remittance transactions, according to the University's annual comparative collection report. The number of bank remittances increased significantly from SY 2019-2020 to SY 2020-2021, as shown in Table 2, as all classes in the University were still held entirely online during SY 2020-2021. Limited classes were permitted in SY 2021-2022, but the students and parents still made a significant number of bank transactions.

**Table 2**

*Number of bank remittances in paying the tuition fee*

Period (School Year)	Number of Bank Remittances
June 1, 2016 to May 31, 2017	2,136
June 1, 2017 to May 31, 2018	1,937
June 1, 2018 to May 31, 2019	2,090
June 1, 2019 to May 31, 2020	4,574
June 1, 2020 to May 31, 2021	31,364
June 1, 2021 to May 31, 2022	32,876

*Source: Data from nine (9) depository banks of the University*

Despite the 32,876 bank remittances made in SY 2021-2022, the majority of respondents in the study still prefer paying cash directly at the University Cashier's office, as shown in Table 3. The lowest and highest sum of ranks, as shown in Table 3, indicate the most preferred and least preferred modes of payment, respectively. According to the findings, the most preferred payment mode is cash through the Cashier's office, followed by bank transactions. Except for the 'Others' option, the Academic Management System (AMS) portal via Paygate and Remittance Centers are the least preferred modes of payment. The findings show that, despite the University's adoption of innovative payment methods, students and parents still prefer cash payments over bank remittances. One reason could be the lack of awareness of the bank remittance payment options, as indicated by 217 (49.88%) of the respondents, as well as knowledge of the use of the platforms. As shared by one student, "my parent chose to pay via

bank transactions because she didn't know how to use Paygate". Furthermore, there are only a few payment channel options when paying directly at the AMS portal via Paygate.

Table 3 also shows that the majority of the 435 respondents (203 or 66.67 percent) preferred cash payment through the cashier's office. The top three influencing factors were: more secure (75.86 percent), convenient (69.46 percent), and accessibility (62.07 percent). 'Saves time' is the least influential factor among those who prefer paying cash, with only 50.24 percent choosing this option. The findings imply that most respondents prioritize security over time savings when paying cash through the cashier's office. They prefer cash payments due to perceived risks associated with cashless or online payment methods. Security concerns the possibility of fraud and the level of protection against fraudulent activities (Hayashi, 2012, as cited in Smolarczyk, 2018). As revealed in the study by Gaba and Nagpal (2017), the main disadvantage of a cashless society is privacy issues and accounts hacking. E-commerce becomes a target for acquiring sensitive personal information and/or stealing money due to users having to provide sensitive information online, such as credit card details, not knowing if its transmission is secured (Rachna & Singh, 2013 as cited in Ching, 2017).

**Table 3**

*Students and parents/guardians' preferred mode of payments (n=435)*

<b>Modes of Payment in the University</b>	<b>Sum of Rank</b>	<b>Rank</b>	<b>n (%)</b>
<b>1. Cash payment thru UB Cashier</b>	1072	1	203 (46.67%)
<b>2. Bank Transaction</b> (Online Fund transfer, over-the-counter deposite and bills payment)	1292	2	73 (16.78%)
<b>3. Remittance Center</b> (Western Union, Cebuana Lhuillier, Palaw and Bayad Center)	1592	4	14 (3.22%)
<b>4. E-Wallet</b> (Gcash, Paypal, Paymaya, Cliqq or 7/11)	1357	3	56 (12.87%)
<b>5. AMS Portal</b> (Paygate)	1635	5	40 (9.20%)
<b>6. Others</b>	1806	6	49 (11.26%)

Payment convenience was another reason most respondents preferred the cashier's office over bank transactions, remittance centers, and e-wallets. According to Smolarczyk (2018), convenience is associated with ease of use, payment process speed, money transfer speed, and portability. Payments made at the cashier's office are automatically credited to the student's ledger, which respondents find convenient. Students and parents will no longer email the Accountant's office proof of payment. When payments are made through bank transactions,

remittance centers, and e-wallets, the student must wait at least ten (10) days after the university receives the bank remittance details before the payment is posted to his/her ledger and an official receipt is issued. The delayed posting is due to the accounting office's verification processes, as outlined in the Accountant's Office's PPG for Bank Remittances. As confirmed by the survey results, 268 (61.61 percent) of respondents preferred bank remittances through remittance centers and e-wallets the least because of delays in posting/crediting payments in the student's ledger, 225 (51.72 percent) indicated that there are many processes in crediting payments in the student's ledger, and 201 (46.21 percent) indicated that they don't have any notification if it was already credited in the student's ledger.

Further analysis of the survey results shows that most respondents considered paying directly at the cashier's office due to its accessibility. Because of its convenient location, the cashier's office is easily accessible to students and parents from Baguio City and surrounding areas. This will address the issue when the accessibility of online payment platforms is a major concern. Online payment is not the most convenient option in some areas of the region and other parts of the country due to limited internet access and technology usage. According to Rachna and Singh (2013, as cited in Ching 2017), one of the issues and challenges in the electronic payment system is the lack of usability, which means that the online forms require a lot of information from users and using of complex website interface that makes it difficult for the users to adopt. Furthermore, according to Yakean (2020), e-payment applications such as PromptPay, QR code, or e-Wallet cannot be used without a smartphone or tablet. As a result, users must have technological skills, a smartphone, and access to technology. According to survey results, "higher fees in other modes of payment" and "excessive transaction rates" discouraged students from using bank remittances. As revealed in the study by Maken and Shekhar (2017), mobile wallet companies impose about 1% to 4% charges for transactions to bank accounts which lay hindrances to readily accepting bank remittance services. Moreover, the bank remittance services also impose a limit on money transfers.

The respondents' payment preferences can be explained by the Technology Acceptance Model (TAM), which states that users tend to use a system when it is simple to use and useful to them (He et al., 2018). Furthermore, technology acceptance is measured based on intention and its effect on attitudes, perceived usefulness, perceived ease-of-use, and intention to use, according to the Theory of Reasoning Action (TRA) (Ofori & AppiahNimo, 2019). As Świecka and Grima (2019) point out, despite the development of cashless payments, cash remains

powerful because it meets consumers' expectations. While the role of cashless payments is growing, it is not growing at the rate that institutional stakeholders in the financial market would expect. Cash has a significant advantage in the consumer payment market in terms of ease of use and transaction costs. The survey results are further explained by the study of Nguyen and Nguyen (2020) that awareness of usefulness, awareness of risk, awareness of trust, awareness of the ease of use, product uncertainly perception, and perceived behavioral control have effects on the behavior of deciding on online payment methods. Awareness of risk has the strongest negative impact on online payment method decision behavior, and awareness of usefulness has the strongest positive impact on online payment method decision behavior.

Even though 75 percent to 81 percent of respondents were aware that payments could be made through banks, due to delayed posting in the student ledgers and security concerns, only 16.78 percent chose bank transactions as their preferred mode of payment, as shown in Table 2. Of those who preferred bank transactions, convenience (75.34 percent), accessibility (71.23 percent), and greater efficiency were the factors that most influenced their choice (68.49 percent). 'Saves time' and 'more secure' were chosen least by the respondents. The survey results are consistent with the findings of Świecka and Grima (2019), who discovered that when choosing between cash and cashless forms of payment, the most important factor is the ease of transaction, followed by speed and safety, and the least important is cost. Surprisingly, as the authors point out, safety is not a top priority for all payment systems. The current survey results coincide with the study of Davies (2017), which proved that University students favored card payment over contactless payment. The preference for payment methods was due to convenience, ease of use, and efficiency.

One of the primary advantages of bank remittances over cash payments through the Cashier's office is eliminating the need to travel to the University and wait in line to pay. Bank remittances are a better option for those who live far from Baguio and cannot travel due to COVID-19 health and safety protocols. According to Fabris (2019) and Singh et al. (2020), bank remittance has become the most preferred method of payment by customers because it is faster, more accessible, and more convenient for the users. Similarly, Wulandari et al. (2016) found that bank remittance transactions eliminate store queuing. In addition, with the number of banks with which University has partnered in recent years, bank transactions have become increasingly convenient for students.



### *3.2. Level of satisfaction of the students and parents/guardians on the bank remittance process adopted in the University*

According to the survey results, respondents were moderately satisfied ( $M=2.88$ ) with the University's bank remittance payment method. This implies that the majority of respondents are moderately satisfied with the ease of use, accessibility, and security of the bank remittance facilities. Ease of use is one of the most important measures of customer satisfaction, especially in online transactions, since they are often complicated and intimidating to some users. Further, ease of use is related to efficiency, which is the ability of the customer to get to the website, find their desired product and information associated with it, and check out with minimal effort" (Parasuraman et al., 2005 as cited in Smolarczyk, 2018). Smolarczyk (2018) defines convenience as "the ability to conduct payments quickly, easily, and independently of the possession of cash and cards." Another factor that influences satisfaction is accessibility. Because of the number of University partners accepting tuition fee payments, most payment options are accessible physically and online.

Bank remittances as a mode of payment in the University are very easy for students and parents to use because they allow them to transact business more quickly and efficiently. They also save time because customers, such as parents and students, do not have to go to the university to pay their school fees physically. They can avoid hassles while also saving time this way. In terms of accessibility, many companies offer multiple modes of payment via bank remittance; some can be accessed online, allowing students and parents to select and obtain the services provided by remittance centers easily. It is simple to use when sending and receiving money and paying bills and school fees. Bank remittances are more efficient because payment of goods and services via any mode of bank remittances is a time-saving and effective option for customers. The transaction is properly documented in real-time so that the customer can determine whether the payment has been transferred to the intended recipient. Parents and students can use bank remittances to pay their school fees efficiently, systematically, and cost-effectively. To increase security, parents and students must pay a convenience fee. Security is essential for anyone conducting an online transaction. Cardholder information is highly sensitive and can be used fraudulently if it falls into the wrong hands.

The survey results show that there were 90 (21.69%) and 30 (6.90%) respondents who were slightly satisfied and not satisfied, respectively, with bank remittance as the mode of payment. One factor that could have affected students' satisfaction was the aspect of customer

responsiveness. Customer responsiveness refers to your business's ability to respond to service inquiries and fulfill them on time. This includes both the speed it takes your agents to initiate the interaction and the time it takes for them to complete the customer's request (Fontanella, 2022). As shown in the study of Smolarczyk (2018), quality and satisfaction are influenced by the customer's ability to communicate with the technical support and customer service representatives and the quality of this contact (interactive fairness/contact), complaints management, including the procedures, policies and responsiveness (how fast the company manages the problem) (procedural fairness/responsiveness). The main problem with the University's bank remittance process was the posting and crediting payments to the student ledger.

### ***3.3. Challenges encountered by University personnel associated with bank remittance as mode of payment***

The increasing number of bank remittances made by the University students in the last two years is indicative that many students are adopting to this mode of payment, recognizing convenience, accessibility and efficiency of such mode of paying the tuition fee. The main problem with the bank remittance mode of payment is the delayed posting and crediting of the remittance to the student's ledger. The procedure followed by the university is tedious thus posed challenges to both students and university personnel. The student emails the bank transaction slip or deposit slip and the slip is printed, verified and sent to the cashier for the issuance of official receipt and posting to the student's ledger. With the volume (in thousands) of emails to open and reply, the finance department could not easily cope with the demand from the students for immediate posting of their bank remittances to the banks of the university. In addition to the process, those emailed deposit slips or bank transactions should still be verified from the bank book if the remittance was credited to the university's bank account. Once verified, the student's name will be indicated opposite the amount paid. Online interviews among School secretaries, Finance department and Office of Student Affairs (OSA) personnel revealed several challenges in verifying proof of payments from some students. Some students did not provide complete information, such as a reference number, full name, ID number, program, and amount, while others submitted blurred copies of their payments. There were also multiple emails from one student for a single payment via bank remittance. Furthermore, if students do not receive an immediate response, they will send multiple files or follow-up emails.

Students' knowledge and attitude toward the payment process were also identified as challenges in the bank remittance process. Some students continue to inquire as to which banks accept tuition payments. Some students do not respond to messages sent by University personnel requesting payment verification. They become irritated when their payment does not appear in their account immediately. Students who do not follow instructions made the verification process more difficult because some sent bank remittances via telefax or office email rather than the email address specified by the finance department. They beat the banking hours or cut-off to pay "on time." Another issue was dishonesty, as some students borrow their classmates' bank remittances and used them as their own payment.

#### **4. Conclusion**

Most respondents were aware of the various modes of payments adopted by the University attributed to the information dissemination strategies employed by the University. Payment preferences were influenced by the respondents' awareness and the security, convenience of use, and accessibility of the payment platforms. There were concerns with the bank remittance process that affected the respondents' satisfaction level and the efficiency of concerned offices during the enrollment period. There are known advantages of bank remittance mode of payment as proven in several literatures and the current survey. But in the context of the University of Baguio payment system, these advantages were outweighed by the lack of awareness of some students and parents about the payment process and the tedious process of crediting payments in the student ledger. The study shows that the student's payment process needs improvement because the mode of bank remittances allowed by the University may not be suited for immediate payment verification. Thus, there is a need to increase the number of bank partnerships that allow the integration of the University's software facility for bill payment. There are areas where students do not have access to banks or bill payment services. E-wallet or digital wallet applications such as GCash can be used to pay University school fees.

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# Participative Budgeting, Procedural Fairness, Distributive Fairness and Budgetary Slack: Evidence from Hospitality Sector in Indonesia

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## Abstract

Budgets are important for owners and management in planning, controlling and serving as the basis for measuring performance. In the budgeting process, management often acts unethically, such as making budgetary slack and manipulating data. This study analyzes the direct and indirect relationship between budget participation and budgetary slack. Questionnaires were distributed to 74 respondents who work as supervisors or managers in the hospitality industry in the city of Bandung, West Java, Indonesia. The data is processed using a SEM with the help of Smart-Partial Least Square software with structural models and measurement models. This study shows that budget participation has a positive relationship with procedural fairness and distributive fairness. In addition, budget participation, procedural fairness and distributive fairness has a negative relationship with budgetary slack. Moreover, procedural fairness and distributive fairness mediate the relationship between budget participation and budget slack. This study supports the theory of budget participation and budgetary slack and has implications for budgeting practice. Hence, in the process of preparing the budget, it is very important to involve subordinates because it can reduce budgetary slack.

**Keywords:** *Budget Participation, Procedural Fairness, Distributive Fairness, Budgetary Slack*

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## 1. Introduction

Planning is important for running a business to determine what things to achieve in the future and the steps to be taken to achieve these goals. Budgeting is a part of planning (Garrison et al., 2021) that helps management and owners plan and exercise control to compare what actually happened with what was expected in the budget (Mowen et al., 2018). According to Warren and Tayler (2020), there are several behaviors that can arise in the budgeting process: the budget is set too tight, so it is difficult to achieve; the budget is set too loose, so it is easy to achieve; and the goals of a budget conflict with company and employee goals. When the budget is used as the primary tool for management to assess performance, the objective of the budget becomes a very influential decision to set performance evaluation standards and managers' salaries (Sheng, 2019). This can significantly affect the behavior of managers because their financial status and career can be affected, either positively or negatively, depending on how the budget is used (Mowen et al., 2018). On the bright side, management can be motivated to pursue predetermined targets. However, it can also make management act unethically. One of the unethical actions taken by management is creating budgetary slack and manipulating data (Klein et al., 2019; Langevin & Mendoza, 2013).

Budgetary slack occurs when management deliberately underestimates revenue or overestimates costs so that the budget can be more easily achieved (Devie et al., 2018; Mowen et al., 2018; Staley & Magner, 2007). It is a condition where the budget is set with a biased estimate of conditions that will occur in the future (Little et al., 2002; Staley & Magner, 2007). In this case, management tries to reduce the risks it faces when there is uncertainty in the future, and in the end, it is easier to meet targets and receive bonuses (Schmitz, 2020). Participation in budgeting is one of the factors that influences budgetary slack (Chong & Strauss, 2017; Mowen et al., 2018; Onsi, 1973; Schmitz, 2020; Schoute & Wiersma, 2011; Wafiroh et al., 2020). By involving lower-level managers in preparing the budget, budget goals can turn into personal goals for managers, so that budgets can be prepared in such a way as to follow the manager's wishes (Mowen et al., 2018). But some argue that a high level of participation does not lead to a higher level of slack in the budgeting process (Schmitz, 2020) and can even be used by companies to reduce the level of budgetary slack (Chong & Strauss, 2017; Onsi, 1973; Schoute & Wiersma, 2011; Wafiroh et al., 2020). Participative budgeting will lead to good communication so that a manager does

not feel pressure to create a budget (Onsi, 1973). With more and more information obtained from the participation process, the value of a budget can be more accurate and can reduce the slack that occurs. This indicates the possibility of the influence of intervening variables. This study expands the literature on budgetary slack by adding procedural and distributive fairness.

Procedural fairness is an individual's perception of fairness in the procedures and systems applied by the organization in determining the allocation process (Leventhal, 1980). Being involved in the decision-making process can satisfy someone's desire to be heard and their views considered (Chong & Strauss, 2017). Several studies have examined whether budget participation helps improve individual perceptions of procedural fairness (Klein et al., 2019; Maiga & Jacobs, 2007; Osikhena & ODIA, 2013). Participating in budgeting will also increase individuals' perceptions of fair rewards because they are involved in the budgeting process (Langevin & Mendoza, 2013). On the other hand, distributive fairness emphasizes the individual's perception of everything that is accepted as fairly distributed according to certain criteria (Schmitz, 2020). Several studies have been conducted to test whether participation in the budgeting process can increase individual perceptions of distributive fairness (Devie et al., 2018; Maiga & Jacobs, 2007; Wentzel, 2002; Zahro & Januarti, 2016). When management's perceptions of the budgeting process or the results of the distributive process are perceived as unfair, the propensity to create budgetary slack will increase (Wentzel, 2004).

Several studies have discussed budgeting in the manufacturing and distribution sectors (Chong & Strauss, 2017; Devie et al., 2018; Kohlmeyer et al., 2014; Little et al., 2002) and in the public sector (Kinnersley & Magner, 2008; Mahmudah, 2016; Ozer & Yilmaz, 2011; Staley & Magner, 2007). However, this research focuses on the hospitality industry in the city of Bandung. If compared between the hospitality industry and the manufacturing industry, managers in the hotel industry must face a more uncertain, complex and competitive working environment (Dakhli, 2021). In fact, the COVID-19 pandemic has had a considerable impact, especially on the tourism sector. Based on information from the Bandung Culture and Tourism Department (2020), there was a decrease of more than 50 percent from 8.4 million tourists in 2019 to 3.2 million tourists visiting Bandung in 2020. As the world prepares for the end of the pandemic and prepares to return to how it was before,

business people in this field need to prepare strategies to increase business and profitability, one of which is a financial and cost management strategy (Afianti & Megasari, 2022). Budgeting is a form of strategy in financial management for the future (Mowen et al., 2018). Budgeting serves to plan and control the business effectively to maximize optimal productivity and profitability (Arnold & Artz, 2018). The operational budget is one of the things that is very necessary, especially in managing the hospitality business, because it contains important information about costs that can be controlled to determine the true ability and effectiveness of managers (Dopson & Hayes, 2017).

Operational budgets are used in predicting the revenue, expenditure and profit that will be generated in a period. Establishing the rates of rooms sold and managing costs effectively is essential to determining the profitability of the hotel operated (Dopson & Hayes, 2017). Based on a study conducted by Steed and Gu (2009), most hotels prepare annual budgets established based on previous year's achievements and structured based on monthly and departmental formats. For the profit center department, it typically covers all revenue and expenditure, while for the cost centre department, it usually only covers projected expenses for a certain period (Chibili, 2017). Therefore, control is important in budgeting in the hospitality industry because the budget is also used as one of the performance measurements to determine the bonuses to be allocated (Steed & Gu, 2009). By involving subordinate participation in budgeting practices in the hospitality, it is one way to influence positive behavior (Dakhli, 2021) as well as avoid budgetary slack (Garrison et al., 2021).

