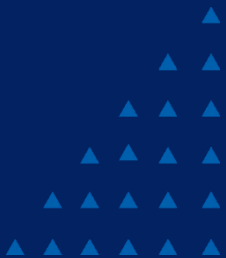


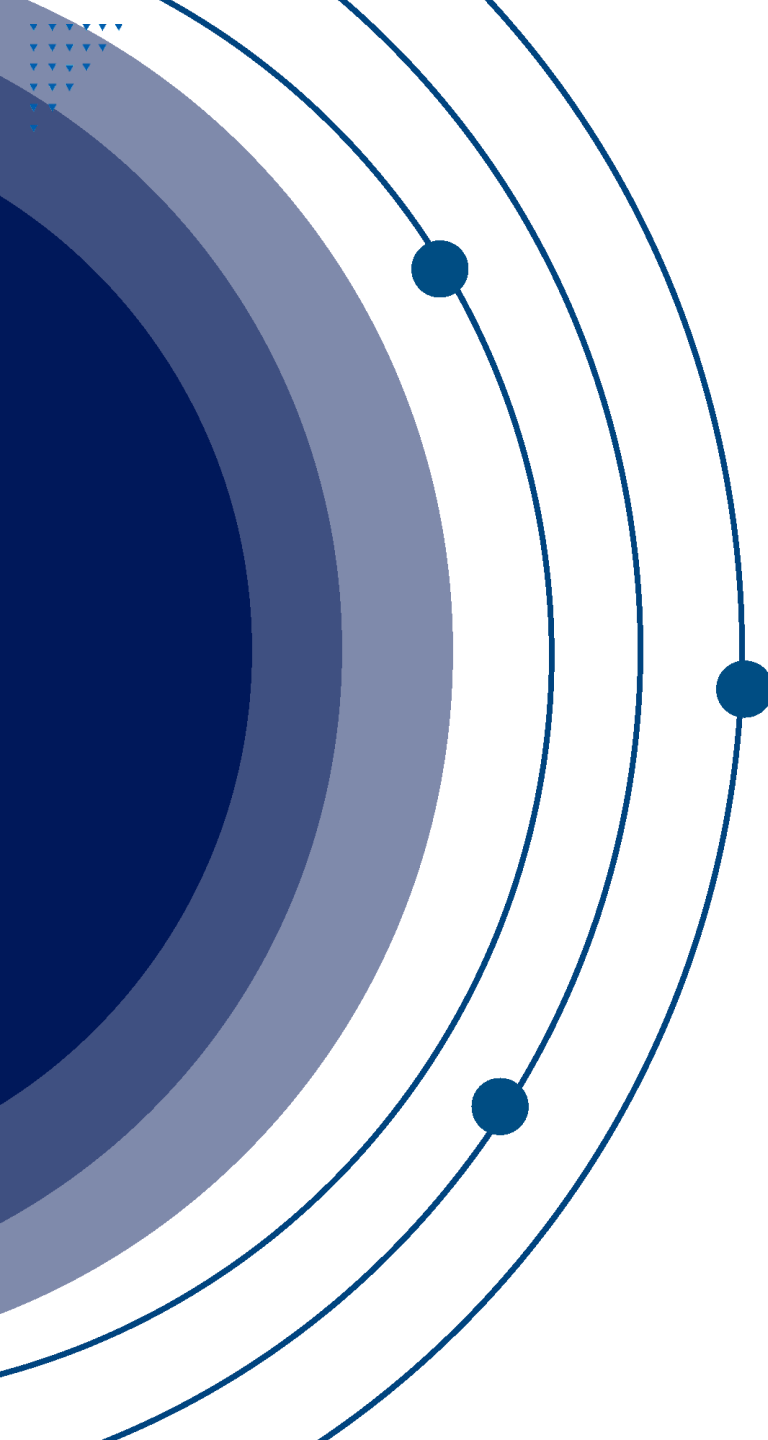
# Construction Performance and Productivity Improvement

