

# Improving University Ranking to Achieve University Competitiveness by Management Information System

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**Abstract.** One way to increase university competitiveness is through information system management. A literature review was done to find information system factors that affect university performance in Quacquarelli Symonds (QS) University Ranking: Asia evaluation. Information system factors were then eliminated using Delphi method through consensus of 7 experts. Result from Delphi method was used as measured variables in PLS-SEM. Estimation with PLS-SEM method through 72 respondents shows that the latent variable academic reputation and citation per paper have significant correlation to university competitiveness. In University of Indonesia (UI) the priority to increase university competitiveness as follow: (i) network building in international conference, (ii) availability of research data to public, (iii) international conference information, (iv) information on achievements and accreditations of each major, (v) ease of employment for alumni.

**Keywords** – Competitiveness, Management Information System, University, Quality

## 1. Introduction

In 2015, ASEAN Economic Community will be implemented among ASEAN countries. ASEAN Economic Community (AEC) aims to make Southeast Asia a hub where products, services, investment, skilled workers, and capitals can move freely among ASEAN countries (ASEAN Secretariat, 2014).

University is not only as teaching establishment, but also as an organisation that creates new knowledge and support social communities (Numprasertchai & Yuen, 2006). University plays important role to increase economic competitiveness in local, provincial, and national scale (Lane, 2012). Based on Quacquarelli Symonds (QS) University Rankings: Asia report, University of Indonesia is ranked eight in ASEAN. This ranking is based on evaluation in academic reputation, employee reputation, faculty student ratio, paper per faculty, international students and academic staff, and inbound/outbound exchange students (QS University Rankings: Asia 2014, 2014). One way to increase organisation competitiveness is through strategic information system (Hemmatfar, Salehi, & Bayat, 2010).

Information system is a virtual system that helps management to organize operations in a company (McLeod & Schell, 2008). The basic goal of information system is to prepare organisation to adapt to changes (Salwe, Ahmed, Aloufi, & Kabir, 2010). Several usages of information system are as base for decision-making, virtual communication, e-commerce, knowledge management, etc. (Petter, DeLone,



& McLean, 2008). Information system implementation are consist of three steps; pre-implementation, implementation, and post-implementation.

Competitiveness is the ability to provide products and services in more efficient and effective manner compared to other firms in the same business (Blunck, 2006). Competitiveness is capacity to manage and access company resources efficiently (Rutkauskas, 2008). Competitive advantage is a part of strategic management study (Sigalas & Economou , 2013). There are two schools of teaching in competitive advantage literature. The first stated that competitive advantage is highly related to company performance (Sigalas & Economou , 2013).

Global university ranking serves to increase accountability and transparency, which helps universities in arranging strategy to encounter global competition (Jöns & Hoyler , 2013). There are many methods to rank universities, such as issued by Times Higher Education Supplement (THES), QS Top Universities, US News and World Report, and Shanghai Jiao Tong University.

Quacquarelli Symonds (QS) is a higher education consultancy service provider which was established in 1990. Annually since 2004, QS has issued QS World University Rankings. The evaluation is based on nine factors shown in Table 1.

Table 1. QS University Ranking: Asia Factors

Factors	Description	UI Score in 2014
<i>Academic Reputation</i> (30%)	Number of academic referees endorsing institution in QS Global Academic Survey	80.9
<i>Employer Reputation</i> (10%)	Number of employer referees endorsing institution in QS Global Employer Survey	88.6
<i>Faculty Student Ratio</i> (20%)	The ratio of faculty to students	73.8
<i>Papers per Faculty</i> (15%)	Research papers (Scopus) per faculty member	3.1
<i>Citations per Paper</i> (15%)	Citations per paper – adjusted for institutions with negligible activity in medicine, science and technology	27.1
<i>International Faculty</i> (2.5%)	Proportion of international faculty	75.7
<i>International Students</i> (2.5%)	Proportion of international students	12.4
<i>Inbound Exchange Students</i> (2.5%)	Proportion of inbound exchange students	25.8
<i>Outbound Exchange Students</i> (2.5%)	Proportion of outbound exchange students	15.7

Source: (QS University Rankings: Asia 2014, 2014)

The potential of information system in company management has widely been acknowledged (Díez et al, 2009). In strategic management, resource-based view (RBV) is a dominant concept used by in gaining competitive advantages (Peppard, Galliers, & Thorogood, 2014). The information system can increase company competitiveness if integrated with resources and business process (Louis, Hackney, & Braganza, 2008).

