

1. Please explain the strategies for handling missing data in detailed, and list some methods in estimate missing values. 10%
2. Give the assumptions of multivariate analysis and describe how to test their assumptions are true. 10%
3. Sample size consideration, please give the minimal and preferable sample size for simple regression and multiple regressions, and recommend the ratio of observation to variable for minimal and preferable case. 10%
4. What are path analysis and its data assumption? 10%  
Please list the differences between regression and path analysis (at least five facets) 10%
5. What's structural equation modeling (SEM)? Please list and explain SEM process from review literature to interpret results. 10%
6. Please read the partial contents, Table, and Figure (in Appendix) from the journal paper of Information & Management (2015):
  - (1) Please criticize the sample size problem based on the related literature. 10%
  - (2) Based on the related literature, and Table 6, please explain whether the model fit has been sufficient the demand, or some model fit indices is not satisfy the demand. 10%
  - (3) From Fig. 4, please interpret the results and all of relationships: interdependent, path-dependent, reciprocal, loop relations. 20%

## Appendix: I & M Journal paper (partial contents)

Paper title: Evaluation of knowledge management performance: An organic approach

### 3.3. Sample and procedures of the survey study

Large and medium-sized construction contracting firms operating in Hong Kong were targeted as the research population. These firms are important sources and adopters of innovation. Through project operations, they improve technologies and integrate different activities and knowledge introduced by different parties into the construction process [26,27]. In addition, these firms work within a very dynamic and competitive market, where regulatory and competitive conditions are subject to rapid change [88,89]. According to the assertions of the DCV [20,92], the empirical context is suitable for studying dynamic capabilities such as the KMC.

Firms were randomly drawn from two trade directories, the "Members List" of the Hong Kong Construction Association [38] and the "List of Approved Contractors for Public Works" [22], to form the sampling frame. Among the 260 firms in the sampling frame, 109 (42%) were Group C contractors for public works with contract values exceeding HK\$50 million [22], and 125 (48%) were Group B contractors for public works with contract values of up to \$50 million. Some Group A contractors (for public works with contract values of up to HK\$20 million) [22] with reasonably large scope, as well as in-house contractors of major developers, were also considered as part of the sampling frame.

A questionnaire survey was designed to elicit opinions on the governance mechanisms, learning routines and business performance of the research population. Before the main survey, the questionnaire was pre-tested with 10 contractors in Hong Kong. The purpose of the pre-test was to ensure the survey's clarity, avoid bias, modify ambiguous questions, and in particular, to increase its relevance to the business operations of the research population. The data collection process began after the questionnaire had been finalized based on feedback from the test. The self-administered questionnaires were distributed to firms in the sampling frame. Data preparation removed six outliers, leaving a total of 143 cases ( $n = 143$ ) in the data set. An assessment based on the sample size determination formula [6] confirmed that a sample size of 143 was sufficient to achieve an alpha level of 0.05 and a margin of error of 0.03 for the variables of learning routines, governance mechanisms and business performance. The responses were considered to be a good representation of the opinions of the population because the majority of the respondents were experienced in construction operations and knowledgeable about issues related to organizational learning and KM implementation within their firms. The respondents' demographic information is summarized in Table 1.

**Table 6**  
Model fit indices of the fitted path model.

Model fit indices	Fitted path model
Chi-square ( $\chi^2$ )	17.58
Normed Chi-square: $\chi^2/df$ (df: degree of freedom)	1.76
$p$ (probability level)	0.06
Bollen-Stine bootstrap $p$ (computed across 1000 bootstrap samples)	0.15
RMR (root mean square residual)	0.02
GFI (goodness-of-fit index)	0.97
NFI (normed fit index)	0.97
CFI (comparative fit index)	0.99
RMSEA (root mean square error of approximation)	0.07

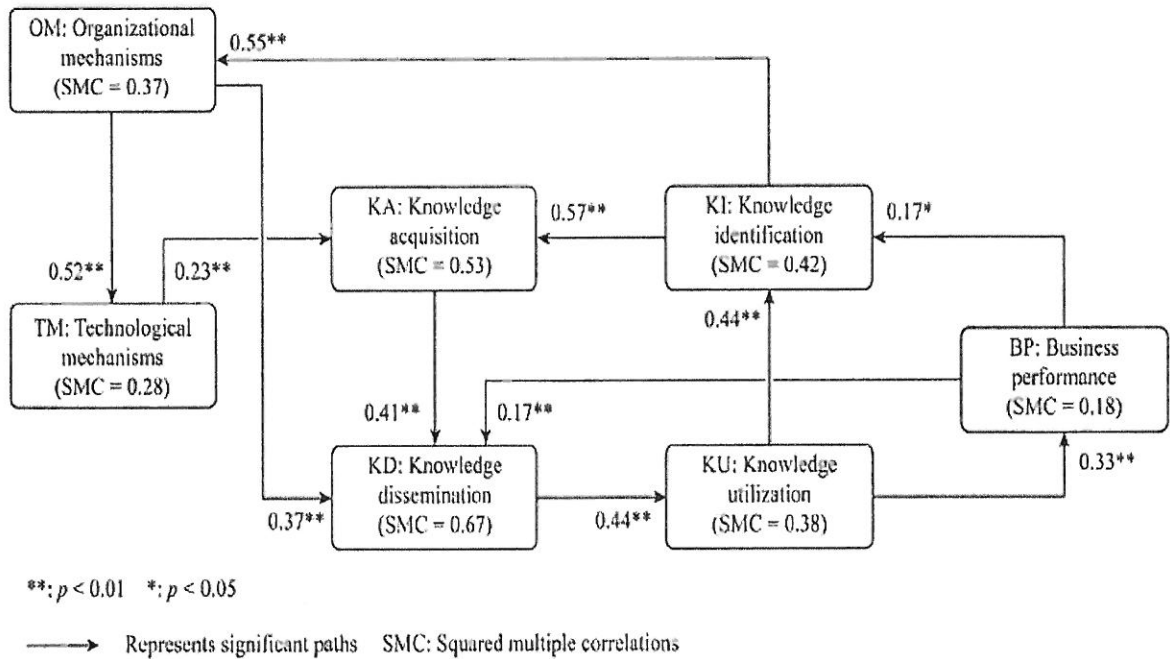


Fig. 4. The fitted path model.