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Stakeholders' satisfaction in public construction projects in Rupandehi district

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Abstract
Stakeholders of public construction project are contractors, clients, workers and public that they directly or indirectly affect from the project. Different stakeholders have different expectation. The projects are designed to satisfy various expectations of their shareholders. This study explains the factors that govern the satisfaction of related people in that particular project. This study also identifies the several socio-economic factors and environmental considerations before, during and after implementation of public construction projects. The main objective of this study is to identify the level of satisfaction of stakeholders in the public construction projects at Rupandehi district. One to one interview and questionnaires were distributed to the employees of public entity, contractors, clients, workers, and public people. The collected data was analyzed using on SPSS software. The statistical t-test and one way ANOVA test were conducted to find out the relationship between different aspects of study. A reliability test for internal consistency was conducted using Cronbach's Alpha. Regression analysis was also done in the study. The study found out that the contractors have higher satisfaction level for all the variables used in the analysis whereas beneficiary has lowest satisfaction level. General publics are also less satisfied from the public construction projects. The government should provide the proper guidelines for quality assurance projects in every project and government should also provide better working environment for the contractors to execute the construction process more efficiently and effectively.

Keywords: Public constructions projects, stakeholders satisfaction, improvement of product

Introduction

Stakeholder's satisfaction can be defined as the ability of a project to meet the stakeholder's expectations. Stakeholders of public construction project are contractors, clients, workers, public, etc. that they directly or indirectly affect from the project (Watt, 2014) [51]. A project must have a thorough understanding of project expectations and be able to satisfy these expectations. The outcomes of the projects can be evaluated in numerous ways. One of the methods is to measure the satisfaction of participants as represented by the differences between their expectations and performances (Forero & Gomez, 2017) [16]. This measurement is used widely in construction project as it promises benefits, such as the improvement of product delivery, and enhances services quality by identifying some necessary changes. The level of client satisfaction with construction performance can be determined by evaluating their level of satisfaction. The measurement of public satisfaction is also based on the quality of the end product. This research also discusses stakeholder's satisfaction attribute on project performance. The aim of this research is to reach the most important factors influencing public satisfaction level of performance provided by contractor and employee of public entity in Rupandehi District. There are seven extremely important factor that have a significant affect in public satisfaction level and immediately need to improve namely quality service, budget adherence, time adherence, personnel skills of employee, management capabilities, communication skills and safety performance.

A construction project typically has a bidding process that is open to the public, including small and mid-sized contractors who compete for the opportunity to work on the project and receive payment. Understanding the process is important for the company, agency and individual that becomes part of the bid and the project so that there is little confusion later.

Statement of the problem

Nepal has built an infrastructure in large amount throughout whole nation through different public entity and public private partnership. It is important that these projects should meet the desire of nation's goal and requirement of public people. It is required to meet all expectations in terms of quality of product and service provided by it. This thesis identified the factors that governed public satisfaction and whether the public construction project conducted on Rupandehi district satisfied its stakeholders or not.

It is difficult to measure and evaluate stakeholder satisfaction in public construction projects. Traditional methods, such as surveys and focus groups, may not provide a comprehensive or accurate picture of stakeholder attitudes and needs. Moreover, the complexity of these projects and the number of parties involved can make it difficult to gather and analyze data on stakeholder satisfaction.

Therefore, there is a need for more effective approaches to assess and address stakeholder satisfaction in public construction projects. Researchers have suggested a variety of strategies, such as incorporating stakeholder input at the planning and design stages, using multi-criteria decision-making tools to weigh different stakeholder interests, and implementing ongoing communication and feedback mechanisms to ensure that stakeholder needs are being met throughout the project (Smith *et al*., 2019) [49]. By adopting these approaches, project owners and managers can improve stakeholder satisfaction and increase the chances of project success.

Basically, the level of satisfaction of the stakeholders at public construction projects are the functions of both individual and project characteristics. The different other characteristics that govern the satisfaction are demographic variables such as age, gender, educational status and ethnicity. This study has carried out to determine the determinants of different stakeholder's satisfaction in public

construction projects and also helps to compare the relationship between the stakeholder's satisfactions.

Research Questions

This research has addressed the following research questions

- What are the primary factors (including quality, cost, time, and work environment) influencing public satisfaction with public construction projects?
- How does stakeholders' satisfaction with public construction projects vary across different demographic groups (e.g., age, gender, income level, education)?
- How do aspects of project management, such as quality, cost, time, and work environment, impact stakeholders' satisfaction with public construction projects?

Objectives of the Study

General objectives: The general objective of the research is to analyze the stakeholder's satisfaction in public construction projects in Rupandehi district.

Specific objectives: The specific objectives of this study are

- To analyze factors affecting the public satisfaction for public construction projects.
- To examine stakeholders' satisfaction based on their demographic characteristics towards public construction project.
- To assess the effect of quality, cost, time and work environment on stakeholders' satisfaction towards public construction projects.

Hypothesis of the Study

The hypothesis for the study is as follows

H_1: Public building construction quality has significant impact on stakeholders' satisfaction.

H_2: Public building construction cost has significant impact on stakeholders' satisfaction.

H_3: Public building construction timeframe has significant impact on stakeholders' satisfaction.