Strategic of Information system can change goals, process, products, organisational interaction with surroundings to increase competitiveness and minimize weaknesses (Turban, King, Viehland, & Lee, 2006). Strategic information system improves company differentiation, development, cost, innovation, and network, which lead to competitive advantages (Jaf, Xinping, & Sabr Jaf , 2012).

## 2. Method and Data

Delphi method is used to obtain expert feedback from a group of respondents through a series of controlled questionnaire (Hadaya, Cassivi, & Chalabi, 2012). Recommended number of respondent in Delphi ranged from 5 to 14 (Afshari, Yusuff, & Derayatifar, 2012). Delphi is also often used to select criteria for other method in research (Vidal, Marle-Jean, & Bocquet, 2010) (Afshari, Yusuff, & Derayatifar, 2012) (Verhagen & et al, 1998). Criteria selection is done through mean elimination from a group of data based on a certain cut-off point (Broomfield & Humphris, 2001).

Literature review was done to list information system factors that support university performance in nine aspects QS evaluates (Pillai, Khan, Ibrahim, & Raphael, 2012), (Nawaz & Gomes, 2014), (Khan & Zaidi, 2009), (Dukić, 2013), (Solomona, 2008), (Huang Yi, Xiaolan Ao, & Yuh-Shan Ho, 2008), (Bornmann, Schier, Marx, & Daniel, 2012), (Piwowar, Day, & Fridsma, 2007), (Rubbia, Franco, Pellizzonc, & Nannipieri, 2014), (Smith & Rankin, 2002), (Yilin Lu, Mavondo, & Qiu, 2013), (Hasan, 2013), (Gray & Fam, 2003) and (Massey & Burrow, 2012). From the extensive literature study, 67 information system factors that affect QS.

In this research, Delphi questionnaire was disseminated to seven experts from top management and administrative staffs in UI. Questionnaire consisted of 67 questions that aim to evaluate the degree of importance from each information factors to their related QS factors. Likert-5 scale was used ranging from 1 for very unimportant to 5 for very important. Geometric mean for each factor was then calculated. Cut-off point in this research is 4.5. Based on this cut-off point, *Employer Reputation* (10%) and *International Students* (2.5%) were eliminated and are excluded.

Structural Equation Modelling (SEM) is a multivariate method comprised of factor analysis and multiple regressions. SEM facilitates evaluation of relationship between measured variables/indicators and latent constructs/variables simultaneously (Dachyar & Noviannei, 2012). SEM consists of two sub models, outer model/measurement model shows relationship between latent constructs and their measured variables. Inner model/structural model shows relationship between latent constructs (Wong, 2013).

There are two types of indicators in measured model, namely formative and reflective (Wong, 2013). Reflective relationship is where indicators are segmented of their latent constructs, while formative where indicators affect their latent constructs (Freeze & Raschke, 2007). Reflective indicator is represented by one-way arrow pointing outwards from latent construct while formative indicator is represented by one-way arrow pointing from indicator to latent construct (Hair, Ringle, & Marko, 2011).

Minimum recommended sample for SEM is five times amount of measured variables (Dachyar & Hananto, 2014). Several software used for CBSEM are AMOS, EQS, LISREL, and MPlus (Wong, 2013).

PLS-SEM or partial-least square SEM (also called component-based SEM) focus on variance analysis. PLS-SEM use regression to minimize variance within endogen latent constructs. PLS-SEM first optimizes parameters in measurement model, and then estimates the path coefficient in structural model. In PLS-SEM context, structural model is called inner model and measurement model is called outer model (Hair, Ringle, & Marko, 2011). Thus the name partial-least square is used since this method minimalizes variance partially between inner or outer model. In reflective relationship, coefficient from latent construct to measured variables is used as weight. In formative relationship, coefficient from measured variable to latent construct is used as weight. Approximation of inner and outer model will continue until the parameter estimates come together (Hsu, Chen, & Hsieh, 2006).