In the private sector, generally, the budget is information that is closed to the public because it is a company secret, while in the public sector the information is open and can even be accessed by the public so that it can be seen and discussed (Arifin, 2017). With the lack of control exercised by independent parties in preparing the budget, researchers are interested in conducting research on the private sector, especially the hospitality industry. This research focuses on how the effect of budget participation on budgetary slack is mediated by procedural and distributive fairness. There is still limited study that examine directly the effect of procedural and distributive fairness on budgetary slack (Little et al., 2002; Ozer & Yilmaz, 2011; Setin et al., 2021; Wentzel, 2004). By discussing more deeply

the fairness factor in budgeting, it is hoped that it can contribute to the literature and policymakers understanding of the budgeting process.

## **2. Literature review**

### ***2.1. Budget Participation***

Budget participation allows subordinates to participate in voting opinions so that they can influence the budget setting process (Mowen et al., 2018; Schmitz, 2020). Participation can make subordinates provide better information to superiors with the aim that budgets can be prepared more accurately (Nouri & Parker, 1998). In a nutshell, budget participation is the participation of subordinates in preparing budgets where quality information is provided by subordinates to superiors thereby encouraging managers to make better budget decisions. Budget participation encourages subordinates to provide more in-depth information, because often top management is not involved in detail in day-to-day operations. Meanwhile, top management has a major role in formulating strategy. By involving lower-level managers, it can encourage top-level managers to make optimal plans (Garrison et al., 2021). Providing employees with opportunities through budget participation can enable them to understand strategy and expectations, enabling them to perform tasks more effectively (Nguyen et al., 2019).

### ***2.2. Procedural Fairness***

Procedural fairness is an individual's perception of the fairness of procedures and systems implemented by organizations in determining the allocation process (Leventhal, 1980). Procedural fairness is a term used for the view that fairness is used in procedures to control and manage a process (David, 2021). This concept places more emphasis on one's views when assessing a procedure. One of the methods used in assessing procedural fairness is when procedures in making budgetary decisions provide opportunities for employees to be involved in voicing opinions and making appeals and of course procedures are made consistently, accurately and impartially for personal gain (David, 2021; Staley & Magner, 2007). There are two perspectives on how employees can assess procedural fairness (Langevin & Mendoza, 2013). The first is when employees will focus on long-term rather than short-term results, because the long term is more favorable for them. In this view, it focuses on material results such as rewards. Second, when employees pay attention to the

fairness of budgeting procedures because they want to be treated as fairly as possible because they show their values in an organization. In this view, the focus is on psychological outcomes such as self-confidence and recognition from the group.

There are six rules that individuals use in determining the allocation procedure according to Leventhal (1980). Consistency rule believes that procedures are applied consistently over time. Bias-suppression rule believes that at all points of allocation, self-interest that benefits one person should be prevented. Accuracy rule believes that in the process of determining allocations, all of the information should be processed with minimum errors. Correctability rule suggests an opportunity to change or change the rules that have been set. Representativeness rule states that in determining the allocation, it must represent the group of people involved in the organization. Ethicality rule is based on ethical rules which state that the distribution procedure must represent basic morals and ethical values accepted by individuals.

### ***2.3. Distributive Fairness***

Distributive fairness is an individual view that rewards, punishments or resources are distributed fairly according to certain criteria (Leventhal, 1980). The main concept of distributive fairness is "fair share". Employees will perceive it as fair when the allocation of salaries, rewards, and promotions is appropriate and distributed according to what they do (Maiga & Jacobs, 2007; Schmitz, 2020; Sheng, 2019). In other words, distributive fairness can be felt when what is done and what is received is balanced (David, 2021). The difference between what is received and what is normally received is an unfair condition for employees (Magner & Johnson, 1995). In measuring the level of distributive fairness, there are three ways that need attention; must reflect a need, according to expectations, and the budget can be properly accepted (Magner & Johnson, 1995).

### ***2.4. Budgetary Slack***

Budgetary slack occurs when management underestimate revenue and/or overestimate costs to make the budget easier to achieve (Devie et al., 2018; Mowen et al., 2018; Staley & Magner, 2007). Managers often plan concessions to avoid future unforeseen circumstances (Warren & Tayler, 2020). Often the budget is made by reducing its productive

ability when its performance will be evaluated (Young, 1985). In the private sector, managers will focus on income and costs, whereas in the public sector they usually only focus on costs, because usually the public sector does not focus on income. The budgetary slack can be seen from two perspectives. The good thing is, budgetary slack can make management better prepared when facing bad things in the future. Bad things make management act unethically for their personal interests. According Onsi (1973), there are several attitudes of managers when creating budgetary slack: the manager proposes an easily achievable budget to protect himself; there are two levels in preparing the budget, between himself and his superiors and between himself and his subordinates; under good business conditions, supervisor will accept a reasonable level of budgetary slack; and budgetary slack is good for doing things that cannot be officially approved.

### ***2.5. Budget Participation and Budgetary Slack***

Factor that influences the budgetary slack is budget participation. Participation describes how subordinates are involved in giving opinions to influence the decision-making process (Schmitz, 2020). Budget participation can lead to good communication, thereby making managers feel less pressured to create slack in the budget (Onsi, 1973). Cooperation between superiors and subordinates is something that has a positive impact on the organization. When subordinates participate in budgeting, they will be encouraged to share the information they have so that budgets can be prepared more accurately (Said et al., 2023). When subordinates have right to participate, they tend not to create budgetary slack because they do not want to lose the right to participate (Chong & Strauss, 2017). Thus, it can be said that a high level of budget participation will reduce the budgetary slack. This is in line with previous research by Chong and Strauss (2017), Huseno (2017), Onsi (1973), and Said et al. (2023).

H1: Budget participation has a negative relationship with budgetary slack.

### ***2.6. Budget Participation and Procedural Fairness***

Budget participation is part of the management control system, which is used to ensure that the behavior and decisions of subordinates are consistent with organizational goals and strategies (Langevin & Mendoza, 2013). Based on the representativeness rule

developed by Leventhal (1980), a person will experience higher fairness when they are involved in the allocation determination process. Participation in the budgeting process will increase data accuracy because it allows subordinates and superiors to exchange information (Klein et al., 2019). In the "Group Value" model developed by Lind and Tyler (1988), in general, people value participation in a group and respect their status as members in a group. So that someone will feel fairness when given the opportunity to express an opinion because it is a form of participation in a group (Devie et al., 2018; Klein et al., 2019; Maiga & Jacobs, 2007; Osikhena & ODIA, 2013; Wentzel, 2002; Zahro & Januarti, 2016). Participation allows subordinates to give opinions and be proactively involved in providing input and fulfilling ethical criteria, because it is in line with moral values that must be owned by someone who has the opportunity to be involved in target setting (Klein et al., 2019).

H2: Budget participation has a positive relationship with procedural fairness.

### ***2.7. Procedural Fairness and Budgetary Slack***

When implementing budgeting procedures, decision makers must treat subordinates well, respect employee rights, avoid self-interest, respect subordinate opinions, and provide feedback regarding budget decisions and their consequences (Staley & Magner, 2007). When employees or managers perceive budgets, targets, budget evaluation process to be unfair, they tend to turn things around and creating budgetary slack, engaging in budget games, or behaving unethically (Schmitz, 2020). When budget procedures are applied fairly, managers will try to collect information from various sources and the best size in the budgeting process. Conversely, when budget procedures are not applied fairly, a person is not optimally motivated in preparing a budget. This creates a negative influence on individual perceptions of fairness and budgetary slack, making it more likely that slack will occur when the budgetary process or outcome is perceived as unfair (Langevin & Mendoza, 2013; Wentzel, 2004).

When the processes and procedures in the participatory budgeting process are considered fair, the manager's tendency to create slack will decrease (Chong & Strauss, 2017). This is because the involvement of managers in the budgeting process will increase one's views in assessing fair budgeting procedures. With increased procedural fairness,

managers will avoid the tendency to create budgetary slack (Kinnersley & Magner, 2008; Little et al., 2002; Ozer & Yilmaz, 2011).

H3: Procedural fairness has a negative relationship with budgetary slack.

H4: Relationship between budget participation and budgetary slack is mediated by procedural fairness.

### ***2.8. Budget Participation and Distributive Fairness***

In the self-interest model, a person is involved in a process that determines a decision because basically they care about what they will get (Lind & Tyler, 1988). In that way, the perception of fairness will increase along with being given the opportunity to participate because someone will believe that what is given will affect the desired outcome (Wentzel, 2002). In terms of budgeting, participation will also provide an opportunity for managers to influence the targets and resources allocated to them which will then affect their performance appraisal. Thus, participation in budgeting increases the likelihood that managers will be fairly rewarded because their judgments depend on the budgets they have helped set (Klein et al., 2019). Therefore, budgetary participation has a positive relationship with distributive fairness (Devie et al., 2018; Maiga & Jacobs, 2007; Wentzel, 2002; Zahro & Januarti, 2016). Participation provides a higher opportunity for managers to determine a more profitable allocation of resources (Devie et al., 2018).

H5: Budget participation has a positive relationship with distributive fairness.

### ***2.9. Distributive Fairness and Budgetary Slack***

In the concept of distributive fairness, someone will compare the results received with the contributions made (Greenberg, 1990). Employees feel that the contribution that has been made is in accordance with the rewards that will be received (incentives, bonuses), then the perception of distributive fairness will increase. When employees feel unfair about the results they will receive, they may engage in creating budget slack and manipulating data to get fair results (Klein et al., 2019). The concept of "budgetary slack" assumes that when slack are applied, they will use them to increase profitability at the end of the year with the aim of influencing the compensation to be received (Onsi, 1973). Budgetary slack and data



manipulation will help managers offset perceived fairness and improve their performance and get rewards accordingly (Langevin & Mendoza, 2013). It is expected that distributive fairness has a negative relationship with budgetary slack (Wentzel, 2004). The higher the perception of distributive fairness, the budget slack can be minimized.

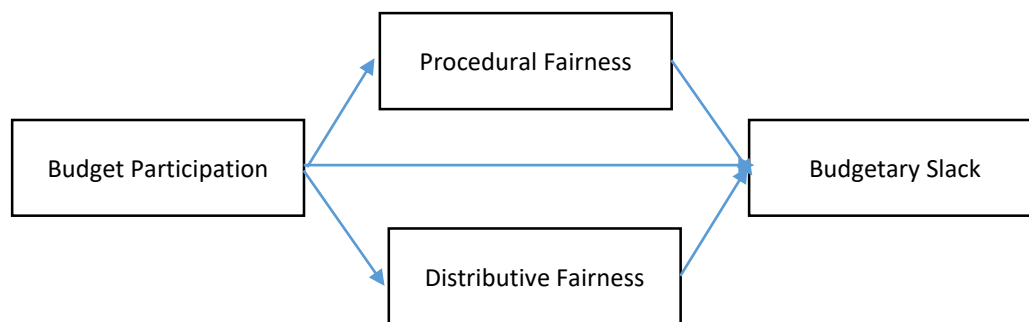
During the participation process, a manager will have the opportunity to influence the targets and resources to be taken. So that the opportunity to achieve the specified target will be more easily achieved and affect the assessment and rewards they will receive. Thus, the perception of distributive fairness will increase (Langevin & Mendoza, 2013). It is expected that distributive fairness has a negative relationship with budgetary slack (Wentzel, 2004).

H6: Distributive fairness has a negative relationship with budgetary slack.

H7: Relationship between budget participation and budgetary slack is mediated by distributive fairness.

**Figure 1**

*Hypothesis Framework*



### 3. Methodology

This research was conducted by collecting primary data obtained from questionnaires. The subject of this research is a company in the hotel sector with the criteria of a five-star hotel in the city of Bandung – Indonesia, which consists of 1 - 5-star hotels. The criteria for the unit of observation (respondents) in this study are employees who are at the manager or supervisor level. The sampling technique was convenience purposive sampling with the aim to select only personnel involved in the budgeting process. Most of questionnaires were distributed to hotels that are members of a chain hotel or group of affiliated hotel (e.g. Accor,

Archipelago International, Ascott, InterContinental Hotels Group, Starwood Hotels Marriot, etc.) and some were distributed to local hotels that had already implemented a budgeting system. Respondent represented various functional areas that are usually involved in budget practices, including sales, marketing, finance/accounting and operation division (e.g. room division, food and beverage division). These selection criteria ensured that the respondents chosen were experienced in budgeting issues in their respective organizations. The author distributes survey papers to managers and supervisors directly and distributes Google Forms via LinkedIn. The questionnaire contains personal data regarding gender, age, place of work, position and statements regarding involvement in budgeting. Researchers guarantee that all data collected were kept confidential.

The sample size to be tested can be determined using the 10 times rule formula proposed by Barclay et al. (1995). Based on these rules, the sample size must be greater than the largest number of structural paths leading to a particular construction multiplied by 10. In this study, the largest number of structural paths leading to the construct is 3, so the minimum sample size is 30. According to Hair et al. (2014), it is recommended to use Choen's (1992) formula with sufficient statistical power. With a significant level of 5%, a statistical power level of 80%, a minimum  $R^2$  of 0.25, and a maximum number of arrows to the construct is 3, the minimum sample size required is 59. Measurement were made by using a five-point Likert scale.

**Table 1***Respondent Profile*

<b>Respondent Profile</b>	<b>Σ Respondent</b>	<b>%</b>
<b>Sex</b>		
Man	44	59%
Woman	30	41%
<b>Total</b>	74	100%
<b>Age</b>		
< 30 years	16	22%
30 - 40 years	45	61%
41 - 50 years	9	12%
51 - 60 years	4	5%
<b>Total</b>	74	100%
<b>Position</b>		
Manager	50	68%
Supervisor	24	32%
<b>Total</b>	74	100%

Of the 77 questionnaires distributed, only 74 could be processed according to the criteria for being involved in preparing the budget. Table 1 shows 74 respondents who participated, at most 59% or 44 people were men, 61% or 45 respondents aged 30-40 years, and 68% or 50 respondents held managerial positions.

Data were tested using Partial Least Square(PLS), and Structural Equation Modeling (SEM) using the Smart PLS application. The analysis was carried out with a structural model or inner model and a measurement model or outer model.

**Table 2**

*Test Indicator*

VARIABLE	SOURCE	INDICATOR
Budget Participation	Milani 1975	1. I am involved in the budgeting process
		2. My supervisor explains the budget revision clearly
		3. My boss and I often discuss budgets
		4. Budget is heavily influenced by me
		5. I have a very important contribution to the budget
		6. My supervisor often starts discussing the budget when preparing the budget
Procedural Fairness	Magner and Jhonson (1995), Greenberg (1993)	1. All divisions consistently implement budgeting procedures
		2. Time to time budgeting procedures are applied consistently
		3. Accurate information and well-informed opinions are the basis for making budgetary decisions for my division
		4. I can appeal the budget set for my division because it is stated in the budgeting procedure
		5. Current budgeting procedures comply with my own ethical and moral standards
		6. Budget procedures allow decision makers to be impartial to one of the divisions
		7. The attention of all divisions has been represented by the established budgeting procedures
		8. The budget allocation for my division has been sufficiently explained by the decision makers
Distributive Fairness	Magner and Johnson (1995), Greenberg (1993)	1. My division receives a decent budget
		2. The budget allocated to my division is sufficient to reflect my needs
		3. My division's budget is as I expected
		4. The budget is allocated fairly
		5. When discussing distributed budget allocations, concern and sensitivity was expressed by my supervisor
Budgetary Slack	Onsi 1973	1. The budget is proposed to be achieved easily, to protect yourself
		2. Standards are set with two standards to be safe, between me and the supervisor, and with top management
		3. Budgetary slack is permissible if implemented reasonably when business is good
		4. When faced with things that can't be officially agreed upon, a budget slack is one way to go.

Table 2 shows budget participation is measured using six items developed by Milani (1975) where respondents are asked to assess the level of involvement in the budget preparation process. Budgetary participation was measured following previous studies (e.g. Chong & Strauss, 2017; Maiga & Jacobs, 2007; Osikhena & ODIA, 2013).

Procedural fairness is measured using eight questions. Six items were developed by Magner and Johnson (1995) related to five of the six rules of Leventhal (1980) to determine procedural fairness (consistency rules, accuracy rules, correction rules, ethics rules, bias suppression rules) and two items were developed by Greenberg (1993) which discusses representative and informational aspects. Procedural fairness was measured following previous studies (e.g. Maiga & Jacobs, 2007; Osikhena & ODIA, 2013; Wentzel, 2002).

Distributive fairness is measured using five questions. Four items were developed by Magner and Johnson (1995) to assess different comparative bases that people can apply in assessing distributional fairness (needs, expectations, and what is appropriate) plus 1 item developed by Greenberg (1993). Distributive fairness was measured following previous studies (e.g. Maiga & Jacobs, 2007; Wentzel, 2004).

Budgetary slack is measured using the four items used by Onsi (1973). Budgetary slack was measured following previous studies (e.g. Chong & Strauss, 2017; Staley & Magner, 2007). Measurements were made using a five-point Likert scale.

## **4. Findings and Discussion**

SEM with an alternative PLS method is used to answer the research hypothesis. In SEM, there are two types of models that are formed, the measurement model (outer model) and the structural model (inner model).

### ***4.1. Measurement Models***

The measurement model aims to explain the relationship between construct variables and their indicators. In this study, there are four construct variables with twenty-three indicators. The construct variable of budget participation consists of six indicators, procedural fairness consists of eight indicators, distributive fairness consists of five

indicators, and budgetary slack consists of four indicators. Evaluation for the measurement model is carried out through convergent validity, and discriminant validity.

**Table 3**

*Loadings Factor*

Indicator	Loading Factor			
	BP	PF	DF	BS
1	0.767	0.742	0.662	0.793
2	0.720	0.726	0.888	0.874
3	0.736	0.769	0.885	0.833
4	0.881	0.681	0.852	0.819
5	0.784	0.693	0.779	-
6	0.765	0.735	-	-
7	-	0.804	-	-
8	-	0.745	-	-
<b>CR</b>	<b>0.901</b>	<b>0.905</b>	<b>0.909</b>	<b>0.899</b>
<b>AVE</b>	<b>0.604</b>	<b>0.544</b>	<b>0.669</b>	<b>0.689</b>

*Source: Output of PLS*

Composite reliability must have a value between 0.7 and 0.9 (Hair et al., 2014). Indicators with a loading factor of less than 0.4 must be removed from the measurement model (Hair et al., 2014). The average variance extracted (AVE) value with a value of 0.5 or higher indicates that the construct variable explains some or more of the variance of the indicators (Hair et al., 2014).

In the budget participation construct variable, the composite reliability result is 0.901. This means that the budget participation variable has a high reliability value. The loading factor for all indicators is between 0.720 – 0.881 so that it can be said that all indicators are valid. The BP<sub>4</sub> indicator has the largest loading factor compared to the others. The data show that there is a considerable influence on the final budget which is the strongest indicator in explaining the construct variable of budget participation. While BP<sub>2</sub> has the smallest loading factor compared to the others. The data show that superiors clearly explain the budget revision which is the weakest indicator in explaining the construct variable of budget participation. The AVE value of 0.604 proves that on average, 60.4% of the information contained in the construct of the budget participation variable is reflected through each indicator.

In the procedural fairness construct variable, the composite reliability result is 0.905. This means that the procedural fairness variable has a high reliability value. The loading factor for all indicators is between 0.681 – 0.804 so that it can be said that all indicators are valid. The PF<sub>7</sub> indicator has the largest loading factor compared to the others. The data show that budgeting represents all divisions and is the strongest indicator in explaining the construct variable of procedural fairness while PF<sub>4</sub> has the smallest loading factor compared to the others. The data show that filing an appeal against a predetermined budget is the weakest indicator in explaining the construct variable of procedural fairness. The AVE value of 0.544 proves that on average 54.4% of the information contained in the procedural justice construct variable is reflected through each indicator.