H_4: Public building construction working conditions has significant impact on stakeholders' satisfaction.

Literature review

A construction contractor is an individual or an organization that is responsible for constructing the projects according to agreement between the contractor and the client within the time, acceptable quality and within cost keeping in mind the safety of the project. Incomplete project may extra cost to the contractor as well as public entity so, work schedule should be prepared before execution of time.

The various factor affects the construction project performance. They are payment difficulties, poor contractor management, material procurement problems, poor technical ability, and escalation of material prices, poor workmanship and poor technical ability. Time, cost and quality are the essential components in project management. Balance of these components helps the efficient delivery of projects. Predicting the performance of the contractor is highly important for the contractor and the public entity.

In any project, there are several constraints that must be considered, including cost, scope, quality, risk, resources, and time. The cost of a project is the budget allocated for it, including all necessary expenses. Poor budget planning can lead to a rush to spend the funds at the last minute. The scope of a project refers to its goals and the work involved in achieving them, as well as the processes used to complete the project. The quality of a project is determined by the standards and criteria that the project's deliverables must meet in order to function effectively. These deliverables should also meet other performance requirements, such as availability, reliability, and maintainability, and have an acceptable finish. Time should be set aside to review the original quality plan and compare it to how quality is being ensured during the project's implementation.

Quality Performance

Quality performance is defined as the total of features required by a product or services to satisfy a given need, or fitness for purpose (Parfitt & Sanvido, 1993). In other words, quality in construction industry is on the ability to meet the established requirements and specification. Specification are the established characteristics of a product, process or service as specified in the contract agreement (Papazoglou and Van Den Heuvel, 2007) [42].

In order to achieve a completed project that meets the client's quality expectations, all parties to a project must acquire an understanding of those expectations, implement them into the contract to the extended possible, and committing upmost to carry them out. The meaning of quality varies from industry to industry, project to project, contractor to contractor, and from one owner to another (Flyvbjerg, 2014) [15]. In order to achieve a completed project that meets the owner’s quality expectations, all parties to a project must acquire an understanding of those expectations, incorporate them into the contract price and other contract documents to the extent possible, and commit in good faith to carry them out (Ganaway, 2006) [18].

Quality on a project is controlled through quality assurance, which is the process of evaluating overall project performance on a regular basis to provide confidence that the project will satisfy the relevant quality standards. The purpose of quality assurance is to create confidence that the quality plan and controls are working properly (Watt, 2014) [51].

Timely performance

Time performance is essential factor for construction projects to be completed on time, as the stakeholders and the general public. The stakeholders look at project success from the macro level where the first criteria are the completion time (Lim & Mohamed, 1999) [40]. The time element indicates to project managers that whether the project was running as smoothly as scheduled or not. The construction time of a project is known before the commencement of project. Project time can also be reduced by preparing work schedule and execute work exactly as per schedule (Alexander *et al*., 2007) [2].

Costs

Bidding price is the amount coated by the contractor to the public entity during tendering process to execute the specific work as per bill of quantities. As per PPMO act 2063 and PPMO regulation 2064, the lowest responsible bidder/contractor is awarded a tender (Nepal Government, 2007). The price specified by that lowest responsible bidder is called bidding price of the contact. The contractor performed its work keeping in mind that the total cost of the project doesn't exceed the bid price. Total cost of project is the sum of variable cost and fixed cost (Glaeser and Poterba, 2020) [19].

A public entity is responsible for preparing a cost estimate for construction work. This includes determining the rates and prices for various construction materials, such as cement, iron rods, bricks, stone, soil, corrugated sheets, bitumen, emulsion, fuel, polythene pipes, sanitary goods, electrical goods, and other materials (Bartel, 1954) [9]. The rates for these materials should be based on the rates set by the Rate Fixation Committee. The cost estimate may also include the rental costs for equipment or the wages of labor (Nepal Government, 2007).

Environmental Safety

All projects are unique. All the external and internal forces that exert on the project can be called as working environment of the projects (Leung *et al*., 2014) [39]. Internal factors include elements such as organizational culture, structure, and governance as well as security and safety measures. External factors include political, economic, sociocultural, technological, environmental, and legal factor. Internal factors are the strength and weakness of the projects whereas external factors are the risk and opportunities of the project (Boamah, 2014) [10]. The more uncertain the environment, the greater the need for information and continuous monitoring of project factors and decision making becomes difficult.

Public Satisfaction

Public satisfaction is determined by the degree to which an individual's perception of an outcome meets their expectations for that outcome (Chatterjee & Suy, 2019) [13]. In construction projects, achieving public satisfaction can be difficult due to the presence of many stakeholders. Project success can be evaluated at a micro level, examining achievements at smaller component levels, and is typically assessed at the end of the construction phase by the parties involved (Heravi *et al*., 2015) [21]. The completion criteria and satisfaction criteria are two sets of conditions used to determine project success. If the project is well received by the users, it is considered to be successful, and the higher the level of user satisfaction, the higher the perceived success of the project (Lim & Mohamed, 1999) [40].