Based on the result from Delphi method and some previous literature (Vidaver-Cohen, 2007), (Fraj, 2014), (Memon & Rahman, 2013), (Wong, 2013) and based on interrelation factor in the literature, the proposed model of this research is displayed in Figure 1. The model consists of seven latent variables from factors used in QS University Ranking: Asia and 28 measured variables from information system factors support university in QS evaluation.

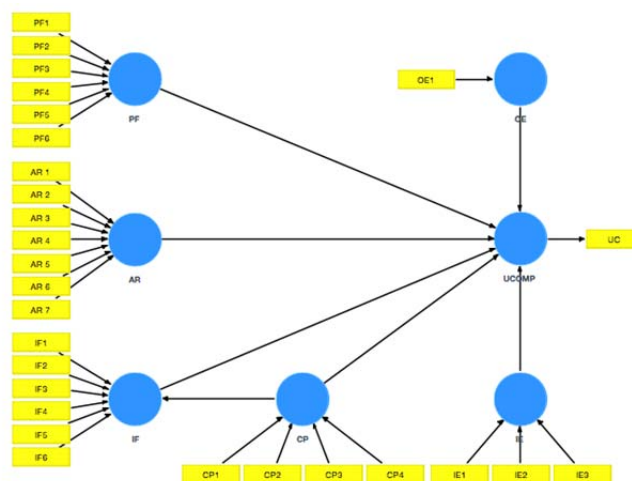


Figure 1. Proposed information system in relation to university competitiveness model

Factors in QS University Ranking: Asia report were used as latent variables and information system factors were used as measured variables. Hypothesis tested in this model are:

- H1: Academic Reputation (AR) affects University Competitiveness (UCOMP)
- H2: Citation per Paper (CP) affects International Faculty (IF)
- H3: Citation per Paper (CP) affects University Competitiveness (UCOMP)
- H4: International Exchange (IE) affects University Competitiveness (UCOMP)
- H5: International Faculty (IF) affects University Competitiveness (UCOMP)
- H6: Outgoing Exchange (OE) affects University Competitiveness (UCOMP)
- H7: Paper per Faculty (PF) affects University Competitiveness (UCOMP)

The PLS-SEM questionnaire consisted of 28 questions corresponding to the measured variables in the model. Questions were in form of statement that performance of a certain information system component in UI is suitable, and respondents were asked to rate their agreement to the statement in Likert-5 scale. Respondents were academic and administrative staffs of UI from various faculties.

Initial evaluation was done to assess the reliability and validity of the proposed model with 25 respondents (Hair, Ringle, & Marko, 2011), (Urbach & Frederik, 2010). In this research, SmartPLS software was used.

Measurement model evaluation differs for reflective and formative latent variable (Hair, Ringle, & Marko, 2011). Reflective latent variable is evaluated based on its reliability and validity. Reliability assessment consists of composite reliability (higher than 0.7) and indicator reliability (higher than 0.7). Validity is evaluated through convergent validity (average variance extracted higher than 0.5) and cross loading (each indicator's loading should be higher for its respective latent variable). The reflective latent variable UCOMP in this research pass both the reliability and validity assessments. Formative latent variable doesn't rely on reliability and validity assessment since it is assumed that measured variables in formative latent variable have strong theoretical based. Bootstrapping was done to find significance of weight and loading in each measured variable. From initial assessment, measured variables with both insignificant weight and loading were eliminated. The  $\alpha$  in this study is  $\alpha = 0.1$  (t-value = 1.65). Variance inflation factor (VIF) evaluation was done to avoid multicollinearity within measured variables (VIF valued should be lower than 5). Measured variables that will be included further in the research after initial model evaluation are AR1, AR2, AR4, AR5, AR6, AR7, CP2, CP3, CP4, IF1, IF2, IF3, IF4, IF6, IE1, IE3, OE1, PF1, PF5, PF6, and UC.

Structural model evaluation was done with  $R^2$  and  $Q^2$  assessments. Endogen latent variable was assessed based on its  $R^2$  value, where value higher than 0.67 means strong, 0.33 means moderate, and 0.19 means weak relationship.  $Q^2$  assessment evaluate if model is predictive enough and latent variable should have  $Q^2$  value higher than 0 (Lee & Chen, 2013).