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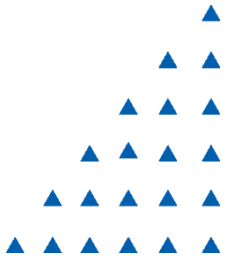


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# Research Validation: Challenges and Opportunities in the Construction Domain



# Validation

- ❑ The purpose of validation is to ensure:
  - ❑ Each phase of the chosen research methodology rigorously adheres to the highest standard of quality
- ❑ Validation always depends on the specific purpose of the research (Law 2007)
- ❑ No single definition of the ingredients or subsets of the concept of validity exists (El-Diraby and O'Connor 2004)
- ❑ More challenging in interdisciplinary fields including construction

# Validation and Related Concepts

- ❑ Validation vs Verification

  - ❑ “Doing the right things” vs “doing things right”

    - e.g. Simulation study to evaluate the risk level of Covid-19

- ❑ Internal validity vs External validity

- ❑ Face validity, content validity, criterion validity, and construct validity

# Internal Validity

- ❑ Related to the concept of causality and about the derivability of relations within data (Leedy Ormrod 2001)
  - ❑ e.g., gas consumption and residential construction projects
- ❑ A “true” causality can only be established through repeated trials under carefully controlled environment.
  - ❑ In observation studies where many uncontrollable environmental factors exist, only correlation can be identified
- ❑ While multiple regression analysis would help achieving causality, many conditions should meet, including:
  - ❑ internal consistency reliability

# Internal Validity

- ❑ Misspecification of the model components: excluding important or including unimportant independent variables
- ❑ Multicollinearity: independent variables are highly correlated and thus redundant
- ❑ Micronumerosity: small sample size
- ❑ Heteroskedasticity: nonconstant variance in data points,
- ❑ Autocorrelation: repetitive pattern within the data points
- ❑ Nonzero expected disturbances: regression assumption of zero error mean does not hold
- ❑ Nonlinearity: regression assumption of linear relationship between independent and dependent variables does not hold

# External Validity

- ❑ Related to generalizability of results.
  - ❑ Representativeness is related to sampling (random vs stratification)
  - ❑ Sample size
- ❑ A challenge exists in deploying a new model, method, or technology into the ongoing industry practice (pilot testing, prototyping)

# Face Validity

- ❑ Requires the approval of nonresearchers regarding the validity of a study (do the right things?)
- ❑ Can be achieved by:
  - ❑ Involvement of domain experts (subject matter experts) in the research process or;
  - ❑ Interview (e.g., focus group), Delphi analysis.
  - ❑ Visualization



# Content Validity

- ❑ Nonstatistical approach to determine whether the content of a study represents reality.
- ❑ Using data from redundant sources: “triangulation”
- ❑ Documenting their entire approach in detail with an open and self-critical mind.
  - ❑ Abstracting and modeling real-world processes entails simplifying assumptions, which must be clearly stated so that readers can independently assess the quality of the study, creating content and face validity

# Criterion Validity and Construct Validity

- ❑ Criterion validity is about the assessment tools (measurements)
  - ❑ The extent to which the results of an assessment instrument correlate with another, presumably related measure.
  - ❑ Compares the indicator to some standard variable that it should be associated with if it is valid.
  
- ❑ Construct validity is about whether operationalizations of theoretical constructs are appropriate
  - e.g. Theoretical construct: Covid risk level
  - Assessment instrument: Average physical distances

# Reliability

- ❑ About consistency and repeatability
  - ❑ Interrater reliability
  - ❑ Internal reliability: consistency within a measurement instrument (Crobach's a)
  - ❑ Test-retest reliability
  - ❑ Parallel forms reliability: two different surveys about the same sample

# Discussion

1. Please describe how you will achieve external validity for your research.
2. What would be the challenge in testing/achieving external validity for your research?
3. In addition to external validity, which level of validity (e.g., internal validity, face validity, content validity, criterion validity, construct validity) will be critically questioned for your research? Then how would you achieve that validity and what will be the challenge in that process?