Dissatisfaction among clients in the construction sector is often caused by various factors, including cost overruns, delays, poor quality standards, and incompetent service providers (Ali and Rahmat, 2010) [3]. The expectations for a particular service can change over time. There is a growing body of literature on citizen satisfaction, providing ongoing learning from the findings of previous research (McKenney and Reeves, 2018) [41]. A public satisfaction survey is a commonly used tool for assessing the results of actions taken by local governments.

These surveys play a crucial role in resource procurement and performance improvement and can help local governments be more responsive to the needs of the public, which can increase trust in government (Lehmann, 2018) [38]. Satisfaction is an evaluation of the quality of services after consumption and is related to perceptions of performance. It is also used as a standard for measuring service performance. Expectations, which are formed prior to experiencing a product or service, are a key aspect of satisfaction studies and can influence satisfaction individually or collectively with perceptions. Performance is the degree to which expectations are met or exceeded. Transparency and trust can have direct effects on satisfaction, and overall satisfaction is formed by satisfaction with the process, outcome, and information (Chatterjee & Suy, 2019) [13].

Public Construction Projects in Rupandehi District

Public construction project means any project planned or undertaken by the city or any governmental entity for construction, reconstruction, maintenance, or repair of public facilities or improvements, or any other purpose of a public nature. Funding from various public sources is used to invest in local and national projects. These sources typically provide funding on an individual basis, through a competitive process where a set of requirements, criteria, and indicators must be met to receive funding. There are different types of projects which are Manufacturing Projects, Construction Projects, Management Projects, and Research Projects. The stages of the project life cycle are initiating, planning, executing, monitoring, and controlling and closing. Public construction project is the combination of physical assets, management practices, policies, and personnel necessary for government to provide and sustain structures and services essential to the welfare and acceptable quality of life for its citizens. The stages of the project management lifecycle to achieve optimal results regardless of construction industry are planning, analysis, design, development, testing, implementing and maintenance. From water and sewer services, to sanitation, to salting and plowing the roads in the winter, and making sure potholes are filled in the spring and summer. Public construction projects keep our cities and towns running smoothly and efficiently. Public construction projects involve engineering, construction, and other related activities carried out by the government for the benefit of citizens. This includes the acquisition, leasing, maintenance, and disposal of real estate owned by the state.

Providing health and education facilities, construction of roads, bridges, railways, harbors, generating electricity, providing irrigation through dams are some of the public sector activities. These activities are the primary responsibility of the government. The district has good network of link roads within district as well as connected with other party of Nepal and also to the boarder of India. This has paved the way to flourish big factories and small cottage industries, thriving in the economy of the district.

Types, Cost and Employment Opportunities of Public Construction Projects

Public construction projects involve the construction, repair, or upgrading of infrastructure and public facilities using public funds. These projects may include building or repairing roads, bridges, dams, railways, tunnels, hospitals, schools, prisons, libraries, and leisure centers, among others. The costs associated with these projects can be divided into direct costs, which are directly related to the work being done, and indirect costs, which are expenses necessary for conducting business (Short *et al*., 1995) [46]. There are also fixed costs, which are one-time charges, and variable costs, which vary depending on the length of the project. Sunk costs are costs that have already been incurred and cannot be recovered. Public construction projects can have significant economic, social, and environmental impacts and often play a key role in the development of a country's infrastructure (Köhler *et al*., 2019) [24].

The construction industry is often a key contributor to a country's economy, especially in developing countries where a significant portion of the national budget is often allocated to infrastructure projects (Engel *et al*., 2008) [14]. These projects create value by turning raw materials into assets essential for economic activities and by providing infrastructure-related services. They can also help reduce poverty and promote pro-poor growth. Public investment programs often have specific development goals, such as economic growth, poverty reduction, and environmental protection. Employment opportunities in the construction industry can also have political benefits, such as promoting peace by providing alternatives to violence for young people (Pruijt, 2012) [43]. Economically, employment in the construction industry can provide income for families, stimulate domestic demand for goods and services, and contribute to overall economic growth (J and Majid, 2020) [22]. On a social level, employment in the construction industry can also promote social healing, encourage the return of displaced persons, and improve overall social welfare in the long run.