In the distributive fairness construct variable, the composite reliability result is 0.909. This means that the distributive fairness variable has a high reliability value. The loading factor for all indicators is between 0.662– 0.888 so that it can be said that all indicators are valid. The DF<sub>2</sub> indicator has the largest loading factor compared to the others. The data show that the budget allocated to divisions adequately reflects needs, which is the strongest indicator in explaining the construct variable of distributive fairness. While DF<sub>1</sub> has the smallest loading factor compared to the others. The data show that the part that receives the budget properly is the weakest indicator in explaining the construct variable of distributive fairness. The AVE value of 0.669 proves that on average 66.9% of the information contained in the construct variable of distributive justice is reflected through each indicator.

In the budgetary slack construct variable, the composite reliability result is 0.899. This means that the budgetary slack variable has a high reliability value. The loading factor for all indicators is between 0.793 – 0.874 so that it can be said that all indicators are valid. The BS<sub>2</sub> indicator has the largest loading factor compared to the others. This shows that setting two standard levels for safety is the strongest indicator in explaining the budgetary slack construct variable. While BS<sub>1</sub> has the smallest loading factor compared to the others. This shows that the budget proposal that can be safely achieved is the weakest indicator in explaining the budgetary slack construct variable. The AVE value of 0.689 proves that on average 68.9% of the information contained in the budget gap construct variable is reflected through each indicator.

Convergent validity analysis was used to test the validity of each relationship between each indicator and the construct internally. Furthermore, discriminant validity is discussed to ensure externally that each concept between one construct is different from other constructs (Hair et al., 2014). In the following, the results of discriminant validity analysis using cross-loading and Fornell-Larcker criteria are presented.

**Table 4***Cross Loadings*

Indicator	Loadings Factor			
	BP	PF	DF	BS
BP-1	<b>0.767</b>	0.256	0.249	-0.241
BP-2	<b>0.720</b>	0.325	0.384	-0.389
BP-3	<b>0.736</b>	0.399	0.295	-0.305
BP-4	<b>0.881</b>	0.327	0.502	-0.370
BP-5	<b>0.784</b>	0.308	0.439	-0.319
BP-6	<b>0.765</b>	0.319	0.286	-0.415
PF-1	0.174	<b>0.742</b>	0.241	-0.276
PF-2	0.431	<b>0.726</b>	0.202	-0.409
PF-3	0.295	<b>0.769</b>	0.500	-0.403
PF-4	0.230	<b>0.681</b>	0.304	-0.349
PF-5	0.349	<b>0.693</b>	0.258	-0.356
PF-6	0.205	<b>0.735</b>	0.348	-0.346
PF-7	0.312	<b>0.804</b>	0.552	-0.439
PF-8	0.363	<b>0.745</b>	0.467	-0.378
DF-1	0.115	0.335	<b>0.662</b>	-0.309
DF-2	0.424	0.382	<b>0.888</b>	-0.376
DF-3	0.494	0.403	<b>0.885</b>	-0.428
DF-4	0.441	0.473	<b>0.852</b>	-0.435
DF-5	0.350	0.423	<b>0.779</b>	-0.415
BS-1	-0.360	-0.402	-0.334	<b>0.793</b>
BS-2	-0.539	-0.421	-0.415	<b>0.874</b>
BS-3	-0.305	-0.439	-0.477	<b>0.833</b>
BS-4	-0.244	-0.436	-0.374	<b>0.819</b>

*Source: Output of PLS*

According to Hair et al. (2014), cross loading of other constructs should not be higher than the outer loading. If the cross loading is greater than the outer loading, then this indicates a discriminant validity problem. As reflected in Table 4, the value of the loading factor in each construct with its indicators is greater than the indicators in other construct. This shows that the indicator has a stronger relationship with the construct compared to other construct variables. These results indicate that there is no discriminant validity problem.

**Table 5***Fornell-Larcker Criterion*

	<b>BS</b>	<b>DF</b>	<b>BP</b>	<b>PF</b>
<b>BS</b>	<b>0.830</b>			
<b>DF</b>	-0.484	<b>0.818</b>		
<b>BP</b>	-0.444	0.475	<b>0.777</b>	
<b>PF</b>	-0.510	0.494	0.417	<b>0.738</b>

*Source: Output of PLS*

The Fornell-Larcker criterion is a more conservative approach to assessing discriminant validity. According to Hair et al. (2014), each construct must have a higher AVE square root value than the highest correlation with other constructs. If the square root of the AVE is bigger than the correlation value between the other construct variables, this indicates there is no discriminant validity problem. Based on Table 5, the AVE square root of each construct variable is greater than its correlation with other construct variables. Based on the test results, it shows that there is no discriminant validity problem among the four construct variables.

#### ***4.2. Structural Model***

The structural model serves to explain the relationship between exogenous and endogenous variables. The following are the results of the tests.

**Table 6***Coefficient of Determination*

<b>Endogenous Variable</b>	<b>R<sup>2</sup></b>	<b>Q<sup>2</sup></b>
BS	0.362	0.241

*Source: Output of PLS*

Table 6 shows an R<sup>2</sup> value of 0.362 which indicates that budget participation, procedural fairness and distributive fairness have an effect of 36.2% on the budgetary slack. The Q<sup>2</sup> value shows a result that is greater than 0 which indicates that the structural model obtained has predictive relevance.



**Table 7***Hypothesis Testing Results*

Path	Path Coefficient	t <sub>statistic</sub>	p-value	Results
BP => BS	-0.204	1.776	0.038*	<i>Significant, H<sub>1</sub> Supported</i>
BP => PF	0.417	3.766	0.000**	<i>Significant, H<sub>2</sub> Supported</i>
PF => BS	-0.309	2.790	0.003**	<i>Significant, H<sub>3</sub> Supported</i>
BP => PF => BS	-0.129	2.194	0.014*	<i>Significant, H<sub>4</sub> Supported</i>
BP => DF	0.475	4.807	0.000**	<i>Significant, H<sub>5</sub> Supported</i>
DF => BS	-0.235	2.187	0.015*	<i>Significant, H<sub>6</sub> Supported</i>
BP => DF => BS	-0.112	2.078	0.019*	<i>Significant, H<sub>7</sub> Supported</i>

Source: Output of PLS (\*\*p-value <1%; \*p-value <5%)

### **Budget Participation and Budgetary Slack**

Table 7 shows the effect of budgetary participation on budgetary slack had a negative and significant relationship (path coefficient -0.204; p-value 0.038) and it was decided to accept H<sub>A1</sub>. A high level of budget participation will reduce budgetary slack (Chong & Strauss, 2017; Huseno, 2017; Onsi, 1973; Said et al., 2023). The existence of a level of participation can encourage subordinates to participate in providing the information they have and the budget can be prepared appropriately, so that budgetary slack will decrease. The tendency for budgetary slack will decrease because someone will avoid the possibility of losing the right to participate (Chong & Strauss, 2017).

### **Budget Participation and Procedural Fairness**

The results showed that the effect of budgetary participation on procedural fairness had a positive and significant relationship (path coefficient 0.417; p-value 0.000) and it was decided to accept H<sub>A2</sub>. Someone will feel higher fairness when involved in budgeting, because the budget prepared is someone's view in determining the process of allocating resources. In general, people will value participation in a group and respect their status as members in a group (Lind & Tyler, 1988). Someone will feel fairness when given the opportunity to express an opinion because it is a form of participation in a group (Devie et al., 2018; Klein et al., 2019; Maiga & Jacobs, 2007; Osikhena & ODIA, 2013; Wentzel, 2004; Zahro & Januarti, 2016).

### **Procedural Fairness and Budgetary Slack**

The results showed that the effect of procedural fairness on budgetary slack had a negative and significant relationship (path coefficient -0.309; p-value 0.003) and it was decided to accept H<sub>A3</sub>. Budgetary slack will be higher when the budgeting process is considered unfair (Langevin & Mendoza, 2013; Wentzel, 2004). When procedures in budgeting are applied fairly, then someone will collect information properly so that someone will avoid actions to commit budgetary slack.

### **Procedural Fairness Between Budget Participation and Budgetary Slack**

The results showed that the relationship between budgetary participation on budgetary slack mediated by procedural fairness had a negative and significant relationship (path coefficient -0.129; p-value 0.014) and it was decided to accept H<sub>A4</sub>. When participation affects someone procedural fairness, the tendency of budgetary slack will decrease (Kinnersley & Magner, 2008; Little et al., 2002; Ozer & Yilmaz, 2011). Therefore, involving subordinates to participate in the budgeting process will reduce the level of budgetary slack.

### **Budget Participation and Distributive Fairness**

The results showed that the effect of budgetary participation on distributive fairness had a positive and significant relationship (path coefficient 0.475; p-value 0.000) and it was decided to accept H<sub>A5</sub>. The result is that budgetary participation can increase distributive fairness in line with previous research (Devie et al., 2018; Maiga & Jacobs, 2007; Wentzel, 2002; Zahro & Januarti, 2016). Participation can give managers the opportunity to influence the resources that will be allocated to them.

### **Distributive Fairness and Budgetary Slack**

The results showed that the effect of distributive fairness on budgetary slack had a negative and significant relationship (path coefficient -0.235; p-value 0.015) and it was decided to accept H<sub>A6</sub>. With increasing perceptions of distributive fairness, the budgetary slack will decrease (Wentzel, 2004). This is because when employees feel fairness for the results they receive, they are less likely to get involved in creating budgetary slack.

### **Distributive Fairness Between Budget Participation and Budgetary Slack**

The results showed that the relationship of budgetary participation on budgetary slack mediated by distributive fairness had a negative and significant relationship (path coefficient -0.112; p-value 0.019) and it was decided to accept  $H_{A7}$ . Someone who is involved in budgetary participation will tend to avoid budgetary slack. During the participation process, a person will have the opportunity to influence the resources that will be allocated so that it has a greater chance of achieving the specified target and will further affect the assessment and award that will be received. Thus, the perception of distributive fairness will increase (Langevin & Mendoza, 2013) and will further reduce the tendency to create budgetary slack (Wentzel, 2004).

## **5. Conclusion**

The results of the study show that budgetary participation can affect budgetary slack directly or indirectly. Specifically, budget participation has a positive effect on procedural fairness and distributive fairness, budget participation has a negative effect on budgetary slack, procedural fairness and distributive fairness have a negative effect on budgetary slack, and procedural fairness and distributive fairness mediate the effect of budgetary participation on budgetary slack. Overall, this study shows that budgetary participation will affect organizational fairness and will ultimately affect budgetary slack.

The lack of research that examines the effect of budgetary participation on budgetary slack and organizational fairness in a model is the novelty of this study. This research provides theoretical implications for an organization and for subsequent researchers, especially those discussing budgeting. The results of this study support the theory that a high level of participation can increase perceptions of fairness in an organization and a person's high perception of fairness will reduce budgetary slack. This research also has practical implications, especially in determining budgeting procedures in an organization, it is necessary to consider involving subordinates in the budget preparation process to minimize budgetary slack.

This research has several limitations. First, this study used research samples from supervisory and managerial levels in hospitality with a small number that can affect the statistical tests. Hence, future research can consider other sectors and expand the sample size

so that it can be generalized. Second, there are limited references related to organizational fairness and its relationship to budgetary slack. Third, the possibility of bias in data collection due to the use of survey methods. Further research can use other data gathering strategy such as interview to avoid bias.

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# Person-Environment Fit: Empowering Leadership Practices on Teachers' Work Engagement and Motivation

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## Abstract

This research examines the relationship between Person-Environment fit (PE fit) and teachers' work engagement and motivation in the context of public elementary schools in the Department of Education (DepEd) in the Philippines. The study surveyed 117 teachers through random sampling and utilized multiple regression analysis to identify significant predictors of teachers' work engagement and motivation. Results indicate that P-E fit is highly observed among public elementary school teachers with high work engagement and motivation. Moreover, there was a moderate correlation between the different factors of P-E fit, including person-vocation fit, person-organization fit, person-group fit, and person-job fit. The study's most notable finding is that person-organization and person-group fit significantly influenced teachers' work engagement and motivation. This suggests that teachers who fit well with their organization and workgroup are more likely to be motivated and engaged. These findings have implications for human resource management and organizational leadership practices, highlighting the importance of considering P-E fit when hiring and managing teachers. Overall, this study contributes to the growing literature on P-E fit and its impact on work engagement and motivation. It provides valuable insights for school administrators and policymakers on creating a work environment that fosters teacher engagement and motivation, ultimately improving the quality of education for students.

**Keywords:** *Person-Environment Fit, Work Engagement, Work Motivation, Teacher Quality*

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## 1. Introduction

Education is widely recognized as a fundamental human right, potentially impacting social and economic development significantly. It is essential for promoting innovation, productivity, and economic growth and reducing poverty, inequality, and social exclusion (UNESCO, 2015; Sayed & Ahmed, 2015). However, the effectiveness of education depends largely on the quality of the educational institutions and their ability to develop students who can contribute positively to society. To achieve this, schools must implement structural changes that support and sustain high-quality education and involve all teachers and other stakeholders.

One critical aspect of high-quality education is the involvement of teachers in a leadership routine that allows them to contribute according to their skills and commitment to promoting continuous improvement (Wani & Mehraj, 2014). Research has shown that teachers who are involved in decision-making and feel valued and appreciated are more likely to be motivated and committed to their work, resulting in better student outcomes (Díez et al., 2020). Therefore, schools must create an environment that enhances teacher motivation, involvement, and leadership skills to achieve educational goals.

Moreover, person-environment (PE) fit is an essential consideration in the recruitment and retention of teachers (Washington-Lawson, 2021). PE fit is a broad constellation of dimensions relating to an individual's congruence with their work environment, including job demands, social climate, values, and culture. Research has shown that teachers who experience a good fit between their characteristics and work environment tend to have better job satisfaction, performance, and retention (Rauvola et al., 2020). Therefore, schools must consider PE fit when recruiting and retaining teachers to create a supportive and conducive work environment.

In addition, schools and institutions must establish a framework that encourages maximum employee participation and contribution (Tepayakul & Rinthaisong, 2018). The institution should motivate individuals, departments, or teams to accomplish their goals. This can be achieved by creating a supportive work culture that values employee contributions,

provides opportunities for growth and development, and recognizes and rewards employee achievements (Leal Filho et al., 2019).

This paper investigates the factors influencing teacher motivation, involvement, and leadership skills in promoting continuous school improvement. Specifically, it investigates the influence of person-environment fit on teacher outcomes such as job satisfaction, performance, and retention, as well as the role of school culture in fostering employee engagement and contribution. It measures the degree to which the teacher's skills, values, and interests align with the work environment and the organization's culture, objectives, and values. This aims to evaluate the level of zeal and commitment that teachers demonstrate in their work, including their level of job enablement, alignment with organizational objectives, and efficiency of work processes. It measures the motivation and effort teachers put into their work, including their commitment to the organization, sense of accomplishment, recognition, and opportunities for advancement and development. In addition, this study aims to examine the relationship between the various constructs of PE fitness, work engagement, and work motivation and to determine if there is a significant relationship between these variables. Lastly, it seeks to identify the specific aspects of physical fitness most strongly associated with work engagement and motivation and the factors that can increase their engagement and motivation levels.

## **2. Literature Review**

### ***2.1. Person-Environment Fit***

The concept of PE fit has been widely studied in organizational psychology, particularly concerning job satisfaction, performance, and retention. PE fit is a multi-dimensional construct encompassing the congruence between an individual's characteristics, such as values, interests, and personality traits, and the characteristics of their work environment, including job demands, social climate, and organizational culture (Seong et al., 2015). In education, research has shown that teachers who experienced a good fit between their characteristics and their work environment tend to have better job satisfaction, performance, and retention (Kristof-Brown et al., 2018; Rauvola et al., 2020). For example, teachers who perceive a good fit between their values and the school's values tend to be more

satisfied with their jobs and are more likely to remain in their positions (Seong et al., 2015). Similarly, teachers who perceive a good fit between their personality traits and job demands, such as autonomy and task variety, tend to be more motivated and engaged in their work (Jungert et al., 2018). Furthermore, PE fit is a critical factor in the recruitment and retention of teachers. Schools that consider PE fit when recruiting and selecting teachers are more likely to attract candidates who fit the school culture and work environment (Rauvola et al., 2020; Gander et al., 2020). Moreover, schools that promote a good fit between teachers and their work environment are more likely to retain their employees, reducing turnover and associated costs (Seong et al., 2015).

Despite the importance of PE fit in education, its implementation has some challenges. For example, schools may need to clearly understand the personal characteristics that are most important for job success, or they may need a structured approach to assessing these characteristics in job candidates (Rauvola et al., 2020). Moreover, schools may not have the resources or capacity to provide the necessary training and support to ensure a good fit between teachers and their work environment (Gander et al., 2020; Kristof-Brown et al., 2023).

PE fit is critical to teacher motivation, performance, and school retention. Schools that consider PE fit when recruiting and selecting teachers are more likely to attract candidates who fit the school culture and work environment, resulting in better job satisfaction, performance, and retention. Therefore, schools must develop a structured approach to assessing PE fit in job candidates and provide the necessary training and support to ensure a good fit between teachers and their work environment.

## ***2.2. Teachers' Leadership Practices***

Empowering teachers' leadership practices is critical in creating a positive work environment and improving student outcomes. Research suggests that teacher leadership can positively impact school culture, teacher collaboration, and student achievement (Harris & DeFlaminis, 2016). One way to empower teachers' leadership practices is to provide professional development and collaboration opportunities. Professional development can help teachers develop their leadership skills, enhance their knowledge and understanding of

curriculum and instruction, and promote innovative teaching practices (Wenner & Campbell, 2017). Collaboration within and across schools can also enhance teachers' leadership practices by providing opportunities for sharing knowledge and expertise and promoting a culture of continuous improvement field (Hargreaves & Fullan, 2020).

Another way to empower teachers' leadership practices is to give them autonomy and decision-making power. When teachers are given autonomy to make decisions about curriculum, instruction, and assessment, they are more likely to feel a sense of ownership and investment in their work (Hargreaves & Fullan, 2020). Additionally, involving teachers in decision-making processes at the school level can promote a sense of shared responsibility and ownership for school improvement (Whang, 2021).

Empowering teachers' leadership practices can also create opportunities for teacher-led initiatives and innovations. When teachers are allowed to pursue their professional interests and passions, they are more likely to be engaged and motivated in their work (Killion et al., 2016). This can also lead to the developing innovative teaching practices that benefit both teachers and students. Hence, empowering teachers' leadership practices can positively impact school culture, teacher collaboration, and student achievement. Strategies for empowering teachers' leadership practices include providing opportunities for professional development and collaboration, giving teachers autonomy and decision-making power, and creating opportunities for teacher-led initiatives and innovations. Schools should prioritize empowering teachers' leadership practices to promote a positive work environment and improve student outcomes.

### ***2.3. Teachers' Work Engagement***

Work engagement is a positive state of mind that involves energy, dedication, and absorption in work-related activities (Bakker & Albrecht, 2018). In education, work engagement is critical for teachers' well-being and job performance. Research has shown that highly engaged teachers tend to have better job satisfaction, lower burnout, and higher performance levels of performance (Skaalvik & Skaalvik, 2014).

Factors associated with work engagement among teachers include leadership practices, school culture, and professional development opportunities (Zahed-Babelan et al.,

2019; Fu et al., 2022; McChesney & Cross, 2023; Cai et al., 2022). School leaders who adopt a transformational leadership style and promote a positive school culture that values employee contributions and provides opportunities for growth and development are more likely to promote teacher work engagement (Leithwood et al., 2017). Additionally, professional development opportunities tailored to teachers' needs and interests can promote the development of new skills and knowledge, which in turn can lead to greater work engagement (Klassen & Kim, 2017). In contrast, factors that can undermine work engagement among teachers include high workload, low levels of autonomy, and lack of support from school leaders and colleagues (Skaalvik & Skaalvik, 2014). Research has also shown that emotional exhaustion, job demands, and work-life balance can negatively impact teachers' work engagement (Klassen & Kim, 2017).

