Modular Trend Path Analysis Model

Shih-Hsu Wang
Associate Professor, PhD, Department of Civil Engineering, R.O.C. Military Academy, Wei-Wu Rd., Fengshan Dist, Kaohsiung City, Taiwan, R.O.C

Abstract:

Traditional parametric statistical methods impose strict statistical assumptions and can only identify independent and dependent variables with strong linear correlations. This study integrates the K-means clustering algorithm, the Kano model, and regression analysis techniques to propose the Modular Trend Path Analysis Model (MTPA). First, an XY scatter plot containing all sample points is constructed. Then, K-means clustering is applied to group the sample points in the scatter plot into clusters, referred to as "blocks" in this study. Next, through block combination and quadratic regression analysis, the study examines possible trend paths (i.e., block combinations), their probabilities of occurrence, and their quality attributes, classified into five types: one-dimensional, must-be, attractive, indifferent, and reverse attributes. Finally, based on the quality attributes of the paths, their probabilities of occurrence, and the trend combination analysis table developed in this study, investment or usage strategies are recommended for decision-making. To validate the model, this study applied MTPA to statistical data on the adoption of BIM (Building Information Modeling) uses in Taiwan and their impact on project performance. The results show that the MTPA model not only identifies BIM uses that significantly enhance project performance (consistent with findings from parametric statistical methods) but also reveals BIM uses that should not be adopted at the current stage (before improving existing practices), which parametric statistical methods fail to detect.

Keywords:

Modular Trend Path Analysis Model (MTPA), K-means clustering, Kano model, regression analysis, BIM.