Conceptual Framework

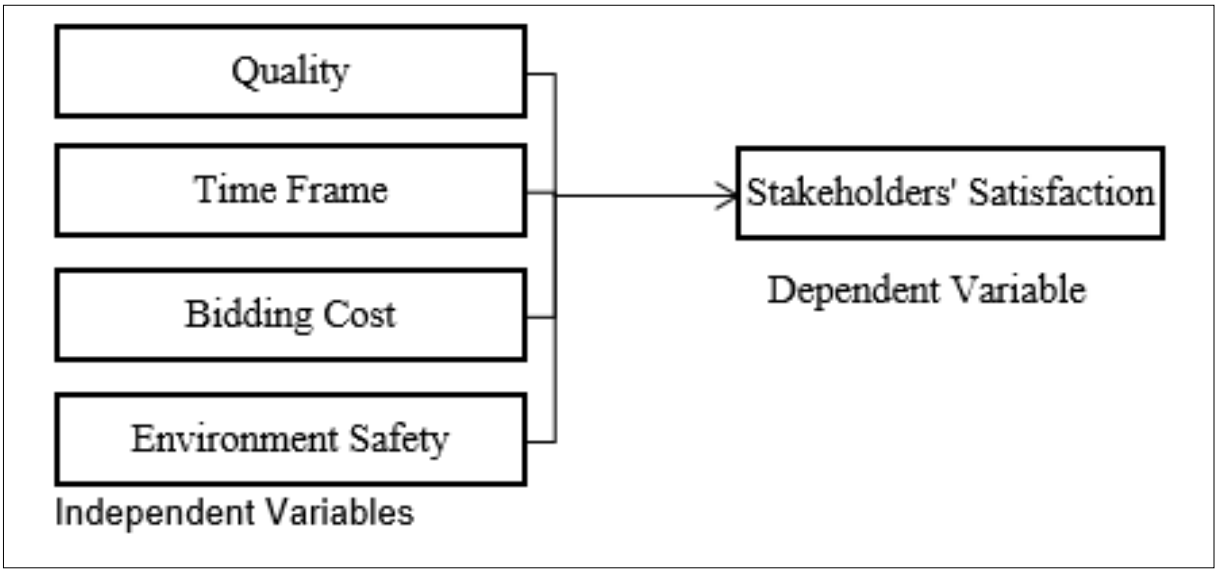

Fig 1: Conceptual framework

Research Method

This study was based on descriptive and explorative research design to deal with the issue related to stakeholder's satisfaction. This study employed descriptive and explorative research design for fact-finding and searching adequate information about determinants (time, quality, cost and working conditions) affecting stakeholders' satisfaction of public construction projects and to assess the opinions of stakeholders. The questionnaire survey was employed to understand the opinions of stakeholders of public construction projects regarding their satisfaction level. Since the primary questionnaire survey with stakeholders was made to collect the opinions on their satisfaction, descriptive research design was helpful. Both primary and secondary data were used in the study. The primary sources of data are collected from the offices, beneficiary, contractors, workers, public entity and general public. The primary data revealed other various facts regarding stakeholders' satisfaction in public construction projects.

In order to collect primary data, questionnaires had sent to stakeholders through mail, Google form and printed questionnaire. They filled the questionnaires and submitted it altogether 300 questionnaire sets were filled up.

The primary sources of data had been used to assess the opinion of respondents with the respect of stakeholders' satisfaction with its determinants (time, quality, cost and working conditions) in public construction projects. The questionnaire survey was conducted to analyze the opinions, perceptions, and characteristics of public, contractors, workers, beneficiaries and public entities. The survey was basically designed to understand the opinions of respondents as how they perceive the factors affecting their satisfaction of the public construction projects in Rupandehi district. Secondary data were included in the research to get the idea about demographic analysis of population.

The questions were structured using the five-point Likert scale format which are 5=Highly Satisfied, 4=Satisfied, 3=Neutral, 2=Dissatisfied, 1= Highly Dissatisfied.

The statistical tools used in this study are descriptive statistics such as mean and standard deviation to describe the importance of variables under considerations. The normality of each variable is confirmed using histogram and P-P plots. Besides, the independent t-test and one way ANOVA was used to find out either variables are considerable different or not based on the demographic factors. Finally, correlation and multiple regressions were used to find out their relationship between the variables and to find out the impact of the variables respectively.

To define study population, person who are underage of 19 years and above 70 years are excluded from the study scope. Since, below 19 are considered to be minor and above 70 years people are senior citizens and mostly not involved in study scope.

So, the population included in the study purpose are above the age of 20 years and below the age of 70 years. Therefore, we defined our population to be 575,654 (CBS, 2024)

There are several different sample size calculation formulas that can be used for a finite population, depending on the specific characteristics of the population and the research objectives. Here is one commonly used formula:

Sample size = (Z^2 * P * (1-P)) / (d^2)

Using above formula sample size is determined 384 sample. However, this study is based on the responses of 441 respondents which is more than the minimum requirement.

Reliability and Validity

Further, a reliability test for internal consistency was conducted using Cronbach's Alpha on 26 items and summated variables. Cronbach's alpha is a measure of internal consistency, that is, how closely related a set of its group. It is considered to be a measure of scale reliability. Cronbach's alpha is not a statistical test, it is a coefficient of reliability (or consistency). It measures how well a set of variables or items measures a single, one-dimensional hidden aspect of individuals. A minimum level of Cronbach alpha value is 0.7 (Nunnally, 1978). Cronbach alpha values are dependent on the number of items in the scale. A validity test for questionnaire was conducted using pilot study taking 57 respondents. Validity refers to the extent you are measuring what you hope to measure. Validity determines whether the research truly measure that what it was intended to measure or how truthful the research results are. The pilot study was conducted using 20 respondents which results confirmed the validity of questionnaire, so these responses are also included in the study.

The Regression Model

The proposed model for the study is:

Stakeholders' satisfaction = $\alpha + \beta_1$Quality + β_2Timeliness + β_3Cost + β_4Working Condition + ε

Were,

α = Constant

$\beta_1,\beta_2,\beta_3,\beta_4$, = Beta coefficients

ε = Stochastic error term

Data analysis and discussions

The collected data have been processed and analyzed in accordance with the outline and down for the purpose. Processing implies editing, coding, classification and tabulation of the collected data so that they are responsible to analysis, relationship or difference should be subjected to statistical tests of significance to determine with what validity data can be said to indicate any conclusions.