Work engagement has been found to have important implications for student outcomes (Holmström et al., 2023; Addimando, 2019; Chinelato et al., 2019; Moore, 2017; Zeng et al., 2019). Teachers who are highly engaged in their work tend to create a positive learning environment, which can lead to better student achievement (Skaalvik & Skaalvik, 2014; Lei, 2018). Thus, promoting work engagement among teachers can have important benefits for both teachers and students.

#### ***2.4. Teachers' Work Motivation***

Work motivation is an important factor that drives teacher performance and behavior. Research has shown that motivated teachers tend to be more productive, committed, and innovative, which can lead to better student outcomes (Aliazas & Chua, 2021). The literature suggests that various factors, including job characteristics, leadership practices, and personal characteristics influence work motivation (Kim, 2016; Smith & DeNunzio, 2020; Liu et al., 2022; Oerlemans & Bakker, 2018). Job characteristics such as autonomy, task variety, and feedback have positively influenced teachers' motivation and job satisfaction (Deci et al., 2015). Moreover, a positive work environment characterized by supportive leadership, a collaborative culture, and opportunities for growth and development can also enhance teachers' motivation and job satisfaction (Leithwood et al., 2017).

Personal characteristics such as self-efficacy and goal orientation have also been important predictors of teachers' motivation. Teachers with high levels of self-efficacy, or confidence in their ability to perform their job effectively, tend to be more motivated and persistent in achieving their goal (Schunk & DiBenedetto, 2020). Similarly, teachers with mastery goal orientation, or a focus on learning and improvement, tend to be more motivated and engaged in their work (Wigfield et al., 2017). On the other hand, factors such as low salaries, limited opportunities for advancement, and high levels of job insecurity can negatively affect teachers' motivation and job satisfaction (März & Kelchtermans, 2020). Moreover, teachers who experience high levels of stress and burnout may become demotivated and disengaged from their work (Alhija, 2015).

Work motivation is a critical factor that drives teacher performance and behavior. Factors that positively influence teachers' motivation include job characteristics such as autonomy and feedback, a positive work environment characterized by supportive leadership and opportunities for growth and development, and personal characteristics such as self-efficacy and goal orientation. Factors that negatively affect teachers' motivation include low salaries, limited opportunities for advancement, high levels of job insecurity, and stress and burnout. Schools should prioritize strategies that enhance teachers' motivation to improve teacher performance and ultimately benefit student outcomes.

### **3. Methodology**

#### ***3.1. Design, Sampling, Procedure, Treatment***

Research methodology refers to the systematic and structured approach used to conduct research. In this particular study, the researcher aims to investigate the relationship between person-environment fit, work engagement, and work motivation among elementary school teachers in the DepEd Division of San Pablo City in the Philippines. The research design employed in this study is quantitative. This design involves collecting numerical data through surveys, questionnaires, and other standardized instruments (Rahi, 2017).

The study uses a survey questionnaire as the main instrument for data collection. The questionnaire comprises three parts that explore different aspects of the research topic. Part 1 of the questionnaire measures the extent of observation on the construct of person-

environment fit. This part of the questionnaire is designed to assess the degree of alignment between the teacher's personal characteristics and the work environment. Part 2 measures the extent of manifestation of work engagement, which refers to the level of enthusiasm and dedication that teachers exhibit in their work. Finally, Part 3 measures the extent of manifestation of work motivation, which refers to the level of drive and effort teachers put into their work.

Descriptive statistics such as mean and standard deviation are used to summarize the data collected from the questionnaire. These statistics help to describe the central tendency and variability of the data (Rahi, 2017). Multiple regression analysis is also employed to identify significant predictors of teachers' work engagement and motivation. Regression analysis is a statistical technique used to analyze the relationship between a dependent variable and one or more independent variables (Ray-Mukherjee et al., 2014).

In summary, the research methodology used in this study involves a quantitative research design, data collection using a survey questionnaire with three parts, descriptive statistics, and multiple regression analysis to identify significant predictors of teachers' work engagement and motivation.

#### **4. Results and Discussions**

The theory of person-environment fit suggests that individuals have an innate desire to seek out environments that match their personal characteristics, values, and goals (Gander et al., 2020). This theory proposes that individuals who are congruent with their environment are more likely to experience positive outcomes, such as job satisfaction, commitment, and performance, while those who are incongruent may experience negative outcomes, such as stress, burnout, and turnover (Van Vianen, 2018).

In this study, the person-environment fit is explored at the level of public school teachers. Specifically, the study investigates how teachers' personal and work environments align with their characteristics, including their vocational preferences, organizational values, group dynamics, and job demands. By examining the different facets of person-environment fit, the study seeks to identify factors contributing to teacher engagement and motivation in the workplace.

The study's findings shown in table 1 suggest that public school teachers' personal and work environments were highly observed. This indicates that teachers in the DepEd Division of San Pablo City are generally well-matched to their work environments, including their job demands, organizational culture, and group dynamics. This finding has important implications for understanding teacher engagement and motivation, as it suggests that teachers who are congruent with their work environment may be more likely to experience positive outcomes regarding their job performance, commitment, and satisfaction (Madigan & Kim, 2021).

**Table 1**

*The extent of person-environment fit observed among public school teachers*

<b>Person-Environment Fit</b>	<b>Mean</b>	<b>SD</b>	<b>VI</b>
Person-Vocation Fit	3.79	.347	HO
Person-Organization Fit	3.76	.406	HO
Person-Group Fit	3.70	.426	HO
Person-Job Fit	3.61	.478	HO
<i>Note:</i>	<i>3.50-4.00</i>	<i>HO</i>	<i>Highly Observed</i>
	<i>2.50-3.49</i>	<i>O</i>	<i>Observed</i>
	<i>1.50-2.49</i>	<i>MO</i>	<i>Moderately Observed</i>
	<i>1.00-1.49</i>	<i>NO</i>	<i>Not Observed</i>

Overall, the theory of person-environment fit provides a useful framework for understanding the relationship between individuals and their work environment (Wang & Wang, 2018). By exploring the different facets of this relationship, researchers can identify the factors that contribute to positive outcomes for employees, such as engagement and motivation, and inform policies and practices to improve the work environment and promote better outcomes for both employees and organizations.

**Table 2**

*The extent of teachers' work engagement manifested among public school teachers*

<b>Teachers' Work Engagement</b>	<b>Mean</b>	<b>SD</b>	<b>VI</b>
Job Enablement	3.50	.415	HM
Performance and Accountability	3.52	.489	HM
Strategic Alignment	3.55	.441	HM
Work Processes	3.60	.422	HM
<i>Note:</i>	<i>3.50-4.00</i>	<i>HM</i>	<i>Highly Manifested</i>
	<i>2.50-3.49</i>	<i>M</i>	<i>Manifested</i>
	<i>1.50-2.49</i>	<i>MM</i>	<i>Moderately Manifested</i>
	<i>1.00-1.49</i>	<i>NM</i>	<i>Not Manifested</i>

People's identities are often closely intertwined with their work, as they spend a significant portion of their lives engaged in work-related activities (Bakker & Albrecht,



2018). Consequently, work can profoundly impact an individual's sense of purpose and fulfillment (Klassen & Kim, 2017). It is common for individuals to seek meaning and purpose in their work, and to desire a job or career that offers more than just financial gain (Aliazas & Chua, 2021). Meaningful work is a term used to describe work perceived as particularly significant and fulfilling by an individual (Leal Filho et al., 2019). This type of work is often characterized by a sense of purpose and is viewed as more valuable than factors such as job stability, promotions, pay, or hours (Washington-Lawson, 2021). Individuals engaging in meaningful work are more likely to experience high work engagement, job satisfaction, and motivation.

In the context of this study, the findings shown in table 2 suggest that work engagement among public school teachers in the DepEd Division of San Pablo City was highly manifested. This indicates that teachers in this setting are likely to find their work meaningful and fulfilling and are, therefore, more likely to experience positive outcomes such as job satisfaction, commitment, and performance.

The recognition that individuals seek meaning and purpose in their work has important implications for organizations and policymakers (Hargreaves & Fullan, 2020). To promote employee engagement and satisfaction, organizations should strive to provide employees with opportunities to engage in meaningful work and to recognize and reward their contributions (Díez et al., 2020). This can involve initiatives such as allowing employees to participate in decision-making processes, providing opportunities for professional development and growth, and creating a culture that values employee well-being and work-life balance.

Overall, meaningful work provides a useful framework for understanding the relationship between individuals and their work environment. By promoting meaningful work, organizations can create a more engaged and motivated workforce, leading to positive outcomes for both employees and organizations.

Motivation is an essential factor contributing to the success of classroom teaching and learning outcomes (Schunk & DiBenedetto, 2020). Highly motivated teachers are more likely to engage their students in the learning process, create a positive classroom environment, and provide quality instruction. Research has shown that motivation can be energizing, help

individuals to focus, and encourage them to maintain good conduct over time. In the context of teaching, motivated teachers are more likely to go above and beyond their required duties, creating opportunities for student learning and success field (Wenner & Campbell, 2017).

**Table 3**

*The extent of teachers' work motivation manifested among public school teachers*

<b>Teachers' Work Motivation</b>	<b>Mean</b>	<b>SD</b>	<b>VI</b>
Commitment	3.62	.419	HM
Achievement	3.56	.459	HM
Recognition	3.59	.436	HM
Advancement and Growth	3.63	.434	HM

*Note:* 3.50-4.00 HM Highly Manifested  
2.50-3.49 M Manifested  
1.50-2.49 MM Moderately Manifested  
1.00-1.49 NM Not Manifested

The findings in table 3 suggest that teachers in public schools in the DepEd Division of San Pablo City appear to be more motivated due to several factors, including job satisfaction, competitive salaries, and advancement opportunities. Despite working in a highly controlled environment, teachers in this setting reported high levels of job satisfaction, which is often associated with increased motivation (Toropova et al., 2021). Furthermore, the competitive salaries and opportunities for advancement provided by the public school system contribute to higher work motivation among teachers. These factors may serve as incentives for teachers to perform well and continue to develop their skills and knowledge (Tehseen & Hadi, 2015).

It is worth noting that while the study found that teachers in public schools in the DepEd Division of San Pablo City were generally highly motivated, there may be variations in motivation levels among individual teachers. Therefore, school leaders need to continue to monitor teacher motivation and provide support to ensure that all teachers are adequately motivated to deliver quality instruction and support student learning (Whang, 2021).

In summary, motivation is critical in creating effective classroom teaching and learning outcomes. The findings of this study suggest that job satisfaction, competitive salaries, and advancement opportunities contribute to higher work motivation among public school teachers in the DepEd Division of San Pablo City. By recognizing and supporting these factors, schools can foster a more motivated and engaged teaching workforce, improving student learning outcomes.

The interrelationships between person-environment fit and teachers' work engagement and motivation suggest that the alignment between an individual's needs and their work environment plays a crucial role in their engagement and motivation. A high level of person-environment fit can lead to increased job satisfaction and motivation, which, in turn, can lead to better performance and outcomes in the workplace (Duffy et al., 2015). The moderate association between person-environment fit and teachers' work engagement and motivation indicates that while a good fit is essential, other factors may also contribute to work engagement and motivation.

**Table 4**

*Test of correlation between person-environment fit, teachers' work engagement and work motivation*

	<b>Person-Environment Fit</b>			
	Person-Vocation Fit	Person-Organization Fit	Person-Group Fit	Person-Job Fit
<b>Teachers' Work Engagement</b>				
Job Enablement	.325**	.392**	.330**	.412**
Performance and Accountability	.322**	.333**	.297**	.278**
Strategic Alignment	.370**	.415**	.426**	.388**
Work Processes	.516**	.551**	.469**	.507**
<b>Teachers' Work Motivation</b>				
Commitment	.495**	.496**	.451**	.407**
Achievement	.484**	.529**	.495**	.499**
Recognition	.469**	.458**	.471**	.434**
Advancement and Growth	.447**	.450**	.363**	.473**

\*\* Correlation is significant at the 0.01 level (2-tailed).

Moreover, the teachers' work engagement and motivation constructs are multidimensional, with various factors contributing to each construct (Zahed-Babelan et al., 2019). For instance, teachers' work engagement comprises job enablement, performance accountability, strategic alignment, and work processes. These constructs are all interconnected, and an improvement in one may positively impact the others. Similarly, teachers' work motivation comprises various factors, such as commitment, achievement, recognition, and advancement and growth (Raziq & Maulabakhsh, 2015). An improvement in any of these factors may lead to an increase in work motivation.

Therefore, the study's findings suggest that creating a work environment that aligns with the needs and motivations of teachers is essential in promoting their work engagement

and motivation (Vermooten et al., 2019). This may involve providing opportunities for professional development, recognizing achievements, and creating a supportive work culture.

The relationship between person-environment fit and teachers' work engagement and motivation can be further explained by the Self-Determination Theory (SDT) (Ryan & Deci, 2020). According to SDT, individuals have three basic psychological needs: autonomy, competence, and relatedness. Autonomy refers to the need to feel in control of one's behavior and choices. Competence refers to the need to feel effective in one's actions and to experience mastery (Cook & Artino Jr, 2016). Relatedness refers to the need to feel connected to others and to experience a sense of belonging (Strayhorn, 2018).

When these basic psychological needs are satisfied, individuals experience greater well-being, intrinsic motivation, and engagement in their work (Ilies et al., 2017). The fit between an individual and their environment can influence the degree to which these needs are satisfied (Langer et al., 2019). For example, if teachers perceive a high degree of autonomy in their work environment, they may experience greater work engagement and motivation. Similarly, if teachers perceive a high degree of competence in their work environment, they may experience greater work engagement and motivation.

The relationship between person-environment fit and teachers' work engagement and motivation is complex and multifaceted. The degree to which teachers perceive a fit between themselves and their work environment can impact their basic psychological needs and ultimately influence their level of engagement and motivation in their work.

**Table 5**

*Prediction of perceived person-environment fit to teachers' work engagement and work motivation*

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.396	.262		5.332	.000
Person-Organization Fit	.337	.070	.406	4.801	.000
Person-Group Fit	.238	.067	.301	3.561	.001
<i>F = (2,114) = 33.904; Adjusted R<sup>2</sup> = .362; p &lt; .01; N = 117</i>					
<i>Dependent Variable: Teachers' Work Engagement</i>					
(Constant)	1.128	.273		4.124	.000
Person-Organization Fit	.378	.073	.420	5.163	.000
Person-Group Fit	.285	.070	.332	4.077	.000
<i>F = (2,114) = 41.280; Adjusted R<sup>2</sup> = .410; p &lt; .01; N = 117</i>					
<i>Dependent Variable: Teachers' Work Motivation</i>					

Stepwise multiple linear regression is a statistical technique used to identify which independent variables contribute significantly to predicting the dependent variable. In this study, the dependent variables were teachers' work engagement and motivation, and the independent variables were the four constructs of person-environment fit: person-vocation fit, person-organization fit, person-group fit, and person-job fit.

The results of the multiple regression analysis showed that two of the four constructs of person-environment fit, specifically person-organization fit and person-group fit, were significant predictors of teachers' work engagement. This means that when these two constructs were considered, they significantly contributed to the variation in teachers' work engagement scores (Rahi, 2017; Deci, 2015).

The F-value of the regression model was significant at  $F(2,114) = 33.904$ ,  $p < .05$ , which means that the model was a good fit for the data. The model accounted for 36.2% of the variation in teachers' work engagement scores, indicating moderate explanatory power.

These findings suggest that when there is a good fit between the teacher and the organization and the teacher and their colleagues, it is more likely that the teacher will be engaged in their work (Kristof-Brown et al., 2018). This highlights the importance of organizational and group factors in promoting teacher engagement and ultimately improving the quality of education in public elementary schools in the DepEd Division of San Pablo City.

Furthermore, multiple linear regression analyses in this study identified that person-organization fit and person-group fit significantly contributed to the regression model for teachers' work motivation. The F-value of the regression model was  $F(2,114) = 41.280$ , and the p-value was less than .05, indicating that the model was statistically significant. These two constructs accounted for 41% of the variation in teachers' work motivation scores, suggesting that they substantially impact teachers' motivation in the context of public elementary schools in the DepEd Division of San Pablo City.

The results suggest that teachers who feel a good fit between themselves and their organization and their group are more likely to be motivated in their work field (Bakker & Albrecht, 2018). Person-organization fit refers to the degree to which an individual's values,

goals, and personality match those of their employing organization. In contrast, person-group fit refers to the degree of compatibility between an individual and their workgroup's values, goals, and characteristics (Rauvola et al., 2020). Therefore, educational institutions must consider the alignment of their values, goals, and practices with those of their employees, particularly with respect to group dynamics, to foster a more motivated and engaged workforce (Madigan & Kim, 2021).

## 5. Conclusion

The findings suggest that public elementary schools in the DepEd Division of San Pablo City in the Philippines could benefit from considering person-environment fit (PE fit) when hiring and managing teachers. The study revealed a moderate correlation between the different factors of PE fit on the teachers' work engagement and motivation constructs. The most significant predictors of teachers' work engagement and motivation were person-organization fit and person-group fit.

The study has important implications for school human resource management and organizational leadership practices. It highlights the importance of creating a work environment that fosters teacher engagement and motivation, ultimately improving the quality of education for students. The study's results can be used to guide school administrators and policymakers in creating policies and programs that enhance PE fit among teachers.

In conclusion, this study adds to the growing body of literature on P-E fit and its impact on work engagement and motivation. It offers insights for school administrators and policymakers on how to create an environment that encourages teachers' engagement and motivation. By considering P-E fit in teacher recruitment and management, schools can enhance teachers' job satisfaction, which can lead to improved teaching quality and better educational outcomes for students.

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# The Role of Higher Education Curriculum in the Employability of Health Sciences Graduates

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## Abstract

One of the primary goals of Higher Education Institutions (HEIs) is to ensure that all students develop the skills necessary to respond to rapidly changing labor market requirements and conditions. Universities must consider how they train their students to be employable graduates. This study determined how Bachelor of Science in Medical Technology/Medical Laboratory Science (BSMT/BSMLS) and BS Physical Therapy (BSPT) programs prepared the graduates for employment in the Philippines. The study employed a descriptive-correlational research design to establish a relationship between the graduates' level of satisfaction with their education and the level of adequacy of the BSMLS and BSPT programs. An alumni survey was distributed to all Academic Year 2014-2018 program graduates via e-mail and Messenger. The survey revealed that the preparation for the board examination is the most common influencing factor in the transition from graduation to employment. The vast majority of graduates were employed locally and in positions that were relevant to their programs. The survey also revealed that the University adequately prepared graduates for jobs related to their degrees, and that graduates are satisfied with their education due to high-quality instruction and well-established student internship programs. Pearson correlation revealed that there is a moderate and positive relationship between the level of adequacy of the programs and the level of satisfaction. The study concludes that that graduates' high employability both locally and globally is a result of the adequate academic preparation they received at the University.

**Keywords:** *employability, health sciences programs, graduates, satisfaction, tracer study*

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## 1. Introduction

One of the primary goals of Higher Education Institutions (HEIs) is to ensure that all students develop the skills necessary to respond to rapidly changing labor market requirements and conditions. Universities must consider how they train their students to be employable graduates. In other words, HEIs should be talent engines that foster innovation and competence development (Abelha et al., 2020) resulting to highly qualified graduates who can eventually compete in a local and global arena (Cuadra et al., 2019). HEIs must prepare students for jobs that do not yet exist, for using technologies that have yet to be invented, and for solving problems that no one has thought of (Römgens et al., 2020). However, there is some debate about whether university courses adequately prepare students for 21st-century workplace skills (Oraison et al., 2019) to prepare them for the real contexts involved in their professional practice. As a result, it is not surprising that graduate employability has become one of the central issues driving the mission of HEIs (Small et al., 2018).

