

Conceptual Critical Success Factors Model on Infrastructure Sustainability Rating System for California Construction

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Introduction

Sustainable infrastructure construction projects are being planned, designed, built, operated, and maintained to consider safety, mobility, environmental protection, livability, asset management, and effective cost management over their life cycle. Because of limited resources compared to unlimited demand of long-lasting infrastructure projects as well as the urgent need to repair aging infrastructure systems, the civil infrastructure construction industry has become more interested in sustainable development. Sustainability evaluation in infrastructure construction projects is required to examine the level of impact towards the environment in the short and long term. In the United States and other countries, various studies have been conducted to determine an adequate and suitable rating system to assess civil infrastructure construction projects and achieve global sustainable goals. Although credit weighting components in existing sustainability rating systems are important and extensive collaborative efforts are being made to incorporate sustainable features, these systems leave room for allocation

consideration because of the arbitrary decisions from various organizations' sustainability goals. Therefore, the authors conducted the sensitivity and reliability of the credit weighting components using ENVISION rating system by identifying the best and easiest category to verify in the sustainability rating system. We also compared each category's verified scores with its respective submitted scores to examine which categories present the most challenges for verification.

Study Methods

The authors collected credit score data from state transportation agencies for the infrastructure construction projects that were certified under Envision v2, which was one of the most widely used rating systems at the time of this study. Data was collected from May to December 2023 in California. We collected 21 data of credit score cards for completed California infrastructure construction projects. However, only 14 credit score cards (66.7%) were considered complete datasets and analyzed in this study. We presented the percentage mean of verified and submitted

scores for the five categories and compared them with t-tests to determine if there are any statistically significant differences between verified and submitted scores. This way, the study can determine if infrastructure project teams wanted to achieve certain levels of credits but were unable to verify them. Second, a one-way ANOVA was conducted to compare all percentage means of verified credit scores to identify if there were any statistically significant differences between the five categories' scores. Third, multiple comparisons were conducted (Hsu's MCB) to identify the best category that provided the easiest procedure to achieve the maximum possible score and that allowed project designers to identify the category more likely to be verified and awarded.

What are the most achievable sustainability features in infrastructure construction projects?

Findings

First, the authors found the Natural World category has the highest average score from the submitted and verified data. However, t-tests indicated that the mean value of one category does not differ statistically from that of other categories. Second, two-sample t-tests for comparing the submitted credit scores and the verified credit scores demonstrated no statistically significant difference in all five categories. However, the results showed that the verified credit scores are 18.63% lower than the submitted credit scores for the data. Third, the results obtained from a multiple comparison with best method indicated that the Natural World category is the best category with 95% confidence because a lower bound close to 0 indicates the category is close to the best category. The results also showed that Quality of Life, Leadership, New World, and Climate and Risk categories have a higher possibility to be verified on a similar level, proving that those projects are close to the "best" category and present less challenges to be certified than the Resource Allocation category. Limitations of this research include the need to obtain more data on credit score data and the need to compare with data obtained from other states' sustainability rating systems that use Envision v2 as well as the latest version of Envision v3.

Policy Recommendations

The findings from this study recommend sustainability managers and project teams with insights into credit implementation in the pre-design stage of potential infrastructure projects that may pursue the sustainability certification process.

About the Authors

Dr. Joseph J. Kim, PE (PI) is Professor and Department Chair at the Department of Civil Engineering and Construction Engineering Management at California State University Long Beach. He supervised a graduate student and was responsible for coordinating this project, assuring successful project completion, and preparing the final MTI report. The PI has previous experience as a Geographic Information Systems (GIS) specialist at the Gainesville Police Department in Florida and has a minor in statistics, which is a significant advantage for conducting this research.

Jose Alejandro Arroyo Turcios is a civil engineering graduate student at the Department of Civil Engineering and Construction Engineering Management at California State University Long Beach who contributed to accomplishing the goals of this research project. His interests within the field include transportation engineering and construction project management. The scope of his work includes assistance of design for the stated preference survey form, collection, and analysis of field data with the PI, and preparation of the MTI report.

To Learn More

For more details about the study, download the full report at transweb.sjsu.edu/research/2324



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