The analysis of data generally involves several related steps that are taken to summarize and organize the collected data in a way that answers the research questions. This process was followed carefully in this study and is presented in this chapter.

Reliability Test

Reliability test refers to the evaluation of the consistency and stability of a measurement system, assessment tool, or questionnaire. The purpose of reliability testing is to assess the accuracy and reproducibility of a measurement over time and under different conditions. There are several methods used to test the reliability of a measurement, including test-retest reliability, inter-rater reliability, and internal consistency reliability. The results of reliability tests are expressed as a coefficient, such as Cronbach's alpha, which indicates the degree to which the measurement is consistent and reliable.

Table 1: Result of Reliability Test of Each Statement

Variable	Cronbach's Alpha	Number of Items
Quality	0.771	5
Time	0.795	5
Cost	0.848	5
Environment Safety	0.831	5
Satisfaction	0.813	5

This table displays the results of a reliability test for five variables: "Quality", "Time", "Cost", "Environment Safety", and "Satisfaction". The reliability test used is Cronbach's Alpha, which is a common measure of internal consistency reliability.

Internal consistency reliability is a measure of the degree to which a set of items (i.e., questions or measurements) all measure the same underlying construct. A high Cronbach's Alpha score indicates that the items are highly consistent and measure the same underlying construct, while a low score indicates that the items are not consistent and do not measure the same underlying construct. The value of Cronbach's Alpha more than 0.7 is acceptable (Nunnally, 1978). If the coefficient of reliability is less than 0.60, it is considered poor. Those in the range of 0.70 are considered acceptable and those over the range of 0.80 are considered as good.

This table presents the results of a reliability test using Cronbach's Alpha for five variables: Quality, Time, Cost, Environment Safety, and Satisfaction. The scores in the table indicate the level of consistency of each variable, with higher scores indicating higher consistency and reliability. The all variables have the greater score than the minimum required scored 0.7, indicating that the items measuring these

Normality Test

Most statistical tests rest upon the assumption of normality. In statistics, normality tests are used to determine if a data set follows a normal distribution and to calculate the probability that the underlying random variable of the data set is normally distributed. Deviations from normality, called non-normality, render those statistical tests inaccurate, so it is important to know if the data are normal or non-normal. Tests that rely upon the assumption or normality are called parametric tests.

If data are not normal, non-parametric tests are used for the analysis. Non-parametric tests are less powerful than parametric tests, which means the non-parametric tests have Less ability to detect real variability in the data. In other words, parametric tests increase

The chances of finding significant results.

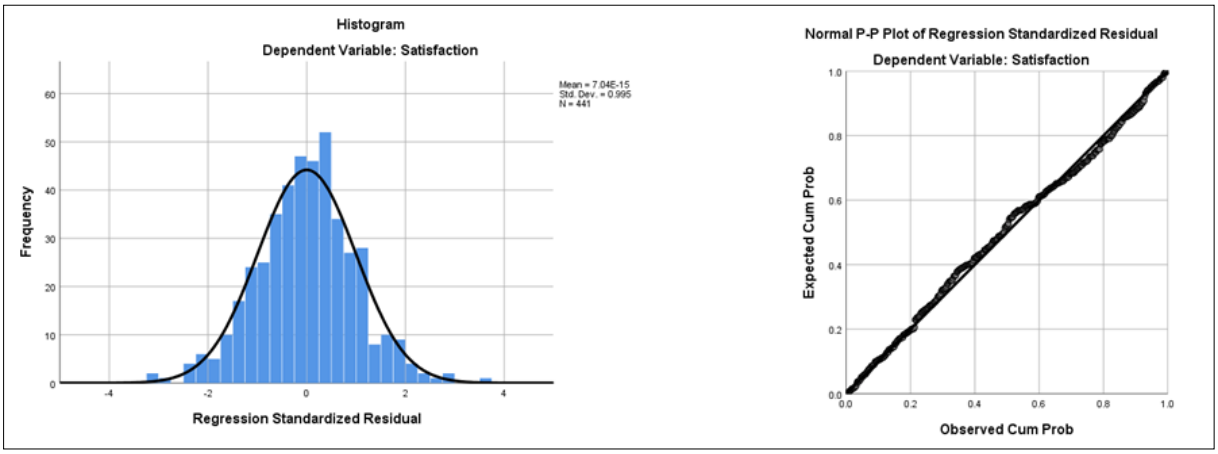

Fig 2: Normality test from histogram of regression standardized residual and PP Plots

Above figures illustrate the histogram of regression residual which is bell-shaped. So, it can be concluded the data taken for analysis are normally distributed. Further, the normality of the data is tested using P-P plots of regression residuals.

The result of P-P plots of regression residuals is demonstrated in Figure No 2 A P-P plot compares the empirical cumulative distribution function (ECDF) of a variable with a specified theoretical cumulative distribution function. Figure No. 2 exhibits that expected cumulative probability and observed cumulative probability area round the mean line which confirms data are normally distributed. Confirmation of normality permits the parametric tests for further analysis of the data.