In a study conducted by Valdez (2010) to assess the career-entry level competencies expected of the graduates of the College of Medical Technology, it was found that further improvement and retooling is needed on competencies such as critical thinking, problem solving and decision-making; communication, teamwork and interactive skills, instrumentation and computer skills; leadership and management; and teaching and training responsibilities. In another study conducted by Lonogan (2016) to assess the career-entry level competencies of BMLS/BSMT graduates, the results have shown that further improvement and retooling are also needed on critical thinking, problem-solving and decision-making competencies. The same arrangement was emphasized in the field of Physical Therapists, as confirmed by the study of Acosta et al. (2020). Moreover, Pacheco et al. (2013) present in their study that about 80.8% of graduates are currently employed and 76.8% are actually practicing physical therapy. Results show that there is no 100% job alignment.

There are various circumstances in which one is unable to take the desired jobs due to the unavailability of jobs that match the individual skills. A requirement in the industry compels one to respond to industry demand, even if it necessitates additional training and skill acquisition. These musings and articulations of the responses demonstrate that industry

demand can change individuals' job priorities to fit in with the world of work, regardless of whether or not it is related to the degree they have learned.

It is clear that even in the health sector, there is growing dissatisfaction with how well-prepared graduates are to function in a fast-paced workplace. HEIs must therefore provide their graduates with skills that go beyond disciplinary knowledge in order for them to perform well in the workplace (Pillay et al., 2019; Briones et al., 2021; Bawica, 2021; Gaite et al., 2022; Refugia, 2021). Universities, health services, and health students now have a vested interest in developing work-ready graduates to improve employment prospects, practice standards, and healthcare outcomes (Jones et al., 2015).

This research is therefore carried out to determine how well the University's BSMT/BMLS and BSPT programs have trained students to be highly employable graduates. In addition, the study assessed if the adequacy of job preparations provided by the University translates to the graduates' satisfaction. Specifically, the study determined the respondents' profile concerning transition from graduation to employment, alignment of work to the completed program, and classification of the workplace (local or international). It also established a relationship between the programs' level of adequacy and the satisfaction of the graduates with their education. The results will form the basis for revisiting the programs to develop further the competencies and abilities of graduates contributing to long-term employability.

## **2. Literature review**

It is claimed that graduates lack the competencies required by end-users, which is reflected in the growing trend of graduate unemployment worldwide. Among the contributing factors is a curriculum that lacks innovative aspects that would enable graduates to acquire the competencies required by employers or the skills required to be self-employed (Fulgence, 2015). According to Pan and Lee (2011), the aims of providing a good, high-quality curriculum and of enhancing employability are not oppositional, but that instead, good learning, teaching and assessment projects will be developing practices that are also likely to help students make good, well-founded claims to employability. Thus, curriculum design and personal development planning are closely linked to discussions on employability competencies (Billet, 2015). As further pointed out by Theron (2014), HEIs must include the development of employability skills in their program offerings to respond to the needs of the

industry and expectations from graduates to maintain a competitive status. Cuadra et al. (2019) discovered that relevance of the degree program to professional requirements was a major strength of the undergraduate curriculum in a study involving 1,983 graduates from one of the Philippines' state universities.

Oraison et al. (2019) suggest that employers seek and prioritize graduates who possess practical competencies and 21st-century skills such as problem-solving and communication. The industry requires professionals who can fulfill the demands of the new contexts and trends, such as the Fourth Industrial Revolution (Schwab, 2016). According to Pillay et al. (2019), employers maintain that emerging graduates, while usually skilled in the subject and career-specific knowledge, lack competencies that would enable them to transform and adapt to their organizations. These popularized graduate attributes typically include interpersonal skills, the ability to work in a team, respect for multiculturalism and diversity, effective communication skills, creative thinking, and problem-solving skills.

While curricula and graduate attributes are frequently developed with industry involvement to address the gap between previous academic goals and industry needs (Gill, 2018), the research findings summarized in the study of Oraison et al. (2019) indicate that the gaps remain. Gaps have been identified in Europe, with graduates from 13 countries expressing dissatisfaction with their tertiary education training. More than 40,000 students from the United Kingdom, France, Italy, and Spain are reported to lack the required job skills, and the skills they have acquired at university are believed to be of limited practical workplace use. Furthermore, Spanish employers stated that university training offered poor resemblance to industry requirements. Similarly, employers in the United States, the United Kingdom, and Australia expressed concern about graduates' skill gaps, reporting deficiencies in the graduates' skill sets by identifying unmet industry requirements such as teamwork and communication. Several tell-tale signs of job-education mismatch were reported in the 4th Philippine Graduate Tracer Survey, which included 11,547 graduates from AY 2009-2011: (a) graduates believe they did not sufficiently develop communication, critical thinking, and problem-solving skills; (b) less than 70% believe their college degree is relevant to their first job; and (c) less than half believe occupational skills, which they learned in college, are the main reason for their success. Thus, graduates and employers are in congruence on the skills gaps preventing graduates from achieving their preferred occupations (Tutor et al., 2019).

The available literature clearly demonstrated that employability in relation to how well university courses adequately prepare graduates is a critical issue among higher education institutions. To address this, a graduate tracer study must be carried out on a regular basis. Graduate tracer studies (GTS) are conducted by HEIs around the world in response to a need to understand how graduates perceive their experiences during their degree program and transition to the labor market. A GTS is a highly effective tool that can provide valuable information on the success of education and training in relation to graduates and employers (Cuadra et al., 2019). Tracer studies are one of the tools that educational institutions may use to gauge the applicability of the courses they offer to their work environments (Pentang et al., 2022). If universities want to improve their graduate education and training, they should start by learning from and improving on the diverse experiences of their graduates (Badiru & Wahome, 2016). As Cañizares (2015, p. 82) emphasizes, “GTS is important to Higher Education Institutions because it enables such institutions to accommodate changes in society, particularly the demands of current and potential employers, through evaluation and constant review of their curricula.”

Various definitions of employability have been developed. Robinson (2000) described employability skills as the basic skills needed for one to get a job and enable him or her to carry out duties well. Yorke (2004) argues that the term employability derives from complex learning and is a concept of a wider range than those of 'core' and 'key' skills". He states that employability is a collection of capacities or achievements that constitute a necessary but insufficient condition for gaining employment. However, according to Amoako (2022) employability is a "a set of achievements - skills, understandings, and personal attributes - that make individuals more likely to gain employment and be successful in their chosen occupations, benefiting themselves, the workforce, the community, and the economy."

Knight and Yorke (2004) proposed not only a definition of employability but also a framework for incorporating it into the curriculum. They proposed a close relationship between employability and good learning and emphasized that employability results from a combination of achievements in four broad areas. They represented this in their USEM model, one of the best known and respected in the area of employability. Their model proposes four inter-related components of employability: **Understanding** (of disciplinary



subject matter and how organizations work); **Skillful practices** (academic, employment, and life in general); **Efficacy beliefs** (reflects the learner's notion of self, their self-belief, and the possibility for self-improvement and development); **Metacognition** (complements efficacy, embraces self-awareness, how to learn, and reflection. It encompasses knowledge of learning, thinking, and problem-solving strategies, and supports and promotes continued learning/lifelong learning).

This study is supported by the functionalist theory of education, which focuses on how education serves the need of society through the development of skills encouraging social cohesion (Asuncion, 2019). The importance of achievements, competition, and equality of opportunity are attained through education. Education provides the students with the necessary skills needed for the economy and utilizes each individual for the most relevant jobs according to their talents and qualifications. Emile Durkheim believed schools imprint social values, playing a central role in modern societies (Thompson, 2023).

### **3. Methodology**

#### ***3.1. Research Design***

The study employed a descriptive-correlational research design as it determined the respondents' profile concerning transition from graduation to employment, alignment of work to the completed program, and classification of the workplace (local or international). It also established a relationship between the programs' level of adequacy and the satisfaction of the graduates with their education.

#### ***3.2. Sample of the Study***

The study included all 2014-2018 BSPT and BSMLS graduates from one of the universities in the Philippines. With the help of the School Alumni coordinators, the Google forms were distributed via e-mail and Messenger to 527 graduates, 452 of whom are BSMT/BMLS, and 75 are BSPT. The survey received 282 responses, representing a response rate of 53.51 percent. Of a total of 282 respondents, a great majority (227 or 80.50%) were from the BSMT/BMLS program, considering that there are more BSMT/BMLS than BSPT graduates from 2014 to 2018. Despite this, the BSPT group showed a higher response rate (73.33%) than the BSMT/BMLS graduates (50.22%). The lowest and the highest percentage of the respondents came from the 2014 and 2018 graduates, respectively.

### 3.3. Data Gathering Tool and Procedures

From March to May 2020, an alumni survey developed by the University's Quality Assurance Office was distributed to all 2014-2018 BSPT and BSMLS graduates. The Google form link of the survey was shared on the School's Facebook page and Messenger Group Chat. The research tool was validated by the university's Research and Development Center.

### 3.4. Treatment of Data

Frequency counts and percentages were computed to describe the respondents' profile. Mean values were computed and interpreted using the scales shown in Tables 1 and 2 to determine the level of adequacy of the BSMLS and BSPT programs in preparing graduates for a job aligned to their degree, as well as the level of satisfaction of BSMLS and BSPT graduates with UB education.

**Table 1**

*Likert Scale for the Level of Adequacy of the BSMLS and BSPT Programs*

Likert Scale	Statistical Limit	Interpretation	
4	3.51 – 4.00	More than adequate	The program enabled the graduates to develop a very high level of competency required to land jobs aligned to their degree.
3	2.51 - 3.50	adequate	The program enabled the graduates to develop a high level of competency required to land jobs aligned to their degree.
2	1.51 – 2.50	somewhat adequate	The program only developed a low level of competency among graduates for them to land jobs aligned to their degree.
1	1.00 – 1.50	not adequate	The program did not develop the required competencies among graduates for them to land jobs aligned to their degree.

**Table 2**

*Level of Satisfaction of the BSMLS and BSPT Programs*

Likert Scale	Statistical Limit	Interpretation	
4	3.51 – 4.00	Very satisfied	The students are very satisfied with their academic experience in the University
3	2.51 - 3.50	satisfied	The students are satisfied with their academic experience in the University
2	1.51 – 2.50	Dissatisfied	The students are dissatisfied with their academic experience in the University
1	1.00 – 1.50	very dissatisfied	The students are very dissatisfied with their academic experience in the University

The Pearson correlation was used to determine whether there is a significant relationship between the level of adequacy of the programs and the level of satisfaction of the graduates with the University's Education. The following scale adopted from Cohen (1988), was utilized to interpret the Pearson's correlation coefficients:

**Table 3**  
*Interpretation of the Pearson moment correlation coefficient*

<b>Pearson Correlation Coefficient</b>	<b>Interpretation</b>
0 to $\pm .09$	trivial or very small relationship
$\pm .10$ to $\pm .29$	small (weak) relationship
$\pm .30$ to $\pm .49$	medium (moderate) relationship
$\pm .50$ to $\pm 1.0$	large (strong) relationship

### **Ethical Consideration**

The respondents were adequately informed of the purpose of the study. All responses from the graduates were kept with utmost confidentiality; personal information will not be known, and only generalizations and recommendations were disclosed. Thus, the data collection procedures warranted the anonymity of the participants. Completing the alumni profile was voluntary. The respondents were assured that whether or not they participated, they would not suffer long-term physical, emotional, and psychological harm as a consequence of participating in the survey. Participants were made to understand that they could withdraw anytime. Besides the internet connectivity, the participants were assured that they would not spend or use other resources to answer the alumni profile.

## **4. Findings and Discussion**

### ***4.1. Employment Status of the Graduates***

Table 4 shows the employment status of the University graduates in 2020. The employment rate for 2014-2018 BSMT/BMLS graduates ranged from 64.7 percent to 79.7 percent, while the employment rate for BSPT graduates ranged from 50 percent to 76.9 percent. Overall, 71.8 percent of BSMT/BMLS graduates and 63.6 percent of BSPT graduates are employed. The findings imply that the programs produced a good number of highly employable graduates over a five-year period, albeit at lower rates than the Philippines' overall employment rate. The employment rate in the Philippines in April 2020 was 82.4 percent, which was lower than in previous years due to the COVID-19 pandemic. Previous years' employment rates were 95.4 percent in 2019, 94.7 percent in 2018, and 94.3 percent in 2017 (Philippine Statistics Authority, 2020).

**Table 4**  
*Employment status of the University Graduates*

			BSMT/BMLS Graduates			
			Unemployed	Employed	Self Employed	Total
Year Graduated	2014	Count	3	14	2	19
		%	15.8%	73.7%	10.5%	100.0%
	2015	Count	7	15	0	22
		%	31.8%	68.2%	0.0%	100.0%
	2016	Count	8	30	3	41
		%	19.5%	73.2%	7.3%	100.0%
	2017	Count	12	51	1	64
		%	18.8%	79.7%	1.6%	100.0%
	2018	Count	24	53	4	81
		%	29.6%	65.4%	4.9%	100.0%
Total		Count	54	163	10	227
		%	23.8%	71.8%	4.4%	100.0%
			BSPT Graduates			
			Unemployed	Employed	Self Employed	Total
Year Graduated	2015	Count	0	8	3	11
		%	0.0%	72.7%	27.3%	100.0%
	2016	Count	2	10	1	13
		%	15.4%	76.9%	7.7%	100.0%
	2017	Count	3	8	2	13
		%	23.1%	61.5%	15.4%	100.0%
	2018	Count	5	9	4	18
		%	27.8%	50.0%	22.2%	100.0%
Total		Count	10	35	10	55
		%	18.2%	63.6%	18.2%	100.0%

Although medical professionals including nurses, physical therapists, pharmacists, and medical technologists are in high demand in the Philippines (Adrian, 2020), an oversupply of labor and increasing tertiary enrollment rates are the main reasons of unemployment in the health sector. For example, more than 100 schools offer a medical technology program in the country. Furthermore, from 2014 to 2018, the National passing rates in the Medical Technology licensure examinations were high, ranging from 70% to 80% (Find University, 2022), with the University's passing percentage consistently above the National passing rate. As a result, there is a large supply of Medical Technologists on the employment market, creating fierce competition among graduates. On the other hand, the employment status of University's BSPT graduates can be attributed to the job market supply as well as the performance on the licensure examination. National passing rates ranged from 52% to 68% from 2014 to 2018 (Find University, 2022), but the University's passing rate was not consistently good. This affects the competitiveness of the graduates in the job market.

When comparing the employment rates of graduates from different disciplines, health and welfare graduates have a much lower employment rate than those from other disciplines. This is according to the 4th Philippine Graduate Tracer Survey conducted by Tutor et al. (2019), which included 11,547 graduates. Only 84 out of 100 Health and welfare discipline graduates are in the labor force, and only 72 of those are employed. Furthermore, graduates of Education programs fare best, with 90 out of 100 being in the labor force and a high employment rate of 91%. Engineering, manufacturing, and construction graduates are also doing well, with a labor force participation rate of 89.3%. Meanwhile, graduates of Social sciences, business, and law have a labor force participation rate of 87.2% and an employment rate of 91.6%. The worse employment outcomes for graduates of Health and welfare programs can be related to their longer job transition phase. Thus, in relation to the University's BSMT/BMLS and BSPT graduates' employment rates, the findings suggest that some BMLS/BSMT and BSPT graduates experienced a prolonged job transition period. Thus, these graduates were unemployed during the time the study was conducted.

The COVID-19 pandemic may have impacted the employment rate of the University's 2018 graduates. Some may have begun seeking work in 2019 until early 2020 after passing the board exams in 2019. Unfortunately, the COVID-19 pandemic, which began in March 2020, destroyed the labor market's balance of demand and supply, leading to an immediate and massive reduction in labor demand, working hours, and earnings (International Labor Organization, 2020). Because of the economic downturn, youth unemployment rates have dramatically increased, reflecting the challenges and barriers that young people face in finding employment and integrating into the labor market (Papadakis et al., 2020). The study of Zhu et al. (2021) showed that the career-advancement rate of medical graduate students in 2020 is 71.3%, which is considerably lower than that for the preceding 4 years from 2016 to 2019. The majority of medical graduates believed that the COVID-19 pandemic had a significant or moderate effect on career advancement.

#### ***4.2. Transition from Graduation to Employment***

Literature shows that employability has been a serious concern among HEIs. It is common knowledge that the longer each graduate waits to land a job, the more costly the lost opportunities are (Caingcoy et al., 2021). The International Monetary Fund (2020) reported the cost of joblessness. Accordingly, "unemployment imposes high costs on individuals, society, and country." Its value is more than just financial. When prolonged, it may lead to

one's skepticism. Eventually, the value of education and training would lose among unemployed individuals (Simpson, 2020).

Table 5 shows how long BSMLS and BSPT graduates were employed after graduation. The majority, or 70% of the BSMT/BMLS graduate respondents, were employed within 6 months, and 17% were employed from 7 months to one year after graduation. Of the BSPT graduates, 64% and 20% were employed within six months and from seven months to one year, respectively, after graduation. Based on the survey, the most common reason graduates were not employed within six months after graduation was their preparation for the board examination. Furthermore, among the unemployed respondents, the common reasons for unemployment were: "have not been successful in finding a suitable job," "pursued / currently pursuing another degree program," and "did not apply for a job." Some self-employed respondents started their businesses or became freelancers. These reasons were quite inconsistent with the findings of Albina and Sumagaysay (2020) and Billo et al. (2017). They discovered that family concerns were the primary reason for some graduates' inability to find work. Interestingly, "qualifications did not fit for the job," "further studies," "health-related concerns," and "did not look for a job yet" are ranked at the bottom of this category.

**Table 5**

*Transition from graduation to employment*

	BSMT / BMLS		BSPT	
	N	%	n	%
Within 6 months	159	70%	35	64%
7 months to 1 year	38	17%	11	20%
More than 1 year	13	6%	6	11%
No response	17	7%	3	5%
Total	227	100%	55	100%

The findings of the current study conform with the results of Quinto and Posada (2020) involving 2016 and 2017 Medical Technology program graduates, where 91% reported that they were able to be hired within 1 year of graduation. Similarly, in the survey conducted by Contreras and Moreno (2017), the graduate respondents were largely employed full-time and working. More than half of them could obtain employment within 3 months of securing their license. As stated by Absuelo (2014), Philippine graduates with medical technology degrees were particularly successful at obtaining jobs commensurate with their

educational qualifications despite relatively few holding advanced degrees. In the 4th Philippine Graduate Tracer Survey by Tutor et al. (2019), on average, graduates looked for work 4.6 months after graduation. Graduates of programs requiring a PRC license started their job search on average 5.9 months after graduation. They spent 9 months looking for work and started their first job 15 months after finishing college. As further revealed in the study by Tutor et al. (2019), among those who were not working at the time of their graduation, the main reason for not looking for work was to review for licensure exams (41%) and to rest (33%). Around 12% did not look for work because they got married, got pregnant, or had to take care of family duties.

### ***4.3. Alignment of Work to Program***

A college education's direct output is the knowledge and skills that can be translated into competencies that are ideally relevant to industry needs. These competencies determine the transition of the graduate from college life into a productive member of the labor force (Tutor et al., 2019). Table 6 shows that the majority of BSMT/BMLS (148 or 65.2%) and BSPT (30 or 54.5%) had work aligned to their respective programs. The findings highlight the relevance and responsiveness of the University's BMLS and BSPT curricula to graduate employability. As a result, their jobs have enabled them to put their degree program knowledge to use. According to Tutor et al. (2019), one of the main reasons professionals stay in their jobs is that their work is related to their course program of study. This means that the programs met the needs of society after students graduated with skills in communication, human relations, critical thinking, problem solving, information technology, and teaching. When graduates enter the labor force, they will need these skills (Hansen & Hansen, 2019).