After initial evaluation, questionnaire was disseminated again to respondents. In the end, 72 respondents were obtained. Evaluation was done again in process similar to the initial evaluation. In the final evaluation, only information system factors is included which deemed to be really important and significant compared to other factors in the same latent variable. The measured variables with significance of either weight or loading below 1.65 were eliminated. Measured variables that were included in the final model were AR5, AR6, AR7, CP3, CP4, IE3, IF1, IF6, OE, PF6, and UC which illustrate in figure 2.

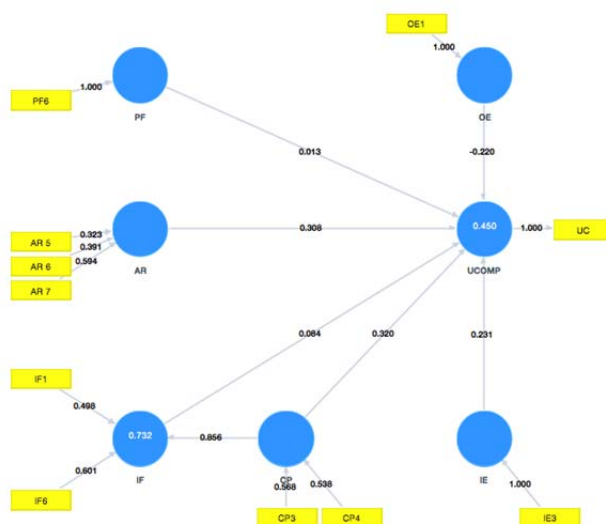


Figure 2. Final Model with Path Coefficients

Result from bootstrapping with 5000 subsamples and  $\alpha = 0.1$  (t-value = 1.65) from model was shown in Table 3.

Table 3. Path significance assessment result  
Tabel 3. Significancy Path

Hypotesis	Relation	Value-t	Significant
H1	AR → UCOMP	2.0010	Yes
H2	CP → IF	22.9120	Yes
H3	CP → UCOMP	1.9933	Yes
H4	IE → UCOMP	1.5670	No
H5	IF → UCOMP	0.5945	No
H6	OE → UCOMP	1.3825	No
H7	PF → UCOMP	0.1564	No

Based on calculation with PLS-SEM method it is found out that:

1. Academic Reputation (AR) affect University Competitiveness (UCOMP) positive and significantly
2. Citation per Paper (CP) affect International Faculty (IF) positive and insignificantly
3. Citation per Paper (CP) affect University Competitiveness (UCOMP) positive and insignificantly
4. Inbound Exchange Student (IE) affect University Competitiveness (UCOMP) positive and insignificantly
5. International Faculty (IF) affect University Competitiveness (UCOMP) positive and insignificantly
6. Outbound Exchange Student (OE) affect University Competitiveness (UCOMP) negative and insignificantly
7. Paper per Faculty (PF) affect University Competitiveness (UCOMP) positive and insignificantly

Latent variable AR and CP have significant positive relation to UCOMP. Latent variable AR has three measured variables, that are AR5, AR6, and AR7. Latent variable CP has two measured variables CP3 and CP4. The five measured variables were then prioritized as alternatives to improve university competitiveness through information system.

Priority was then arranged with regard to performance score from respondents, total effect from its latent variable to university competitiveness (UCOMP), and its weight. Performance score used was 1/geometric mean from the respondent evaluation. The low score means poor performance which will be alternative to be prioritized. Weight from measured variables AR 5, AR6, AR7, CP 3, and CP4 with respect to their latent variables were also used. Priority scores were obtained by multiplying 1/performance score with Total Effect and Outer Weight. Measured variable with highest priority score will be prioritized. Performance score from respondent, Total Effect, Outer Weight, Priority Score, and Priority of Alternatives are showed in Table 4.

