

Response to reviewer's comments

Ms. Ref. No.: 1314586

Title: Evaluation of Informatization Performance of Construction Industrialization EPC Enterprises in China

The authors appreciated the valuable comments and suggestions provided by the reviewers. We have made careful and substantial revisions on the manuscript. **All the changes and responses to the reviewers' comments are listed below point-by-point. The major changes are highlighted with red in the revised manuscript.** We hope that the revised paper meets the raised concerns. We sincerely hope this manuscript will be acceptable for publication in Advances in Civil Engineering.

Reviewer #1:

Consider after minor changes.

Reply: Thanks for the reviewer's positive comments. All the issues mentioned are carefully addressed below point-by-point.

(1) Should elaborate more on the selection of inputs and outputs of the DEA model and include the literature review.

Reply: We have elaborated the selection of inputs and outputs of the DEA model in the revised manuscript (line 222-228).

The first is the input metrics, including 4 first-level and 17 second-level indicators, which refers to the investment collection of various resources in the process of enterprise informatization construction including the internal planning and construction and the promotion of external environment of the enterprise. The second is the output, including 6 first-level and 27 second-level indicators as the metrics, which mainly refers to the growth of enterprise performance capability after the informatization construction.

The literature review has also been added to illustrate the necessity to carry out an information "input-output" analysis in the informatization process (line 165-167).

Constructing the index system of informatization performance evaluation is needed, including input and output metrics, which can clearly understand the consistency and effectiveness between input and output in the informatization process.

(2) Should explain why only 30 construction industrialization EPC enterprises are studied.

Reply: Thanks for your comments. We have explained the reason in the revised manuscript (line 405-410).

In order to understand the actual situation of information construction of construction industrialization enterprises, a rigid selection was carried out based on three principles: (1) The enterprise should be the first or super grade general contractor of housing construction; (2) The enterprise has its own prefabricated component factory; (3) The enterprise mainly adopts EPC mode in the projects under construction. For instance, Longxin Group and Shenyang Wanrong modern construction industry Co., Ltd.

(3) Should explain why only 5 experts are selected for the study.

Reply: Thanks for your comments. We have explained the reason in the revised manuscript (line 429-430).

According to the requirements for the number of expert scores using the AHP method, at least 3 experts with odd number are required to ensure reliable results.

Reviewer #2:

The paper is interesting and combines qualitative and quantitative methods. However, I have some comments that could improve the quality of the paper.

Reply: First, thanks for the reviewer's positive comments and careful check, and we hope this manuscript can provided some insights on proposing an improved qualitative and quantitative methods to evaluate the informatization performance of construction industrialization enterprises in China. All the issues mentioned are carefully addressed below point-by-point.

(1) Lines 197-204 can be added in section “AHP Index Weight Calculation”.

Reply: Thank you for the constructive comments. We have revised it in the revised manuscript (line 322-329).

(2) Lines 205-212 can be presented within the section “DEA Relative Efficiency Calculation”. and Lines 213-218 move to section “FCA evaluation result calculation”.

Reply: Thanks again. We have revised it in the revised manuscript. (line 355-361, line 385-389)

(3) References for these methods are missing.

Reply: We have added the relative references to support these methods.

[57] T.L. Saaty, Decision making with the analytic hierarchy process, *International journal of services sciences* 1 (1) (2008) 83-98.

[58] T. Chen, Y. Jin, X. Qiu, X. Chen, A hybrid fuzzy evaluation method for safety assessment of food-waste feed based on entropy and the analytic hierarchy process methods, *Expert Systems with Applications* 41 (16) (2014) 7328-7337.

[60] X. Zhu, P. Zhang, Y. Wei, Y. Li, H. Zhao, Measuring the efficiency and driving factors of urban land use based on the DEA method and the PLS-SEM model—A case study of 35 large and medium-sized cities in China, *Sustainable Cities and Society* 50 (2019).

[61] D.Y. He, Q.J. Zhang, The application of analytic hierarchy process and fuzzy comprehensive evaluation method for the evaluation of enterprise training effectiveness, *International Journal of Computational Science and Engineering* 14 (2) (2017) 126-134.

(4) Please, could you provide a description in terms of the aggregation method. There are two well-known aggregate methods that are used within the AHP in the case of experts (group) decision-making. Authors mentioned that five experts were included for evaluation indicators. However, in the paper the aggregation method is not well presented. Therefore, I cannot confirm the reliability of the application of the AHP method. Consequently, the steps of this framework and application of other methods cannot be reliable.

Reply: Thanks for your valuable comments. We have added a description for the aggregation method in the revised manuscript (line 196-205).