**Table 6**

*Alignment of Work to Program*

<b>BSMT/BMLS program</b>				<b>Total</b>
Unemployed	Employed with work aligned to program	Employed with work not aligned to program		
54 23.8%	148 65.2%	25 11.0%		227 100.0%
<b>BSPT Program</b>				<b>Total</b>
Unemployed	Employed with work aligned to program	Employed with work not aligned to program		
10 18.2%	30 54.5%	15 27.3%		55 100.0%

Billet (2015) pointed out that curriculum design and personal development planning are closely linked to discussions on employability competencies. The results conform with the tracer study of Ang and Candelario (2021) among Medical Laboratory Science (MLS) graduates from batch 2011 to 2018. Findings showed that the majority of the graduates are employed in the health and social work sector. The analysis of the transcripts revealed that graduates were trained well in terms of skills, attitudes, and knowledge. The study by Quinto and Posada (2020), which covered the first two graduate batches of the Medical Technology program, revealed that a great majority (86%) of the graduates are working in the program they studied, with 10.5% reporting that they were already promoted to supervisors and section /area heads in their work. Further, 66.3% reported working in hospitals or diagnostic laboratories.

#### ***4.4. Work Classification of the Graduates***

As shown in Table 7, the majority of BSMT/BMLS and BSPT graduate respondents (90 percent and 66 percent, respectively) chose to work locally. The study's results conform with the findings of Cuadra et al. (2019), which involved 1,983 graduates in the Philippines. Their tracer study revealed that most respondents work locally in the Philippines, indicating that a large fraction chose to stay and impart their knowledge/expertise in the country.

**Table 7**

*Classification of workplace (local or international)*

<b>BSMT/BMLS Graduates</b>		
<b>Local</b>	<b>International</b>	<b>Total</b>
146	16	162
90.1%	9.9%	100.0%
<b>BSPT graduates</b>		
<b>Local</b>	<b>International</b>	<b>Total</b>
23	12	35
65.7%	34.3%	100.0%

According to Arthur (2019), every Filipino's motivation and inspiration is their career growth. This includes working abroad to fulfill their dreams and apply their educational attainment in a practical setting. Table 7 further shows that around 10% of the University's BSMT/BMLS and 34% of BSPT graduates work abroad. Their reason could be derived from



the study of Castro-Palaganas et al. (2017), which states that overseas employment is seen as a means for personal development since advanced professional learning and training may not be accessed in the Philippines but may be available in more developed countries. Although there are more opportunities for personal and professional development abroad, only a small percentage of the University's BSMT/BMLS and BSPT graduates work abroad. One reason could be the requirement to practice the profession outside the Philippines or in a foreign country. To work as an international medical technologist, certification and the skills to handle and test medical samples are required in addition to a college degree. Depending on the employer, additional laboratory experience may be required, as well as a postgraduate certificate in medical technology or a state Medical Technologist License (Clinical Laboratory Technologist License or Clinical Laboratory Scientist License) (Temporary or Permanent). To practice as a physical therapist in the United States, for example, one must have a Bachelor of Science in Physical Therapy, have passed the PRC board exam, have a doctor of physical therapy degree from a Commission on Accreditation in Physical Therapy Education-accredited physical therapist education program, and pass a state licensure exam (American Physical Therapy Association, n.d.)

In a broader sense, 66 percent of 31,000 registered jobseekers in a survey conducted by the Department of Labor and Employment (DOLE) and the online employment company JobStreet.com Philippines worked in the Philippines. They cited family, work environment, culture, and work-life balance as primary reasons for choosing local jobs (Uy, 2016).

#### ***4.5. Relationship between the level of adequacy of the programs and the level of satisfaction of the graduates with the University's Education***

As shown in Table 8, the current study revealed that BSMT/BMLS graduates perceived that their program is 'more than adequate' in preparing them for a job aligned to their degree ( $M=3.55$ ,  $SD = 0.55$ ). Furthermore, BSPT graduates found that their program has 'adequately' prepared them ( $M=3.05$  and  $SD = 0.56$ ) for a job aligned to their degree. The graduates' responses suggest that their respective programs have enabled them to acquire sufficient knowledge and develop the necessary skills applicable to their professional careers. Specifically, the BSMT/BMLS program enabled the graduates to develop a very high level of competency in performing clinical laboratory tests, analytical and critical thinking skills in the workplace, collaborative and interpersonal skills, and life-long learning activities. On the

other hand, the BSPT program allowed the graduates to achieve a high level of competency in planning and executing appropriate physical therapy interventions for patients/clients across the lifespan within a broad continuum of care. The University develops BSMT/BMLS and BSPT graduate competencies through high-quality teacher instruction and well-established internship programs for students. Students in the BSMLS program are required to complete a 12-month internship. During the first six months of their internship, students are sent outside of the university to various affiliation centers. On the other hand, students in the BSPT program must complete a 10-month internship. One of the important aspects of tertiary education is to provide students with learning outcomes to gain access to a complex and global job market (Harrison & Grant, 2016). These learning outcomes should consider industry demands and standards to facilitate the transition to employment (Oraison et al., 2019).

**Table 8**

*Levels of program adequacy and graduate satisfaction*

	<b>Mean</b>	<b>Std. Deviation</b>	<b>N</b>	<b>Interpretation</b>
BSMT/BMLS Adequacy	3.5507	.54920	227	More than adequate
BSMT/BMLS Satisfaction	3.5903	.51910	227	Very satisfied
BSPT Adequacy	3.0545	.55838	55	Adequate
BSPT Satisfaction	3.2364	.54309	55	Satisfied

The adequacy of preparation of the graduates for job alignment redounds to the relevance of the University's BMLS and BSPT degree programs to industry requirements. Thus, this becomes one of the major strengths of the programs' curricula. The results of the current study conform with the findings of Ang and Candelario (2021) involving Medical Laboratory Science (MLS) graduates from batch 2011 to 2018. Their findings revealed that graduates were trained them well in terms of skills, attitudes, and knowledge. Furthermore, the graduates affirm that the curriculum reflects the University core values. Further supporting the findings are Cuadra et al. (2019), which stated that most of the graduates recognized that their degree programs provided them with the necessary knowledge and skills useful in their respective careers. In addition, the study of Reusia et al. (2020) found graduates' educational background and acquired skills were highly relevant to their current jobs. Based on a study of Cornillez Jr. et al. (2021), graduates of teacher education thought that the scope of the curriculum was relevant, and the general education and teaching

practicum learning areas were identified as the most important topics that have the greatest impact on their ability to find employment.

The results further revealed that BMLS graduates were 'very satisfied with their University education (M=3.59, SD = 0.52). On the other hand, BSPT graduates were 'satisfied' with their University education (M=3.24 and SD = 0.54). The results parallel James-MacEachern's (2017) findings that there was a high degree of student satisfaction with overall institutional experience: 75.6% of undergraduate students reported that they were 'satisfied' or 'very satisfied with the overall quality of instructions. Likewise, a majority of students indicated that they were 'satisfied' or 'very satisfied with the overall academic experiences at the institution at 75.3%, overall university experiences at 71.6%, and overall quality of University services and facilities 70.4%.

Pearson correlation revealed that there is a moderate and positive relationship between the level of adequacy of the programs and the level of satisfaction of the BMLS ( $r = .484, p=.000$ ) and BSPT ( $r=.445, p=.001$ ) graduates with the University's education as shown in Tables 9 and 10, respectively. The satisfaction of the graduates with University's education reflects the adequacy of the BMLS and BSPT programs in preparing the graduates for professional careers and employment. According to a study by James-MacEachern (2017), students felt more prepared for the workplace as a result of their academic experiences than other supports the institution provided. The findings suggested that instead of focusing on career and support services, institutions would be better served by focusing on the academic and learning opportunities available to their students. According to James and Yun (2018), students generally felt satisfied with their progress both academically and personally. In essence, they felt satisfied with the abilities and knowledge acquired at a university, regardless of job expectations, and ready for the workplace.

**Table 9**

*Correlation between the level of BSMT/BMLS program adequacy and satisfaction*

		<b>BSMT/BMLS Adequacy</b>	<b>BSMT/BMLS Satisfaction</b>
BSMT/BMLS Adequacy	Pearson Correlation	1	.484**
	Sig. (2-tailed)		.000
	N	227	227
BSMT/BMLS Satisfaction	Pearson Correlation	.484**	1
	Sig. (2-tailed)	.000	
	N	227	227

\*\* . Correlation is significant at the 0.01 level (2-tailed).

**Table 10***Correlation between the level of BSPT program adequacy and satisfaction*

		<b>BSPT Adequacy</b>	<b>BSPT Satisfaction</b>
BSPT Adequacy	Pearson Correlation	1	.445**
	Sig. (2-tailed)		.001
	N	55	55
BSPT Satisfaction	Pearson Correlation	.445**	1
	Sig. (2-tailed)	.001	
	N	55	55

\*\* . Correlation is significant at the 0.01 level (2-tailed).

## 5. Conclusion

This study showed that the graduates of the BSMT/ BSMLS and BSPT are mostly given employment opportunities both locally and internationally, employed within 6 months after graduation and with work aligned to the program. The BSMLS and BSPT programs of the University adequately prepared the graduates for the job alignment to their degree, hence, graduates were satisfied with the University's education. Furthermore, the completed program is moderately and positively related to the adequacy of the BSMLS and BSPT programs and the adequacy of the programs is also moderately and positively related to the satisfaction of the graduates with the University's Education (BMLS:  $r = .484$ ,  $p = .000$ ; BSPT:  $r = .445$ ,  $p = .001$ ). Based on the results, it is concluded that the University's graduates are highly employable both locally and internationally, owing to the adequate academic preparation they have acquired while in the university. Because of the lower employment rate of the BSPT graduates, it is recommended to further improve the BSPT curriculum to adequately prepare graduates for jobs aligned to their program. Given the limitations of the study, it is recommended to conduct another study to identify the graduates' knowledge and skills acquired during their academic years at the University. To highlight the graduates' local and international presence, a tracer study can be done per program in relation to the standard competencies. The research can also be expanded to other medical professionals such as nurses, pharmacists, and dentists.

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# Site Selection for Sustainable Wind-Solar Hybrid Energy Harvesting Plant

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## Abstract

The world's energy landscape is undergoing rapid transformation as societies strive towards renewable and sustainable power sources in response to the need for energy security and climate change. Depletion of fossil fuels and increasing focus on environmental sustainability have been significant drivers in this global shift towards renewables. Among the promising solutions, solar-wind hybrid energy systems have gained attention, capitalizing on the complementary nature of solar and wind resources. However, selecting the optimal site for these hybrid plants is crucial for their successful implementation and efficiency. This research introduces a comprehensive methodology for site selection, seamlessly integrating the Delphi method and Analytic Hierarchy Process (AHP). The Delphi method harnesses expert consensus to distil essential criteria, while AHP offers a structured framework to evaluate and prioritize these criteria. The results showed successful utilization of the AHP and Delphi techniques for evaluating the optimal location selection among different cities for solar-wind hybrid energy harnessing in the northwest region of Pakistan. The key factors for selection of optimal location were identified through expert feedback and analysis. Among the selected key main criteria, resource availability and infrastructure and socio-economic factors emerged as the top-ranked criteria in this study. The results of this study hold significant relevance and should be duly considered for solar-wind power project site selection, while also offering opportunities for further enhancements in the future.

**Keywords:** *Multi Criteria Decision Making, Site Selection, Renewable Energy, Analytic Hierarchy Process, Delphi method*

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## 1. Introduction

The energy landscape at a global scale is experiencing a notable shift, driven by the growing awareness and recognition of transition towards sustainable and renewable energy sources. This transformation is being embraced by societies worldwide, reflecting a collective understanding of the pressing need to address environmental concerns and ensure a more sustainable future. The depletion of fossil fuels, growing environmental concerns, and the increasing need for energy security have prompted a global transition towards cleaner and more sustainable energy alternatives (World Energy Outlook, 2020). Renewable Energy (RE) resources, including solar and wind energy, have gained remarkable attention due to their abundance, scalability, and minimal environmental impact (Renewable Capacity Statistics, 2021).

As of 30 June 2022, Pakistan's power generation capacity stands at 43,775 MW, comprising various sources. The overall power capacity is derived from various sources. Thermal power contributes 26,683 MW, hydroelectric power provides 10,635 MW, wind power contributes 1,838 MW, solar power stands at 630 MW, bagasse power contributes 369 MW, and nuclear power provides 3,620 MW (List of power stations in Pakistan, n.d.). These various sources contribute significantly to the country's electricity generation and act as a vital role in fulfilling power requirements. However, Pakistan possesses significant potential in RE sources that can help encounter its requirements of growing energy.

In Pakistan, where solar and wind energy exhibit complementary patterns in terms of time and region, the careful assessment of the most optimal locations for wind-solar hybrid energy harnessing becomes imperative. While solar and wind power offer numerous advantages individually, combining these two technologies in a hybrid system can provide enhanced energy generation and improved reliability (Vasant & Pawar, 2017). Specifically, in the north Punjab region, the monsoon climate leads to strong winter winds and low solar radiation intensity, while summers have weaker winds and high solar radiation intensity. The synergistic relationship between solar and wind resources presents an opportunity to maximize energy output and potential of these sources can be effectively harnessed.

However, the efficient output of solar-wind hybrid energy plants heavily depends on the selection of an optimal site. Although there are existing methods as employed by Asadi et al. (2023) for site selection in renewable energy projects, limited studies have focused

specifically on the combination of Analytic Hierarchy Process (AHP) technique along with Delphi method for solar-wind hybrid energy projects. Hence, this research aims to utilize a framework by combination of Delphi and AHP in the context of site selection of hybrid energy harnessing. According to Solangi et al. (2019) and Marttunen et al. (2017), problem arises from the need to consider multiple criteria, expert opinions, and prioritize them effectively to identify optimal sites among different required sites in Pakistan that maximize energy production, minimize costs, and ensure long-term viability and sustainability. In this case, the integration of Delphi and AHP has promising potential.

The Delphi method is an approach utilized in qualitative research, where consensus is sought from experts group through a multiple questionnaires and iterative feedback rounds (Linstone, 1975). It facilitates the identification of essential criteria and the consolidation of expert perspectives, offering valuable insights into intricate issues. On the other hand, the AHP method is a systematic decision making process developed by Saaty in 1980. It is a technique utilized for making decisions by facilitating the systematic evaluation and prioritization of criteria through weightage gain from judgment of experts and finally prioritize/rank the different decision alternatives (Brunelli, 2014).

While previous research has extensively examined the site selection for renewable energy projects (i.e. Tafula et al., 2023; Khazael & Al-Bakri, 2021; Kocabaldır & Yücel, 2020; Wissing, 2013; Goh et al., 2022; Spyridonidou & Vagiona, 2023; Deveci et al., 2021; Hosseinzadeh et al., 2023; Soydan, 2021), there remains a notable gap in the literature concerning location selection for solar-wind hybrid energy projects using the Delphi approach and AHP methods. To address this gap, this study aims to develop a comprehensive approach by conducting a literature review to identify critical factors for site selection. Expert opinions were gathered through the Delphi method to refine and assess the importance and weightage of the obtained criteria/factors through literature review. By utilizing these criteria obtained from expert consensus into the structured decision-making technique of AHP, this research intends to create a robust framework for location selection among different cities in the northwest Punjab region of Pakistan, including Rawalpindi, Islamabad, Taxila, Wah Cantt, and Khanpur, facilitating informed decision-making and promoting the development of sustainable solar-wind hybrid energy harvesting plants. These locations are highlighted in figure 1.

Figure 1

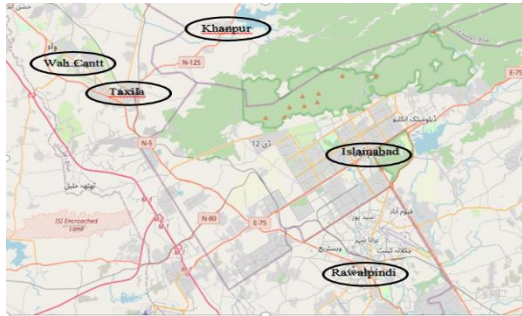


Table 1

*Cities/Alternatives for Present Study*

*Positional Coordinates of Alternative Cities*

Name of city	Longitude	Latitude
Islamabad	73.043 E	33.721 N
Taxila	72.785 E	33.740 N
Wah Cantt	72.751 E	33.771 N
Rawalpindi	73.071 E	33.626 N
Khanpur	70.656 E	28.647 N

## 2. Literature Review

### *2.1. Assessment of Criteria and sub-Criteria for Site Selection*

Many countries endowed with substantial solar and wind power source actively pursuing the development of this environment friendly and pollutant-free energy source. Methods of multi criteria decision making (MCDM) have become progressively common in the energy sector for various applications, including site selection, environmental management, and equipment assessment and evaluating projects, and these techniques have been applied to various decision problems, including site selection. For instance, Acar et al. (2003) employed decision-making techniques to evaluate potential landfill sites for solid waste. Similarly, Heo et al. (2010) utilized the Fuzzy AHP technique to evaluate the effectiveness of RE distribution program. Meanwhile, Cavallaro (2010) applied Fuzzy TOPSIS to compare and prioritize different storage options of thermal energy related to systems of solar potential and Lee et al. (2012) applied Fuzzy Analytic Network Process (fuzzy ANP) to assess wind turbines by considering multiple criteria. In a recent study by Kollati and Debnath (2021), the techniques employed for site selection over the past few decades were systematically examined, providing a comprehensive analysis that has been widely utilized by the scientific community and policymakers.

Various academic researchers have focused on the selection of location for solar-wind hybrid energy harnessing. For example, Aydin et al. (2013) utilized fuzzy decision approach along with GIS to identify the most appropriate location for wind-solar hybrid energy harnessing. Yunna and Geng (2014) formulated a decision framework using AHP to prioritize optimal places for wind-solar hybrid potential harnessing. On the other hand, on the framework assigns priorities to alternatives based on their suitability, Yun-na et al. (2013)

employed the ideal matter-factor model and ELECTRE II method to find the optimal macro-site for hybrid energy harnessing. When Lee et al. (2009) utilized AHP to examine the costs, risks, opportunities, and benefits of wind solar-PV systems, they suggested different criteria and an integrated process for evaluating power system projects. Hence, several studies used various techniques, methods, approach and process. For example, Van Haaren and Fthenakis (2011) investigated the selection process of sites for farms of wind using Spatial MCDM examination, Wanderer and Herle (2015) created a spatial decision support system in Spain, which was web based and utilized a multi criteria analysis approach, Tahri et al. (2015) integrated GIS and MCDM methods to evaluate appropriateness of different sites for renewable energy projects in Morocco, Brewer et al. (2015) employed MCDM analysis approach based on GIS in state of Idaho, USA to find economically viable and socially acceptable area for solar projects, Dawod and Mandoer (2016) conducted a study in Egypt to find optimal locations for solar energy plant, employing a multi criteria scheme based on GIS and Latinopoulos and Kechagia (2015) utilized a multi criteria assessment approach with GIS to get optimal locations for installing wind projects in Greece.

The previous studies also considered various factors, including economic, technological social, and environmental aspects in the site selection. For instance, Azizi et al. (2014) took into account technical, ecological and financial factors during the process of selecting sites for wind energy project. While Gigović et al. (2017) identified eleven criteria for the assessment of appropriate sites in Serbia such as distance from telecommunication infrastructure, land use, land slope, wind speed, population density, approach from power lines, approach from roads, land aspects, nearby tourist facilities, distance from protected areas and proximity to urban areas, Ali et al. (2018) only recognized six primary criteria including wind speed/density, conveyance cost, nearness to power station, and population bulk. Other authors identified various factors such as appropriateness of land considering multiple aspects such as wind potential, proximity to roads, energy demand historical sites natural features and slope (Al-Yahyai et al., 2012), technical, environmental, financial, community criteria, visual impact, wind resources, proximity to the power station, land value and land cover (Tegou et al., 2010), financial, technical, ecological, and topographical factors (Noorollahi et al., 2016), land cover/use, approach from main communication distance, slope, grid access, wind speed average and orientation aspect (Pamučar et al., 2017) and security and quality, financial, policy, environment and ecosystem, and social impression (Yeh &

Huang, 2014). Other studies considered the various factors while integrating other techniques. For instance, Baloch et al. (2019) put forward a proposal for generating off-grid energy from six wind places located in Pakistan, Wątróbski et al. (2015) conducted a feasibility study for selection of farms site for wind project located in Szczecin city, Poland using AHP and PROMETHEE, Wu et al. (2016) worked on decision process in which selection of location is carried out for offshore wind by utilizing ELECTRE III, and Sánchez-Lozano et al. (2016) joint fuzzy methods from different MCDM approaches in order to dealt with problem in making decision for selection of location for building wind project onshore. The various factors generated from the literature are summarized in table 2.