Influences on Stakeholder Satisfaction Based on Gender

The hypothesis sets for independent sample t-test as;

H0: μ1=μ2 (Two population means are equal)

H1: μ1≠ μ2 (Two population means are not equal)

Table 2: Results of Independent t-test for gender

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Quality	Equal variances assumed	3.992	.046	.412	439	.680	.02907	.07049
	Equal variances not assumed			.409	412.855	.683	.02907	.07105
Timeliness	Equal variances assumed	1.056	.305	-.181	439	.857	-.01307	.07227
	Equal variances not assumed			-.180	424.187	.857	-.01307	.07253
Cost	Equal variances assumed	.174	.677	-.080	439	.936	-.00616	.07674
	Equal variances not assumed			-.080	431.778	.936	-.00616	.07672
Environment Safety	Equal variances assumed	.619	.432	.060	439	.952	.00452	.07553
	Equal variances not assumed			.060	422.616	.952	.00452	.07586
Satisfaction	Equal variances assumed	.482	.488	-.812	439	.417	-.05962	.07341
	Equal variances not assumed			-.810	426.090	.418	-.05962	.07361

This table presents results from t-tests for equality of means between two groups (male and female) for 5 variables (Quality, Timeliness, Cost, Environment Safety, Satisfaction). The tests are conducted to determine if there is a significant difference in the mean scores of the two groups for each of the variables.

The Levene's Test for Equality of Variances is performed first to test the assumption of equal variances between the two groups. The null hypothesis for this test is that the variances are equal and the alternative hypothesis is that the variances are not equal. If the p-value is less than 0.05, it suggests that the variances are not equal and the t-test is conducted using the "Equal variances not assumed" column. If the p-value is greater than 0.05, it suggests that the variances are equal and the t-test is conducted using the "Equal variances assumed" column.

The t-test for Equality of Means is then performed to determine if there is a significant difference in the mean scores between the two groups. The null hypothesis for this test is that there is no difference in the means and the alternative hypothesis is that there is a difference in the means. The t-statistic, degrees of freedom (df), and p-value (Sig. (2-tailed)) are reported. If the p-value is less than 0.05, it suggests that there is a significant difference in the means and the alternative hypothesis is supported. If the p-value is greater than 0.05, it suggests that there is not a significant difference in the means and the null hypothesis is supported.

In the results, for Quality, Timeliness, Environment Safety, and Satisfaction, the p-value is greater than 0.05 and the null hypothesis of equal means is supported. For Cost, the p-value is close to 0.05, but not less than it, so the null hypothesis of equal means is still supported.

One-Way ANOVA with Respect to Designation

The hypothesis sets for one way ANOVA test are;

H0: μ1=μ2= μ3 (population means are equal)

H1: μ1≠ μ2≠ μ2 (population means are not equal)

Table 3: One way ANOVA based on Designation

		Sum of Squares	df	Mean Square	F	Sig.
Quality	Between Groups	17.596	3	5.865	11.550	.000
	Within Groups	221.924	437	.508		
	Total	239.520	440			
Timeliness	Between Groups	1.884	3	.628	1.098	.349
	Within Groups	249.845	437	.572		
	Total	251.729	440			
Cost	Between Groups	3.566	3	1.189	1.854	.137
	Within Groups	280.221	437	.641		
	Total	283.786	440			
Envirionment Safety	Between Groups	2.141	3	.714	1.143	.331
	Within Groups	272.781	437	.624		
	Total	274.922	440			
Satisfaction	Between Groups	14.553	3	4.851	8.2923	0.005
	Within Groups	255.514	437	0.585		
	Total	270.067	440			

This table shows a summary of the results of an analysis of variance (ANOVA) performed on five different variables (Quality, Timeliness, Cost, Environment Safety, and Satisfaction) between four groups (Contractor, General Public, Employee of public entity, and Worker).

The "Between Groups" row shows the sum of squares due to differences between the means of the four groups for each variable. The "Within Groups" row shows the sum of squares due to differences within each group, i.e., differences between the observations within each group. The "Total" row shows the total sum of squares for each variable.

The "df" (degrees of freedom) column shows the number of independent observations in each row. The "Mean Square" column shows the average value of the sum of squares for each row.

The "F" column shows the F-statistic, which measures the ratio of the explained variation (the between groups sum of squares) to the unexplained variation (the within groups sum of squares). A high F-statistic indicates a high degree of difference between the means of the groups. The "Sig." (Significance) column shows the p-value, which indicates the probability that the results observed in the sample occurred by chance. A p-value of less than 0.05 is typically considered statistically significant and suggests that the differences between the group means are real and not due to random chance.

For the variable "Quality," the F-statistic of 11.550 and p-value of 0.000 suggest that there is a significant difference in quality between the four groups. For the variable "Timeliness," the F-statistic of 1.098 and p-value of 0.349 suggest that there is no significant difference in timeliness between the four groups. For the variable "Cost," the F-statistic of 1.854 and p-value of 0.137 suggest that there is no significant difference in cost between the four groups. For the variable "Environment Safety," the F-statistic of 1.143 and p-value of 0.331 suggest that there is no significant difference in environment safety between the four groups. For the variable "Satisfaction," the F-statistic of 8.2923 and p-value of 0.005 suggest that there is a significant difference in satisfaction between the four groups.