Table 4. Priority in Improving University Competitiveness Through Information System Management

Alternative (Variable)	Performance Score	1/Performance Score	Latent Variable Total Effect	Measured Var. Outer Weight	Priority Score	Priority
1 (AR 5)	3.52	0.28	0.31	0.32	0.03	5
2 (AR 6)	3.32	0.30	0.31	0.39	0.04	4
3 (AR 7)	3.13	0.32	0.31	0.59	0.06	3
4 (CP 3)	2.94	0.34	0.39	0.57	0.08	1
5 (CP 4)	2.88	0.35	0.39	0.54	0.07	2

From the evaluation above, the strategic priority to improve university competitiveness according to UI academic and administrative staffs is as the following:

- 1<sup>st</sup> Priority: network building in international conference
- 2<sup>nd</sup> Priority: availability of research data to public
- 3<sup>rd</sup> Priority: international conference information,
- 4<sup>th</sup> Priority: information on achievements and accreditations of each major
- 5<sup>th</sup> Priority: ease of employment for alumni

### 3. Conclusion

Through literature review, 67 information system factors that support university in QS University Ranking: Asia evaluation were obtained. After elimination with Delphi method by 7 experts, 28 factors were deemed important to be included further in the research. Experts find the variable Academic Reputation (AR), Citation per Paper (CP), Inbound Exchange Student (IE), International Faculty (IF), Outbound Exchange Student (OE), and Paper per Faculty (PF) are important for University Competitiveness (UCOMP).

Result from Delphi was used as base for PLS-SEM method. Assessment from 72 valid questionnaire responses through UI academic and administrative staffs resulted in two latent variables affect University Competitiveness (UCOMP) significantly, which are Academic Reputation (AR) and Citation per Paper (CP). Priorities in improving university competitiveness through information system are subsequently: (i) network building in international conference, (ii) availability of research data to public, (iii) international conference information, (iv) information on achievements and accreditations of each major, (v) ease of employment for alumni. The studies sampled on the UI,

results of this study can be applied to public and private universities with same factors with this research .

## Reference

- (2014, 9 12). *QS University Rankings: Asia 2014*. Top Universities.
- Afshari, A., Yusuff, R., & Derayatifar, A. (2012). An application of Delphi method for eliciting criteria in personnel selection problem. *Scientific Research and Essays* , 2927-2935.
- Bornmann, L., Schier, H., Marx, W., & Daniel, H.-D. (2012). What factors determine citation counts of publications in chemistry besides their quality? *Journal of Informetrics*, 11-18.
- Broomfield, D., & Humphris, G. (2001). Using the Delphi technique to identify the caer education requirements of general practitioners. *Medical Education*, 928-937.
- Dachyar, M., & Hananto, L. (2014). Innovation and quality service factors to customer loyalty in Indonesia telecommunication company by using structural equation modeling method. *Management and Technology in Knowledge*, 41-44.
- Dachyar, M., & Noviannei, M. (2012). Customer Satisfaction Index Telecommunication Industry in Indonesia. *Engineering and Technology*, 135-136.
- Dukić, D. (2013). Online databases as research support and the role of librarians in their promotion: The case of Croatia. *Library Collections, Acquisitions, & Technical Services*, 56–65.
- Fraj, E. (2014). Environmental strategies and organizational competitiveness in the hotel industry: The role of learning and innovation as determinants of environmental success. *Tourism Management*.
- Freeze, R., & Raschke, R. (2007). AN ASSESSMENT OF FORMATIVE AND REFLECTIVE CONSTRUCTS IN IS RESEARCH. 1481-1492.
- Gray, B., & Fam, K. (2003). Cross cultural values and the positioning of international education brands.
- Hadaya, P., Cassivi, L., & Chalabi, C. (2012). IT project management resources and capabilities: a Delphi study. *International Journal of Managing Projects in Business*, 216-229.
- Hair, J., Ringle, C., & Marko, S. (2011). PLS-SEM: INDEED A SILVER BULLET. *Journal of Marketing Theory and Practice*, 19(2), 139-151.
- Hasan, R. (2013). nfluential Factors in Selecting an Overseas University for Bangladeshi Undergraduate Students.
- Hsu, S.-S., Chen, W.-H., & Hsieh, M.-J. (2006). Robustness Testing of PLS, LISREL, EQS and ANN-based SEM for Measuring Customer Satisfaction. *Total Quality Management*, 355–371.
- Huang Yi, Xiaolan Ao, & Yuh-Shan Ho. (2008). Use of citation per publication as an indicator to evaluate pentachlorophenol research. *Scientometrics*, 67–80.
- Issa-Salwe, A., Ahmed, M., & Aloufi, K. (2010). Strategic Information Systems Alignment: Alignment of IS/IT with Business Strategy. *Journal of Information Processing Systems, Vol.6, No.1*, 121-128.
- Jaf, R., Xinping, X., & Sabr Jaf , S. (2012). The Effect of the Strategic Information Systems (SIS) on the Achievement Competitive Advantage Practical in Samples of Iraqi Banks. *International Conference of Intelligent Systems Design and Engineering Application* (hal. 954 - 959). IEEE.
- Jöns, H., & Hoyler , M. (2013). Global geographies of higher education: The perspective of world university rankings. *Geoforum*, 45-59.
- Khan, A., & Zaidi, S. (2009). Online Databases Usage by Research Scholars of the Aligarh Muslim University. *Journal of Library & Information Technology*, 55-60.