**Table 2**

*List of Criteria & sub-Criteria Obtained from literature*

No.	Criteria	Sub Criteria
1.	Resource Availability	Average wind speed
2.		Average Wind turbulence
3.		Wind patterns and variability
4.		Solar irradiance levels
5.		Annual Sunshine Duration
6.		Shading Analysis
7.	Environmental factors	Area of Flat Land & Without protected areas
8.		Threatened or endangered species
9.		Bird migration patterns
10.		Impact on Biodiversity and Habitat Preservation
11.		Noise and visual impact
12.		Distance to residential areas
13.	Infrastructure & Connectivity	Noise restrictions and regulations
14.		Scenic or protected views
15.		Access to power grid
16.		Population Density
17.		Communication Network Coverage
18.		Roads Accessibility
19.	Land Characteristics	Road conditions and suitability
20.		Water availability
21.		Size and Acquisition of the avail land
22.		Land use restrictions/zoning regs.
23.		Topography and elevation
24.		Suitability for wind/solar
25.	Climatic Conditions	Soil conditions and stability
26.		Risk of hurricanes, tornadoes, etc.
27.		Lightning frequency and intensity
28.		Temperature range and variation
29.	Socio-Economic Factors	Cooling requirements for solar panels
30.		Cost of land
31.		Operation and maintenance expenses
32.		Public Acceptance & Job Creation
33.		Energy production demand
34.		- Renewable energy targets and subsidies



## 2.2. Renewable Energy resources in Pakistan

The Islamic Republic of Pakistan is situated in South Asia. The country is gifted with sufficient amount of RE resources. These resources comprise wind, hydro, geothermal, biomass and solar energy. These sources offer substantial potential for generating electricity. Though the adoption and utilization of these sources have been sluggish in Pakistan, presently, they contribute only a minor portion to the country's total energy. In line with the RE Strategy of 2006, Pakistan has set an ambitious goal of incorporating 10,000 MW of power generated using renewable sources into its energy portfolio by the year 2030 (Farooqui, 2014). Nevertheless, the actual estimated potential of renewable energy far exceeds this figure. With the ever-increasing energy demand, it is crucial to harness the maximum potential of renewable energy sources. Table 3 presents a comprehensive overview of the estimated capacity of these renewable energy sources and the existing energy generation potential derived from these sources in Pakistan.

**Table 3**

*The assessment of renewable energy potential and installed capacity across different sources in Pakistan*

Renewable Source	Potential	Installed
Solar	2,90,000 MW	200
Wind	346,000 MW	308

Source: (Shaikh, Ji, & Fan, 2015) (Zafar, Ur Rashid, Khosa, Khalil, & Rahid, 2018)

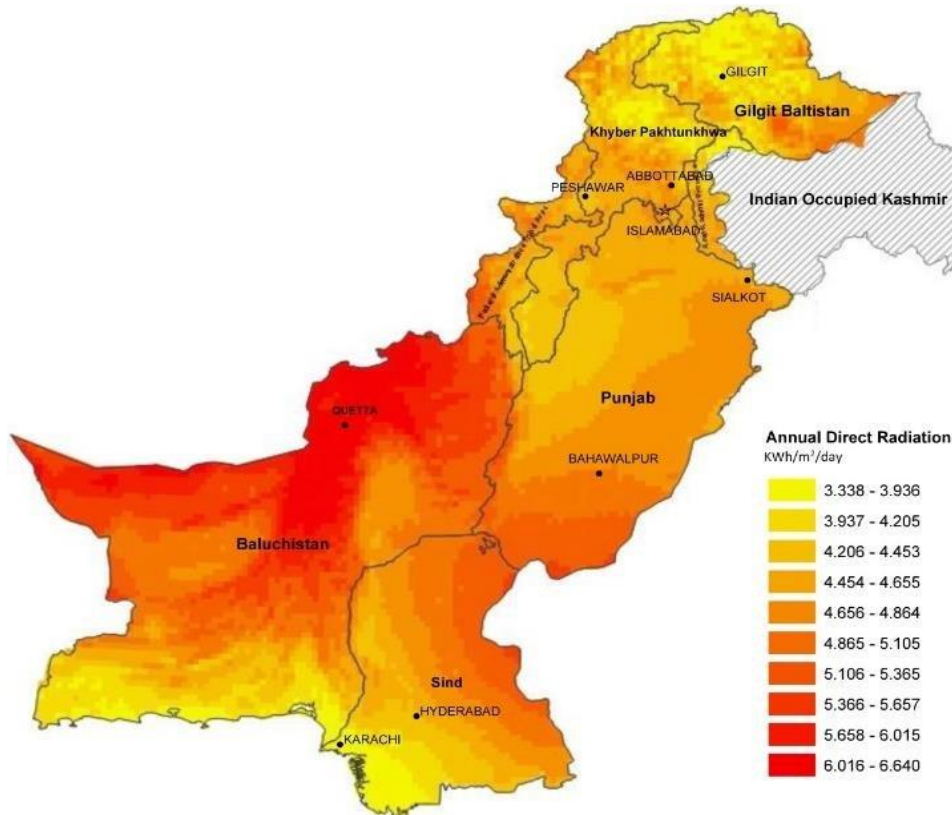
**Solar Resource.** Pakistan is rapidly evolving annually, increasing the requirement of energy demand. This necessitates exploration of alternative energy sources. Among these alternatives, solar power stands out as a promising option due to its distributed nature and holds great potential to address this energy shortage. The country is fortunate to receive ample sunlight throughout the year, making solar energy a viable and abundant renewable resource that can help address the prevailing energy shortage across the nation (Rauf et al., 2015). The country possesses a remarkable solar energy providing a significant opportunity to fulfill the nation's energy demand. However, despite having abundant solar potential, Pakistan has not fully utilized its capacity for solar power plant development.

Pakistan has a rich solar energy resource, with over 300 sunlight days and an average annual radiation of 1800-2200 kWh/m<sup>2</sup> and average temperature of 26-28°C. This translates to a solar energy potential of 5.5-6 kilowatt hour per sq meter in one day (Wakeel et al., 2016) as shown in figure 2. Pakistan possesses solar energy capacity estimated to exceed

50,000 MW, with over 2500 hours of annual sunlight availability. Baluchistan and Sindh, in particular, have excellent potential for solar energy projects, receiving 7-8 hours of sunlight per day, approximately 2300-2700 hours annually (Rauf et al., 2015).

**Figure 2**

*Average solar radiation distribution of Pakistan*



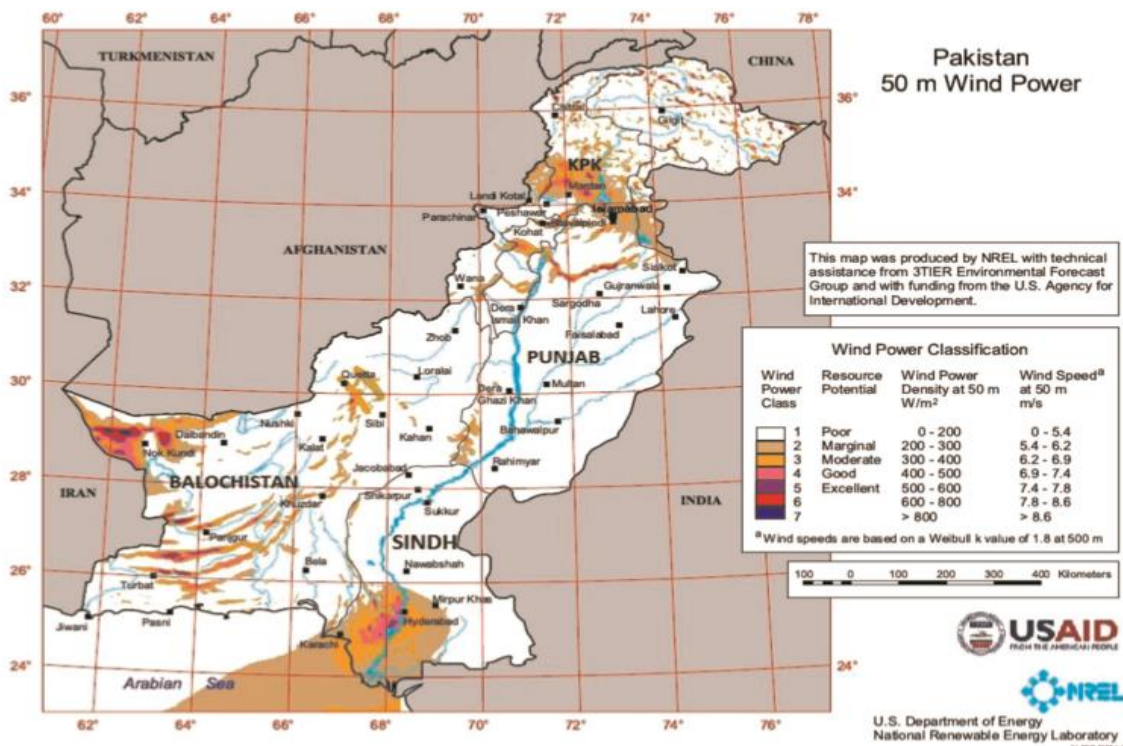
Source: NREL.PakistanResourceMapsandToolkit, 2017

Despite the favorable geographical conditions, the progress in developing renewable energy resources, particularly solar potential for energy generation, is still in its infancy in Pakistan, primarily due to the absence of government attention and obligation (Cantarero, 2020). However, individual efforts by electricity customers such as individual photovoltaic units ranging from 100-500 Watt, have been observed. Yet, these efforts face challenges related to operational maintenance, availability of spare parts, and sustainability. Based on predictions, approximately 40,000 towns in Pakistan have the potential to be electrified by leveraging the annual average sunlight of 8-8.5 hrs/day (Abdullah et al., 2017)

**Wind Energy Resource.** In recent years, significant progress and development across various sectors have resulted in an increased reliance on technology, leading to a growing demand for energy and power generation in Pakistan. At present, conventional methods like, fossil fuels, coal and oil largely dominate the country's energy generation. However, as these finite resources are depleting, it becomes imperative to explore and adopt alternative energy sources to ensure a sustainable and secure energy future for Pakistan (Ullah et al., 2020).

**Figure 3**

*Integrated Delphi-AHP Decision framework*



Source: *PakistanResourceMapsandToolkit—NREL, 2017*

Pakistan possesses a substantial wind energy potential that can be harnessed for electricity generation. As early as 2003, wind projects with unit capacities ranging from 150 to 100 Mega Watts were established in the wind corridor of Sindh province. These projects collectively contributed to a cumulative capacity of 500 MW (Sheikh, 2010). The Renewable Energy Council of Pakistan (PCRET) built 26 wind projects, with a capability of 500W individually, in town named Gul Muhammad, marking Pakistan's first village that is wind power-electrified. The country is estimated to have the capacity to produce nearly 346,000 Mega Watt of power from wind (Solangi et al., 2018). Though the first wind energy

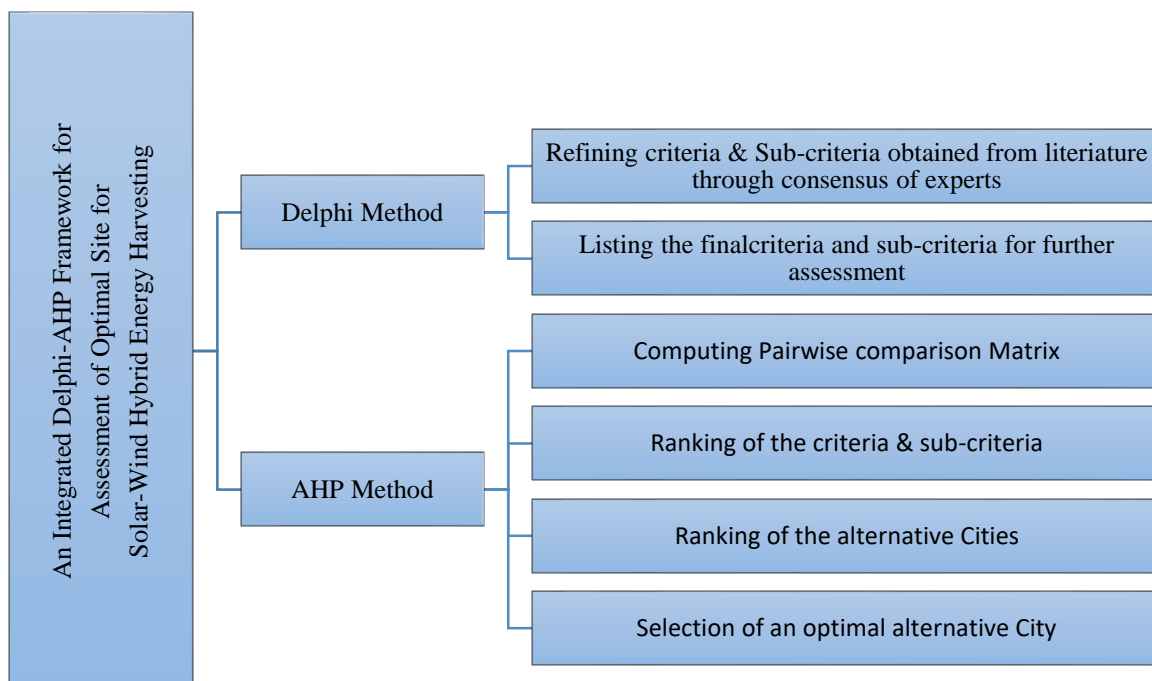
harnessing project became operational in 2013 in Pakistan, a study indicated a significant wind energy source in the southern areas of province Baluchistan and Sindh estimated to be around 50,000 MW, while the Punjab province was estimated to carry a wind energy potential of 1000-1500 Mega Watt. The Pakistan Meteorological Department conducted measurements of speed of wind in the Baluchistan and Sindh coastal areas and identified steady wind speeds of 5-7 metre /second (Wind Energy Project, 2017). In particular, the Gharo and Keti Bandar regions in Sindh shown excellent wind potential for large-scale wind farm projects, an average wind velocity is recorded around 6.86 m/s. These figures indicate the area's economic feasibility and its suitability for wind energy harnessing. The capacity of wind energy in Pakistan is illustrated in Figure 3.

### 3. Methodology

The research methodology is the backbone of any study, guiding the entire process of data collection and analysis. The research begins by extensive review of existing literature to gain insights of previous studies and collection of criteria and sub-criteria related to the problem. Integrated Delphi-AHP Decision framework is presented in figure 4.

**Figure 4**

*Integrated Delphi-AHP Decision framework*



The Delphi technique is employed to assess and refine key criteria and sub-criteria that influence site selection decisions. The research focuses on case studies of five cities in the northwest region of Pakistan, namely Islamabad, Taxila, Rawalpindi, Khanpur, and Wah Cantt. The AHP is then employed and through pairwise comparisons, the weights of the criteria are obtained, providing a rational and transparent basis for the final evaluation and incorporates sensitivity analysis to explore any potential changes due to variations in criteria weights.

### ***3.1 Delphi Method***

This method is implemented to facilitate gathering of expert opinions, consensus building, and refinement of criteria and their importance. The process involves iterations, enabling the gradual convergence of opinions and the refinement of decision criteria. In this study, a panel of 8 professionals was engaged, including specialists from renewable energy field and industries and academia. However, the participation rate for the study survey was limited as only 5 experts consented to participate in the research.

Experts were presented with the list of criteria obtained through literature review. They ranked each criterion on a numerical scale based on their importance, considering their expertise and knowledge. The ratings provided by the experts is collected and examined to get the priority ranking of each factor.

Delphi method focus on achieving consensus among the expert panel regarding the final set of criteria and their relative importance. Feedback from the experts is shared with each other to facilitate the convergence of opinions. A feedback report summarizing the group's ratings, the range of opinions, and any points of disagreement is provided to the experts. They were given the opportunity to revise their ratings based on the feedback and engage in a structured discussion to address any divergent viewpoints. The process continues until a consensus is reached, indicating a high level of agreement among the experts regarding the final set of criteria and their priorities.

### ***3.2 Analytic Hierarchy Process (AHP)***

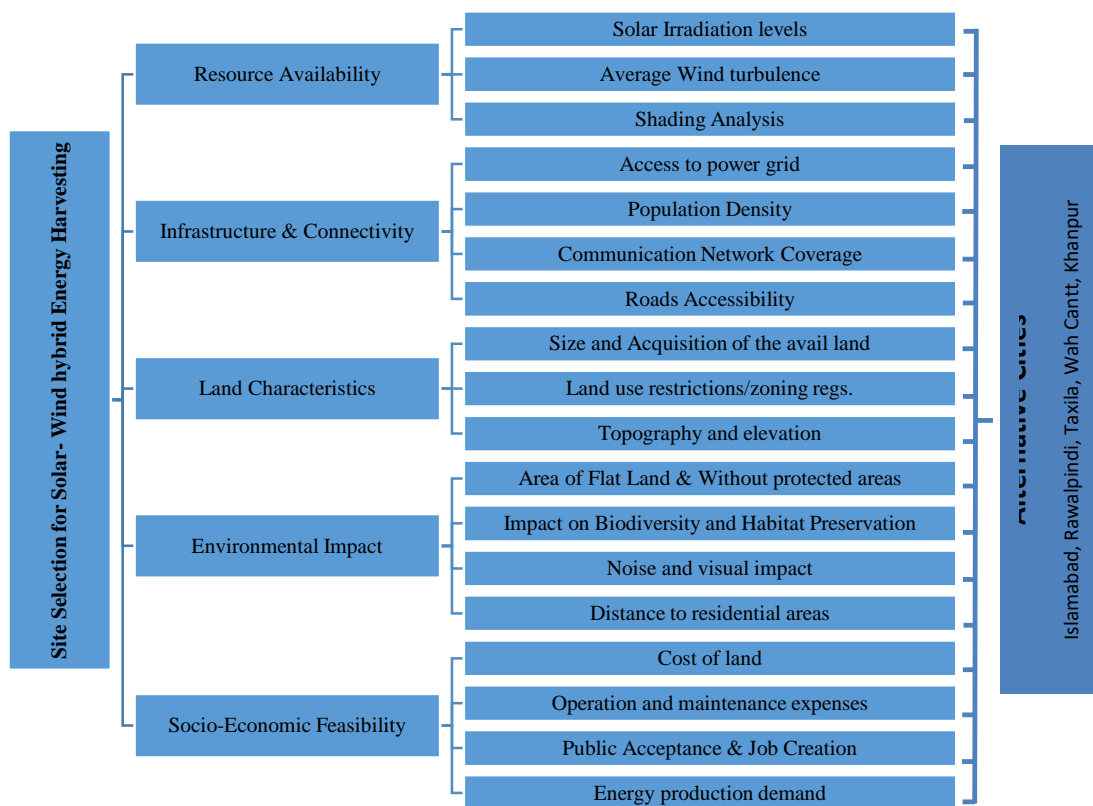
MCDM method is an effective tool in decision problems. One of the widely used MCDM technique pioneered in 1970s by Thomas L. Saaty is AHP. It offers a systematic and structured approach to tackle intricate decision-making challenges by decomposing them into manageable sub-problems. AHP involves pairwise comparisons of criteria and alternatives to

determine numerical priority weights, which are then used to calculate overall priorities. The AHP process consists of several steps:

**Hierarchical Structure:** Hierarchy formation is the first step of this technique which consist of a structure containing criteria linked with their sub-criteria for achieving goal. Decision-makers then brainstorm and organize these elements in descending form to form a hierarchy as shown in Figure 5.