One-way ANOVA with Respect to Living Area

The hypothesis sets for one way ANOVA test are;

H0: $\mu1=\mu2=\mu3$ (population means are equal)

H1: $\mu1\neq\mu2\neq\mu3$ (population means are not equal)

Table 4: Results of One-Way ANOVA with Respect to Living Area

		Sum of Squares	df	Mean Square	F	Sig.
Quality	Between Groups	.412	2	.206	.378	.686
	Within Groups	239.107	438	.546		
	Total	239.520	440			
Timeliness	Between Groups	.301	2	.150	.262	.769
	Within Groups	251.428	438	.574		
	Total	251.729	440			
Cost	Between Groups	.745	2	.372	.576	.562
	Within Groups	283.041	438	.646		
	Total	283.786	440			
Environment Safety	Between Groups	1.216	2	.608	.973	.379
	Within Groups	273.706	438	.625		
	Total	274.922	440			
Satisfaction	Between Groups	1.318	2	.659	1.116	.329
	Within Groups	258.749	438	.591		
	Total	260.067	440			

This table presents the results of an analysis of variance (ANOVA) comparing the mean scores of different groups on different variables (Quality, Timeliness, Cost, Environment Safety, and Satisfaction). The grouping variable is the living area of the respondents, which has been divided into three categories: "Sub-metropolitan city", "Municipality", and "Rural municipality". The "Sum of Squares" column represents the sum of the squared

differences between each group's mean and the overall mean, while the "df" column represents the degrees of freedom associated with each sum of squares. The "Mean Square" column is obtained by dividing the Sum of Squares by the degrees of freedom.

The "F" column shows the value of the F-statistic for each variable, which is calculated as the ratio of the Mean Square between groups to the Mean Square within groups. This statistic tests the hypothesis that the means of the groups are equal.

If the F-statistic is large and the significance level (Sig.) is low, it suggests that the differences between the groups are significant. In this table, for all the variables, the significance level is above 0.05, This means that there is not enough evidence to reject the null hypothesis that the means of the living areas are equal for all the variables.

Regression Results

Hypothesis testing for individual independent variables.

H_1: $\beta_1 \neq 0$ (Coefficient of quality of work completion is not equal to zero)

H_2: $\beta_2 \neq 0$ (Coefficient of work completion on time is not equal to zero)

H_3: $\beta_3 \neq 0$ (Coefficient of cost effectiveness of the project is not equal to zero)

H_4: $\beta_4 \neq 0$ (Coefficient of workability at project is not equal to zero)

Table 5: Regression Results

Model	Constant	Independent Variable				R-Square	F Statistics
		Quality	Timeliness	Cost	Environment Safety		
1	1.963*	0.391*				0.153	79.318*
2	1.418*		0.559*			0.313	199.844*
3	1.455*			0.569*		0.324	210.132*
4	1.233*				0.628*	0.394	285.634*
5	1.136*	0.049	0.528*			0.314	100.340*
6	1.427*	0.023		0.553*		0.321	104.974*
7	1.009*	0.125*			0.569*	0.404	149.881*
8	1.16*		0.307*	0.343*		0.364	126.993*
9	0.841*		0.287*		0.457*	0.445	177.197*
10	0.937*			0.278*	0.447*	0.436	171.103*
11	1.222*	0.072	0.332*	0.373*		0.365	85.416*
12	0.942*	0.005		0.281*	0.447*	0.435	113.814*
13	0.789*		0.155*	0.405*	0.203*	0.453	122.443*
14	0.848*	0.067	0.227*	0.183*	0.405*	0.454	92.445*

* Represents the level of significance at 5% level of significance

The table summarizes 14 multiple regression models, each with different combinations of independent variables ("Quality," "Timeliness," "Cost," and "Environment Safety"). The "Constant" represents the intercept, "R-Square" shows the variation explained by the models, and "F Statistics" indicates overall significance. Asterisks (*) denote statistically significant coefficients at the 0.05 level. Higher R-Square and F Statistics values suggest better model fit and significance.

Model 1: The constant is 1.963 (significant). "Quality" has a coefficient of 0.391 (significant). R-Squared is 0.153, indicating 15.3% variation explained. F Statistics is 79.318 (significant).

Model 2: The constant is 1.418 (significant). "Timeliness" has a coefficient of 0.559 (significant). R-Squared is 0.313, indicating 31.3% variation explained. F Statistics is 199.844 (significant).

Model 3: The constant is 1.455 (significant). "Cost" has a coefficient of 0.569 (significant). R-Squared is 0.324, indicating 32.4% variation explained. F Statistics is 210.132 (significant).

Model 4: The constant is 1.233 (significant). "Environment Safety" has a coefficient of 0.628 (significant). R-Squared is 0.394, indicating 39.4% variation explained. F Statistics is 285.634 (significant).

Model 5: The constant is 1.136 (significant). "Quality" (0.049) is not significant, but "Cost" (0.528) is. R-Squared is 0.314, indicating 31.4% variation explained. F Statistics is 100.340 (significant).

Model 6: The constant is 1.427 (significant). "Timeliness" (0.023) is not significant. R-Squared is 0.321, indicating 32.1% variation explained. F Statistics is 104.974 (significant).

Model 7: The constant is 1.009 (significant). "Environment Safety" has a coefficient of 0.125 (significant). R-Squared is 0.404, indicating 40.4% variation explained. F Statistics is 149.881 (significant).