DEA method is a popular approach for ranking the decision-making units (DMUs) according to their performance based on its excellent data processing ability [50]. However, two shortcomings are existed for DEA: one is preference relations cannot be addressed for decision-making problems, and another is DEA just can classify the units into efficient and inefficient two groups, but it cannot further rank the efficient DMUs. While AHP method usually is used to derive preference relation [51] and FCA can tackle fuzziness or the problem of vague decision-making more efficiently [52]. Therefore, AHP and FCA method are introduced to compensate the shortcomings. An improved D-FCA aggregation method is applied to evaluate the informatization performance.

[50] Q. An, F. Meng, B. Xiong, Interval cross efficiency for fully ranking decision making units using DEA/AHP approach, *Annals of Operations Research* 271 (2) (2018) 297-317.

[51] X. He, J. Zhang, Supplier Selection Study under the Respective of Low-Carbon Supply Chain: A Hybrid Evaluation Model Based on FA-DEA-AHP, *Sustainability* 10 (3) (2018).

[52] D. Yang, C.M. Mak, An assessment model of classroom acoustical environment based on fuzzy comprehensive evaluation method, *Applied Acoustics* 127 (2017) 292-296.

(5) Please, if possible, use the same term as Input and Output metrics or Input and Output factors. Nevertheless, i suggest that within the paper and Table 1 first-level indicator (metrics/factors) should be defined as Measures. Then, could you provide the unit for each indicator?

Reply: Thanks for the reviewer's constructive comments. We have revised the manuscript to use the same term as Input and Output metrics (line 222-228).

The first is the input metrics, including 4 first-level and 17 second-level indicators, which refers to the investment collection of various resources in the process of enterprise informatization construction including the internal planning and construction and the promotion of external environment of the enterprise. The second is the output, including 6 first-level and 27 second-level indicators as the metrics, which mainly refers

to the growth of enterprise performance capability after the informatization construction.

As for the third question, we have designed the questionnaire to collect the enterprise data. The data collected can be divided into two categories: one is quantitative, such as 'Informatization management planning investment (X12)', with the unit of 'ten thousand yuan'. The other one is qualitative, such as 'position and rights of informatization department (X14)', which is measured by the scope of the department's rights in enterprise.

Reviewer #3:

The article is an applied research. Describes customer interaction as a positive impact on the development of new services for companies. The article is well structured and makes a relevant contribution to the literature of the area. The data were collected from companies in China, which is an additional relevance factor, for dissemination in the international market of business practices in a country of the BRIC'S group. The article concludes that customer interaction has a positive impact. It also concludes that social capital plays an important role in the development of services.

Reply: Thanks for the reviewer's positive comments. We are happy that this article can make a relevant contribution to this area.

(1) General comments:

The article is an applied research.

The article is well structured and is a contribution to the scientific literature.

The literature used as a reference is updated and relevant.

Although focused on national and regional data the conclusions and method used are applicable to other parts of the world.

The article addresses the problem presented which consists of large investments that have been spent on computerization for construction, however, production and performance remain uncertain. Research and interview are used to collect data, with

effective responses from thirty construction companies. The computerization performance of these companies is evaluated using an improved D-FCA method that incorporates Analytic Hierarchy Process (AHP), Data Envelopment Analysis (DEA) and Comprehensive Fuzzy Evaluation Analysis (FCA). Survey results indicate that all companies surveyed meet the performance requirement and 60% of the thirty companies show excellent performance, reaching levels A, AA and AAA. This study contributes to evaluate the computerization performance of construction companies in China.

The title “Evaluation of Informatization Performance of Construction EPC Enterprises Industrialization in China” effectively represents what is presented in the content of the study.

The focus of this work is applied and effectively contributes to the development of good practice and academia.

Paper structure, readability and logical flow meet the quality level demanded by the Journal.

The paper is technically relevant and correct, just as the language is clear and explicit enough to constitute an appreciable scientific document.

Reply: Thanks for the reviewer’s positive comments. We sincerely hope this manuscript will be acceptable for publication in *Advances in Civil Engineering* after carefully revising. All the issues mentioned are carefully addressed below point-by-point.

Improvements that you could suggest on the paper.

(2) The abstract needs to be reviewed and should consist of: Purpose; Methodology; Results achieved; Limitations; Applications and Originality.

Reply: Thanks for the reviewer’s comments. We have revised the abstract carefully in the revised manuscript (line 19-20, line 31-33)

(3) Conclusions need to be detailed including contributions to practice and academia, and limitations of the method.

Reply: Thanks for the reviewer’s constructive comments. We have added the

contributions to practice and academia, and limitations of the method in Conclusion carefully in the revised manuscript (line 605-607, line 612-613).