**Figure 5**

*Derived Hierarchy*



**Pairwise Comparisons:** After establishing the hierarchy, decision-makers make pairwise comparisons matrix (table 4) based on judgements of experts between elements using scale (table 5) to express the relative significance of one factor over another. The comparisons are done for elements at the lower levels with respect to elements at the higher levels.

**Calculation of Priority Weights:** The comparative weightage is derived for every level in the hierarchy through pairwise judgments. The number of matrices needed is

determined by the quantity of elements at every level. The maximum eigenvalue and global weights of each matrix are calculated.

**Table 4**

*Pair wise Comparison matrix*

	Criteria x	Criteria y
Criteria x	1	Rating point
Criteria y	1/Rating point	1

**Table 5**

*Saaty Rating Scale*

Rating Values	Definition ( Comparing factor X to Y)
1	X Equally important to Y
3	X Moderately important to Y
5	X Strongly important to Y
7	X Very Strongly important to Y
9	X Extremely important to Y
2,4,6,8	Middle values

**Synthesis:** In the synthesis, the values from the obtained matrix are summed and normalized. The mean of the values in rows of this matrix is computed to obtain the relative priorities of elements.

**Consistency Check:** Decision-makers' consistency is crucial in the obtained responses of experts. The reliability of judgments is ensured using Consistency Ratio (CR) which can be obtained by taking ratio of Consistency and random Index (CI & RI), Consistency is considered satisfactory if this value is less than 10%.

Consistency index can be calculated by Formula mentioned below using Eigen value.

$$\text{Consistency Index} = \frac{\lambda_{\max} - 1}{n - 1}$$

The consistency ratio is computed using Equation.

$$\text{Consistency Ratio} = \frac{\text{Consistency Index}}{\text{Random Index}}$$

***Overall Priority and Ranking:*** The overall priority for ranking alternatives is developed using composite weights derived from the relative weights of elements at different levels. A decision support system called "Expert Choice" is based on AHP and designed to facilitate more logical and unbiased decision-making processes. It organizes data in a hierarchical structure and performs computations on pairwise comparisons to help users solve complex problems involving multiple criteria and alternatives.

The questionnaire served as a tool to gather the valuable opinions and judgments of the expert panel. It is carefully structured in the form of pairwise comparison matrix to collect pertinent information regarding site selection criteria, their respective importance, and the decision making process. Participants assigned numerical values representing the relative importance or preference between each pair of criteria. The selection of an expert panel is crucial for obtaining diverse perspectives and domain-specific knowledge. The experts were invited to participate in the study and contribute their insights throughout the Delphi method and AHP analysis. Their involvement ensured a comprehensive and well-informed decision-making process, taking into account multiple viewpoints and expertise. In this study, the experts include professionals based on their experience and expertise from academia, renewable industry, and government departments like council of Pakistan for RE Technologies (PCRET) and local authorities from different sites. There were around 31 pairwise comparison questionnaires filled by these experts to prioritize the cities for solar wind hybrid energy harvesting plant.

The AHP approach is advantageous as it provides a structured framework for evaluating alternatives and enables decision-makers simultaneously examine both qualitative and quantitative data. It is particularly useful when dealing with large numbers of alternatives and selection factors. However, maintaining consistency in judgments can be challenging, and the AHP process involves several steps to ensure the validity of the results. Hence, AHP is a powerful decision-making method used in various domains. By following a structured approach of hierarchical decomposition and pairwise comparisons, AHP helps decision-makers make informed and rational choices in complex decision-making scenarios. Additionally, decision support systems like 'Expert Choice' based on AHP facilitate the implementation of this methodology and handle large amounts of data efficiently.



## 4. Results

### 4.1 Delphi Results

Based from the literature review, considerable number of criteria were listed down and used for valid research as shown in Table 1. Due to the large number of criteria listed, it was impractical to utilize all of them for pairwise comparisons. Therefore, panel of specialists of 5 members related to renewable energy field were presented questionnaire in which they ranked out refined and key factors. In the end, 5 criteria and 18 sub-criteria were selected for further assessment. Table 6 presents the refined factors which are found vital for evaluation of location for harnessing hybrid energy.

**Table 6**

*Selected Factors*

No.	Criteria	Sub Criteria
1.	Resource Availability	Solar Irradiation levels
2.		Average Wind turbulence
3.		Shading Analysis
4.	Environmental factors	Area of Flat Land & Without protected areas
5.		Impact on Biodiversity and Habitat Preservation
6.		Noise and visual impact
7.		Distance to residential areas
8.	Infrastructure & Connectivity	Access to power grid
9.		Population Density
10.		Communication Network Coverage
11.	Land Characteristics	Roads Accessibility
12.		Size and Acquisition of the avail land
13.		Land use restrictions/zoning regs.
14.	Socio-Economic Factors	Topography and elevation
15.		Cost of land
16.		Operation and maintenance expenses
17.		Public Acceptance & Job Creation
18.		Energy production demand

### 4.2 AHP Results

To obtain the weights of factors in this method, a collaborative and systematic process of decision making was adopted. A total of 31 specialists participated and provided their judgments in the form of pairwise comparison matrices for criteria, sub-criteria, and alternatives. To consolidate the input from individual specialist, the method of taking geometric mean was utilized to compute their weights. The implementation of the AHP involved two distinct phases. Initially, the matrix main criteria were processed and their

weights were measured, and similarly, the weights were determined for sub criteria. Table 7 presents the outcomes of this process.

**Table 7**

*Results of pairwise comparison*

Criteria	Sub Criteria	Local Weights	Global weights	Overall Ranking
Resource Availability		0.613		1 <sup>st</sup> (criteria)
	Solar Irradiation levels	0.472	0.289	1 <sup>st</sup>
	Average Wind Speed	0.444	0.272	2 <sup>nd</sup>
	Shading Analysis	0.084	0.051	5 <sup>th</sup>
Environmental factors		0.053		4 <sup>th</sup> (criteria)
	Area of Flat Land & Without protected areas	0.361	0.019	10 <sup>th</sup>
	Impact on Biodiversity and Habitat Preservation	0.224	0.012	13 <sup>th</sup>
	Noise and visual impact	0.097	0.005	18 <sup>th</sup>
	Distance to residential areas	0.318	0.017	12 <sup>th</sup>
Infrastructure & Connectivity		0.193		2 <sup>nd</sup> (criteria)
	Access to power grid	0.468	0.090	3 <sup>rd</sup>
	Population Density	0.143	0.028	8 <sup>th</sup>
	Communication Network Coverage	0.059	0.011	14 <sup>th</sup>
	Roads Accessibility	0.330	0.064	4 <sup>th</sup>
Land Characteristics		0.062		5 <sup>th</sup> (criteria)
	Size and Acquisition of the avail land	0.460	0.033	7 <sup>th</sup>
	Land use restrictions/zoning regs.	0.319	0.021	9 <sup>th</sup>
	Topography and elevation	0.221	0.009	16 <sup>th</sup>
Socio-Economic Factors		0.079		3 <sup>rd</sup> (criteria)
	Cost of land	0.529	0.042	6 <sup>th</sup>
	Operation and maintenance expenses	0.101	0.008	17 <sup>th</sup>
	Public Acceptance & Job Creation	0.134	0.011	15 <sup>th</sup>
	Energy production demand	0.236	0.018	11 <sup>th</sup>

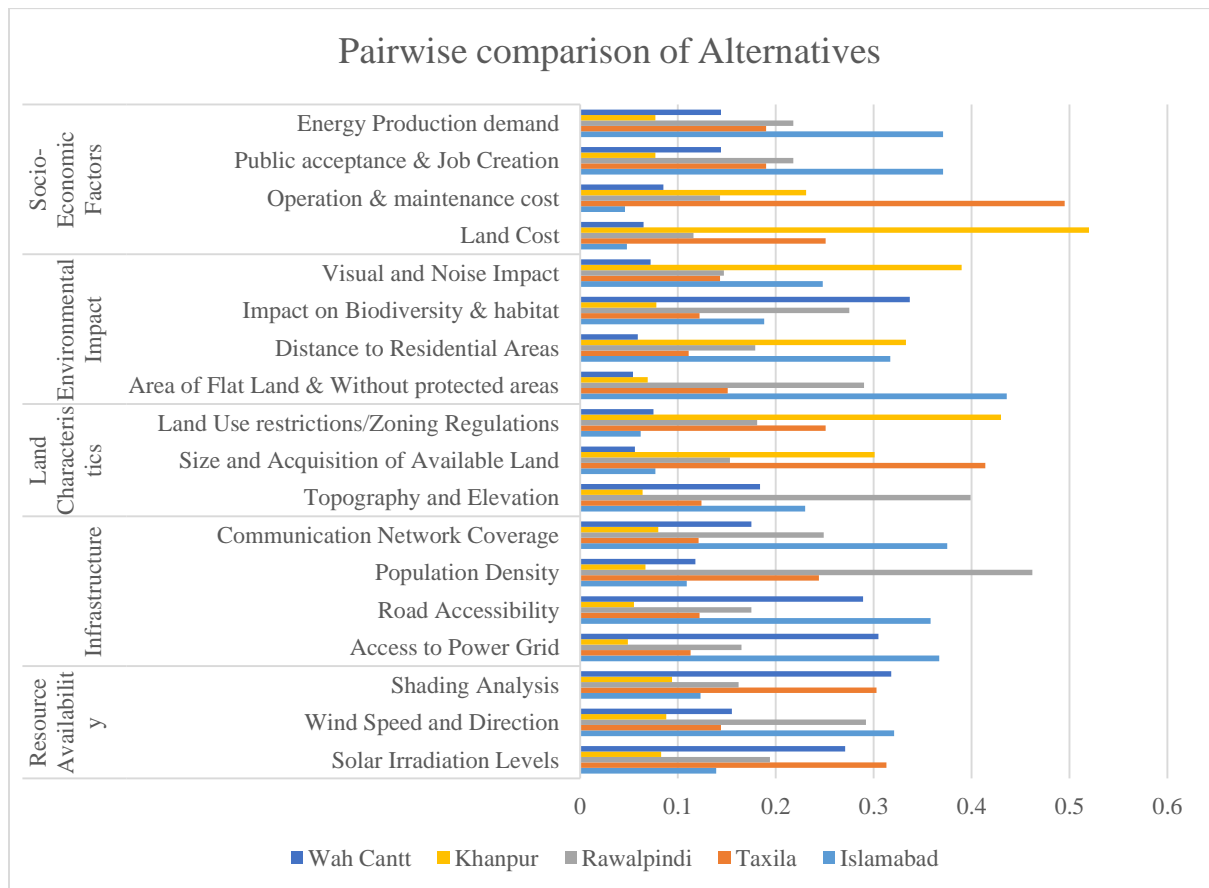
The next step is to perform comparison assessment of alternatives which included all the criteria. It is basically a question which asks experts to compare alternatives based on each criteria. This is done by numbering using the scale. When all the pairwise comparisons are performed, geometric mean is used to aggregate individual judgments (Saaty, 1990). These were analyzed by using the Expert Choice software. This software is used to calculate consistency ratio (CR) and weights of criteria and alternatives.

The judgment is accepted if  $CR \leq 0.10$ . The questionnaire was presented back to expert if their values was greater than 0.10. These experts were explained the meaning of inconsistency in AHP. Many participants were able to achieve this value. The specialists were free to complete the questionnaire is their own way

After completion of pairwise comparison of factors, the next step is to find pairwise comparison of alternatives using each criteria and sub criteria as shown in figure 6 by utilizing judgements recorded by the experts.

**Figure 6**

*Pairwise comparison of Cities using each criteria/sub Criteria*



Finally, overall priorities of decision alternatives are synthesized using the criteria priorities that have been calculated in previous steps as shown in table 8.

**Table 8***Final Ranking of Alternative Cities*

Alternative Cities	Priority weight	Rank
Rawalpindi	0.244	1
Islamabad	0.183	2
Khanpur	0.095	6
Taxila	0.083	7
Wah Cantt	0.101	5

### 4.3 Sensitivity Analysis

In order to examine the potential impact on result due to change in expert's preferences, sensitivity analysis is executed in this research. The focus was to assess the significance of weights of criteria in relation to the priorities of cities as alternatives. Five variations were examined, and it was observed that the sequence of alternatives priorities remained consistent and did not vary. Table 9 shows the weightage of the criteria for the different variations and Table 10 shows the results and priorities calculated from the sensitivity analysis for these variations.

Variation 1 is the weights obtained in this research, while other variations are computed to analyze sensitivity aspect. Table 10 indicates that the alternatives ranking remained unchanged in variation 2 and 3, while the rankings were altered in variation 4 and 5.

**Table 9***Criteria weights used in different Variations for sensitivity analysis*

Criteria	Variation 1	Variation 2	Variation 3	Variation 4	Variation 5
Resource Availability	0.613	0.503	0.437	0.170	0.292
Infrastructure & Connectivity	0.193	0.248	0.255	0.134	0.329
Land Characteristics	0.062	0.08	0.044	0.308	0.030
Environmental Factors	0.053	0.069	0.038	0.300	0.312
Socio Economic Factors	0.079	0.101	0.226	0.088	0.037

**Table 10***Results of the Alternatives ranking for each Variation*

Alternatives	Variation 1	Variation 2	Variation 3	Variation 4	Variation 5
Islamabad	1	1	1	1	1
Rawalpindi	2	2	2	3	2
Taxila	3	3	3	2	4
Wah cantt	4	4	4	5	3
Khanpur	5	5	5	4	5

In conclusion, the sensitivity analysis demonstrates that the main findings of the study remain unchanged, indicating that altering the weights of the obtained results would have an insignificant impact. The highest-ranked alternative remains Islamabad, with Rawalpindi, Taxila, Wah Cantt, and Khanpur following in that order. Based on the conducted analysis and findings, the findings of the research are deemed valid and robust. The rigorous methodology employed and the careful consideration of various factors ensure the reliability and credibility of the study's outcomes.

## 5. Discussion

This study utilized a comprehensive research framework and implemented various methodologies, resulting in valuable insights and significant findings. As a result, energy specialists and policy creators can rely on the research framework and relevant findings to make informed decisions regarding selection of location for solar-wind harnessing.

The successful utilization of the Delphi and Analytic Hierarchy Process (AHP) methods has effectively addressed the process to make decision for selection of optimal city for solar-wind harnessing in the northwest area of Pakistan. The final rankings and results of this research are obtained by a robust methodology and appropriate utilization of expert opinions and related work. Among the selected key criteria identified in this research, namely resource availability, infrastructure and connectivity, land characteristics, environmental impact, and socio-economic factors, resource availability has been recognized as the most

significant factor due to its direct impact on the energy generation potential and overall plant efficiency. Infrastructure and connectivity is considered the second most important factor in the process of selection of location. The prioritization of criteria in this research aligns with the perspective of a typical developing country, where the scarcity of funding resources poses a significant challenge for renewable energy project development. It is noteworthy that the respondents ranked the environmental aspect as the lowest priority. This lower ranking indicates that the local population is unaware regarding the significance of environmental ecological balance.

The results and rankings of the sub-criteria reveal that the quality of solar and wind resources, distance from grid, road accessibility, land availability, cost, and land acquisition are ranked as the top factors. These rankings reflect a robust outcome, emphasizing the critical significance of these criteria in the decision process of optimal city for solar-wind energy harnessing projects.

This ranking of different cities in the northwest region holds significant importance as it is based on a scientifically guided decision-making process and incorporates essential factors and a robust methodology. Islamabad, Rawalpindi, and Taxila are highly suggested as the optimal cities for installation and investments of solar-wind hybrid energy harnessing. Islamabad, in particular, performs well across various criteria, including resource availability, infrastructure, land characteristics, environmental impact, and socio-economic factors. Its favorable access to the power grid, road accessibility, topography, elevation, and public acceptance contribute to its high ranking. These recommended locations have favorable conditions, including an adequate number of solar-windy days throughout the year and the presence of appropriate infrastructure. The complementary nature of solar and wind energy makes them an ideal combination for harnessing renewable energy potential. Solar-wind energy, in particular, shows promise and a valuable solution for addressing the current energy and power crises in the country. Hence, government authorities and decision makers can get valuable insights from this research in prioritizing optimal sites and implementing solar-wind harnessing projects not only in the northwest region but also in other regions of the country.

## 6. Conclusion

The comprehensive and systematic decision support framework was developed successfully in this research by utilization of the AHP and Delphi techniques for evaluating the optimal location selection among different cities for solar-wind hybrid energy harnessing in the northwest region of Pakistan. This research study presented a robust framework and a robust assessment of criteria often overlooked in site selection process that can be effectively employed by developers, policymakers and investors to select optimal decisions and maximize the potential of RE resources. By considering the specific criteria and involving relevant stakeholders, the implementation of sustainable and efficient solar and wind hybrid energy projects becomes feasible, thereby contributing to a greener and more sustainable future.

Solar and wind energy have significant potential offering numerous advantages like reducing dependence of energy mix on fossil fuels, stimulating both regional and national economic growth, employment opportunities and offers significant potential to drive sustainable development. Hence, prioritizing decision of selecting optimal and best locations to build solar-wind energy harnessing project becomes very crucial. Considering the absence of a systematic framework for decision of selecting solar-wind project location in Pakistan, this research aimed to bridge this gap by proposing a systematic decision framework specifically for the North West region of the country. The key factors for selection of optimal location were identified through expert feedback and analysis where experts from academia, industry, and the renewable and environmental field contributed their valuable insights and judgments to the implementation of the AHP decision model.

Among the selected key main criteria, resource availability and infrastructure and socio-economic factors emerged as the top-ranked criteria in this study. Based on the framework developed for supporting decision, the city of Islamabad was determined to be the optimal location for solar-wind harnessing, followed by Rawalpindi, Taxila, Wah Cantt, and Khanpur. It is important to emphasize that the outcomes and results of this research rely on the expert judgments collected at each assessment level, and therefore, engaging different experts and stakeholders, as well as exploring alternative MCDM methods, may slightly influence the results. Nonetheless, this study holds significant relevance and should be duly

considered for solar-wind power project site selection, while also offering opportunities for further enhancements in the future.

The outcomes and findings of this research have several recommendations for practice and future research in the field of solar and wind hybrid energy site selection. The following recommendations/future research are put forth based on the conclusions drawn from this study:

*Engagement of stakeholders:* To ensure comprehensive decision-making in the site selection process, it is advised to actively involve a diverse range of stakeholders. This may include local communities, government agencies, and environmental experts, among others.

*Long-term monitoring:* Continuous monitoring and evaluation of the selected site's performance should be undertaken to validate the site selection decision. This will help assess the accuracy of the initial assessments and identify any changes or improvements that may be required.

*Technological advancements:* As technology in the renewable energy sector advances, it is important to regularly update the site selection criteria and evaluation methods. New advancements may introduce additional factors to consider, such as the integration of energy storage systems or smart grid capabilities.

*Economic viability:* Further research is needed to explore the economic viability of solar and wind hybrid energy plants in different regions. This includes analyzing the cost-effectiveness of hybrid systems compared to individual solar or wind installations and identifying potential financial incentives or support mechanisms.

*Environmental impact assessment:* In-depth studies should be conducted to assess the environmental impact of solar and wind hybrid energy projects on local ecosystems, wildlife, and natural resources. This will help ensure sustainable development and minimize any adverse effects on the environment.

*Social acceptance and community engagement:* Future research should focus on understanding the social acceptance of renewable energy projects and the factors that influence public perception. Community engagement strategies should be developed to promote awareness, participation, and support for solar and wind hybrid energy initiatives.



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