Model 8: The constant is 1.16 (significant). "Cost" has a coefficient of 0.307 (significant). R-Squared is 0.364, indicating 36.4% variation explained. F Statistics is 126.993 (significant).

Model 9: The constant is 0.841 (significant). "Environment Safety" has a coefficient of 0.287 (significant). R-Squared is 0.445, indicating 44.5% variation explained. F Statistics is 177.197 (significant).

Model 10: With "Cost" and "Environment Safety," the R-Square is 0.447, indicating 44.7% variation explained. Coefficients for "Cost" (0.937) and "Environment Safety" (0.436) are significant.

Model 11: With "Quality," "Cost," and "Environment Safety," the R-Square is 0.365, indicating 36.5% variation explained. Coefficients for "Quality" (1.222), "Cost" (0.072), and "Environment Safety" (0.373) are significant.

Model 12: With "Timeliness," "Cost," and "Environment Safety," the R-Square is 0.435, indicating 43.5% variation explained. Coefficients for "Timeliness" (0.005), "Cost" (0.281), and "Environment Safety" (0.447) are significant.

Model 13: With "Timeliness," "Cost," and "Environment Safety," the R-Square is 0.453, indicating 45.3% variation explained. Coefficients for "Timeliness" (0.155), "Cost" (0.405), and "Environment Safety" (0.203) are significant.

Model 14: With "Quality," "Timeliness," "Cost," and "Environment Safety," the R-Square is 0.454, indicating 45.4% variation explained. Coefficients for "Quality" (0.067), "Timeliness" (0.227), "Cost" (0.183), and "Environment Safety" (0.405) are significant except for "Quality."

Findings

The findings are based on the analysis and interpretation of the primary data regarding the factors governing the satisfaction of various stakeholders in the public construction projects in Rupandehi District. The major findings of the research are:

- Male and female respondents have no significant difference in work completion time, cost effectiveness, workability and overall satisfaction but quality of work which has the significant difference.
- Contractors have higher satisfaction level for all the variables used in the analysis which is significant. Beneficiary has lowest satisfaction level. Overall satisfaction level is higher to contractor followed by workers and general public. However, all other stakeholders have below average satisfaction level except contractors and workers.
- People from sub-metropolitan city have poor satisfactions. However, people from municipality have higher satisfaction level. Also, people from rural municipality have also greater satisfaction level.
- Workability at project has high impact on overall project satisfaction.
- Timeliness of the project completion does not significantly impact the overall project satisfaction.

Discussion and Conclusion

The t-tests for equality of means between male and female respondents across five variables (Quality, Timeliness, Cost, Environment Safety, and Satisfaction) reveal no significant differences in mean scores between the two groups. The p-values for Quality, Timeliness, Environment Safety, and Satisfaction are all greater than 0.05, supporting the null hypothesis that there are no significant differences in these variables between males and females. For Cost, the p-value is close to 0.05 but does not reach significance, suggesting that any potential difference is not statistically robust. These findings align with several studies in the literature that also report minimal or non-significant gender differences in perceptions of service quality and satisfaction (Aksoy *et al*., 2013; Sparks & Browning, 2011) [1].

The ANOVA results for differences among four occupation groups (Contractor, General Public, Employee of public entity, and Worker) indicate significant differences in perceptions of Quality ($F = 11.550$, $p = 0.000$) and Satisfaction ($F = 8.293$, $p = 0.005$). However, there are no significant differences in Timeliness, Cost, and Environment Safety. These findings support the conclusions of previous studies that have explored occupation-related differences in perceptions of service quality and satisfaction (Burdorf *et al*., 2021) [12].

The ANOVA results for living area differences (Sub-metropolitan city, Municipality, and Rural municipality) reveal no significant differences in any of the variables. These findings contrast with some research suggesting geographical location can impact service quality perceptions (Frederiks *et al*., 2015) [17].

The multiple regression models show varying degrees of significance and explanatory power for the independent variables (Quality, Timeliness, Cost, Environment Safety). Notably, Model 4, which includes Environment Safety, has the highest R-Squared value (0.394), indicating it is a significant predictor of the dependent variable. These results underscore the importance of Environment Safety in predicting overall satisfaction, aligning with findings from the environmental management literature (Buhalis et al., 2019) [11]. Additionally, the significant coefficients for Cost highlight the consistent impact of cost considerations on service evaluations (Baker *et al*., 2016) [8].

Conclusion

Satisfaction is the fulfilling the desires and needs from the projects. Some stakeholders are directly associated with the outcomes of construction project whereas some are indirectly associated with the project. There is an overview of all stakeholders related to the construction project. Furthermore, this study measures the satisfaction level of different parties involved in the public construction industries. This study examined the difference in satisfaction level and identified how the differences occur.

This study sheds new light on construction management and engineering trials that examine the relationship between public construction project quality, time, cost and workability with the satisfaction of stakeholders with their indicators. Firstly, the quality of the project is a significant indicator of the satisfaction of stakeholders. Further, cost and workability are also the positive significant indicators of stakeholder satisfactions. Similarly, the relationship is positive between project quality, cost and workability with the satisfaction of the stakeholders. However, time is not significant determinant of stakeholder satisfaction.

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