- Lane, J. (2012). *Higher Education and Economic Competitiveness*. Dipetik 7 10, 2014, dari academia.edu: [https://www.academia.edu/2692830/Higher\\_education\\_and\\_economic\\_competitiveness](https://www.academia.edu/2692830/Higher_education_and_economic_competitiveness)
- Louis, S., Hackney, R., & Braganza, A. (2008). Strategies, Contributions and Inhibitors of Information Systems to Organizational Competitiveness: an Empirical Analysis within the Caribbean. *Journal of International Technology and Information Management*, 17.
- Massey, J., & Burrow, J. (2012). Coming to Canada to study: Factors that influence student's decisions to participate in international exchange. *Journal of Student Affairs Research and Practice*, 83–100.
- Nawaz, D., & Gomes, A. (2014). Review of Knowledge Management in Higher Education Institutions. *European Journal of Business and Management*, 71-79.
- Numprasertchai, S., & Yuen, P. (2006). Enhancing University Competitiveness through ICT based Knowledge Management System. *International Conference on Management of Innovation and Technology* (hal. 417-421). IEEE.
- Peppard, J., Galliers, R., & Thorogood, A. (2014). Information systems strategy as practice: Micro strategy and strategizing for IS. *Journal of Strategic Information Systems*, 1-10.
- Pillai, S., Khan, M., Ibrahim, I., & Raphael, S. (2012). Enhancing employability through industrial training in the Malaysian context. *Springer*, 187–204.
- Piwozar, H., Day, R., & Fridsma, D. (2007). Sharing Detailed Research Data Is Associated with Increased Citation Rate. *PLOS One*, 1-5.
- Rubbia, G., Franco, C., Pellizzonc, D., & Nannipieri, L. (2014). Research support services in Higher Education and Research Institutions: approaches, tools and trends. *CRIS*, 309-314.
- Smith, S., & Rankin, C. (2002). *Conferences: Why to Attend and How to Benefit*. University of Texas at Austin.
- Solomona, D. (2008). A longitudinal comparison of citation rates and growth among open access journals.
- Turban, E., King, D., Viehland, D., & Lee, J. (2006). *Electronic Commerce 2006: A Managerial Perspective* (International ed.). NJ: Prentice Hall.
- Urbach, N., & Frederik, A. (2010). Structural Equation Modeling in Information Systems Research Using Partial Least Squares. *Journal of Information Technology Theory and Application*, 11(2), 5-44.
- Verhagen, A., & et al. (1998). The Delphi List: A Criteria List for Quality Assessment of Randomized Clinical Trials for Conducting Systematic Reviews Developed by Delphi Consensus. *J Clin Epidemiol*, 1235-1241.
- Vidal, L.-A., Marle-Jean, F., & Bocquet, J.-C. (2010). Using a Delphi process and the Analytic Hierarchy Process (AHP) to evaluate the complexity of projects. *Expert Systems with Applications*, 5388-5405.
- Vidaver-Cohen, D. (2007). Reputation Beyond the Rankings: A Conceptual Framework for Business School Research. *Palgrave Macmillan Ltd*, 278-304.
- Wong, K.-K. (2013). Partial Least Squares Structural Equation Modeling (PLS-SEM) Techniques Using SmartPLS. *Marketing Bulletin*, 1-32.
- Yilin Lu, Mavondo, F., & Qiu, L. (2013). Factors Influencing the Choice of Overseas Study by Undergraduate and Postgraduate Chinese Students.



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