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Addressing the Resource-Based View: Determinants That Drive Chinese Universities to Offer MOOCs

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Abstract

This study involved 51 Chinese universities from the Quacquarelli Symonds (QS) World University Ranking 2021. With based the resource-based view (RBV) as a framework, it aimed to identify the determinants of human resource capital that were related to universities' production of MOOCs. Three determinants were detected—size, lifelong learning, and proximity to the political centre. Both size and proximity to the political centre proved to be significant. The findings provide timely implications for university managers and suggest that the variety of management spaces be expanded to increase the portfolio of high-quality Chinese universities that facilitate the production of MOOCs. In addition, universities should increase their proximity awareness to remedy the disadvantages of uneven resource allocation due to geographical proximity.

Keywords: MOOCs, resource-based view, knowledge management, proximity

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MOOCs (massive open online courses) are viewed as a means to promote and publicize universities, given increasing demand from students for online learning options coupled with the advanced information and communication technology (ICT; Wang et al., 2022). MOOCs have offered universities the opportunity to connect with students from different countries, which expands their profiles and increases their potential competitive advantages, given the influence of higher education marketisation (Howarth et al., 2022). Additionally, Chinese students have perceived the usefulness of MOOCs and continue seeking for appropriate MOOCs as an alternative way to improve themselves (Wang, 2023).

In particular, universities have been challenged to connect and incorporate diverse roles and facets of value-added management processes (Chatterton & Goddard, 2000). It is essential to ascertain the forces driving organizational success and competition regarding MOOCs. Therefore, understanding the determinants that affect Chinese universities in producing MOOCs is of the utmost importance considering the rapid expansion of online education; this is especially relevant given China's unique educational landscape and potential impact on global online learning trends.

This study aimed to identify and interpret the determinants affecting Chinese universities to produce MOOCs. Following the sample selection method from Zakharova (2019) and considering the impact MOOCs caused on university internationalization (Chuang & Ho, 2016), this study considered only the universities from the Quacquarelli Symonds (QS) World University Ranking 2021 (see Appendix, Table A1), given that leading universities initiated MOOCs before other universities with various online courses. The resource-based view (RBV) is an organizational framework that focused on the resources an organization can use to achieve its sustainable and competitive advantage (Barney et al., 2001). Therefore, this paper considered RBV as the theoretical framework to detect the determinants affecting Chinese university to produce MOOCs.

To begin, exploratory factor analysis (EFA) was used to identify the underlying factors among the data set. Ordinary least squares (OLS) and Tobit regression were adopted to further verify the relationship between the factors and the production of MOOCs, which could help us understand the determinants driving MOOCs' operation in universities.

Literature Review and Hypotheses

MOOCs in China

MOOCs are defined as an instructional approach that uses technologies to provide learners opportunities to access online courses freely worldwide (Wang et al., 2022). Zheng and Yang (2017) considered that MOOCs have changed the relation of supply and demand in terms of knowledge acquisition in China. Compared with traditional education, advances in ICT make MOOCs possible in practice. They also argued that universities should bear the support and service roles for producing and developing MOOCs. Hence, 14 Chinese MOOC platforms, established by enterprise and university respectively or jointly, have appeared

since 2012 (Zheng et al., 2018). Most published literature has focused on six categories (Moreno-Marcos et al. 2018): (a) dropout, (b) scores prediction, (c) forum posts classification, (d) students' motivation, (e) relevance of content, and (f) students' and teachers' behaviour. Little literature has considered the university side and sought to identify the determinants that influence universities to produce MOOCs. This study served to bridge the research gap.

Resource-Based View

RBV is an organizational framework used in strategic management (Khanra et al., 2022); it focuses on the interaction of an organization's internal resources—which are variable, rare, inimitable, and non-substitutable—to determine the strategic resources an organization may use to achieve its sustainable and competitive advantage (Barney et al., 2001). The resources in RBV include tangible as well as intangible assets. Intangible resources hinder competitors' efforts to imitate and substitute in the short term, due to the inherent complexity and specificity of their accumulation process, including financial and capital assets, reputation, human capital, management skills, organizational processes, and an organization's information and knowledge (Battisti et al., 2022).

Focusing on higher education institutions (HEIs), researchers have expanded the RBV in researching global alliances (Sanders &Wong, 2021), competitive strategy making (Valaei et al., 2022), and information technology (IT) adoption (Karim et al., 2022). Institutional resources are essential for universities to achieve objectives (Williams, 2014). It is crucial for universities to manage the tangible and intangible resources that can be bundled to construct organizational capabilities to produce MOOCs as innovative educational products of HEIs. Therefore, this study used RVB as a research framework to identify the underlying determinants behind MOOCs and further interpret how these determinants, integrated as complementary capabilities, help MOOCs be successful in terms of higher education strategic management.

Research Model and Hypotheses

Empirical studies of higher education management have included measures of institutional resources as independent variables or control variables. This study considered the variables confirmed by Lowry (2004), Muscio et al. (2013), Sav (2013), Schlesselman and Coleman, (2013), and Ospina-Delgado et al. (2016). Several hypotheses were generated and are outlined below.

Wernerfelt (1989) considered an organization's age to be an intangible resource that impacted performance. In addition, Schlesselman and Coleman (2013) and Ospina-Delgado et al. (2016) determined the year in which a college was established to be significantly correlated with the performance of HEIs. Therefore, we proposed our first hypothesis:

H1: The age of a university positively influences it to produce MOOCs.

In terms of resource-related measures, Huang and Lee (2012) indicated that human resources were one of a university's essential internal resources, and they considered the number of teaching faculty to be an input variable (Sav, 2013). In this sense, we proposed a second hypothesis:

H2: The number of teachers positively influences a university to produce MOOCs.

Student enrollment has been viewed as a resource acquired by the university, which is a crucial indicator of institutional characteristics and a university's ability to achieve economies of scale (Worthington & Higgs, 2011). Therefore, we proposed a third hypothesis:

H3: The number of students positively influences a university to produce MOOCs.

Rothschild et al. (1991) indicated that the degree program portfolios offered by a university were a crucial resource factor for competing against rivals in the marketplace. Loukkola et al. (2020) stated that the number of degrees obtained at each of the bachelor, master, and doctoral levels were crucial indicators in funding mechanisms. Thus, we proposed our fourth, fifth, and sixth hypotheses:

H4: The number of bachelor programs positively influences a university to produce MOOCs.

H5: The number of master programs positively influences a university to produce MOOCs.

H6: The number of doctoral programs positively influences a university to produce MOOCs.

The location of university can be defined as geographical proximity, which has been well documented as being related to organizational outcomes such as innovation and knowledge creation (Catalini, 2018). Besides, the political environment has the capacity to influence education policies, school curricula, and investment in education and research (Boschma, 2005; Jowett & O'Donnell, 2014). For this reason, we proposed a seventh hypothesis:

H7: Proximity to the political centre (Beijing) positively influences a university to produce MOOCs.

Internationalization as a concept and strategic agenda is a diverse phenomenon in tertiary education (De Wit & Altbach, 2021). The international activities in universities have expanded dramatically, ranging from traditional study-abroad programs to foreign language programs. Loukkola et al. (2020) suggested that international students be part of statistics related to measuring internationalization. Therefore, we proposed our eighth hypothesis:

H8: The number of international students positively influences a university to produce MOOCs.

The number of post-doctoral positions played a crucial role in research productivity (Scaffidi & Berman, 2011). According to Chen et al. (2015) post-doctoral positions can be viewed as a university's research resource. Thus, we proposed a ninth hypothesis:

H9: The number of post-doctoral programs positively influences a university to produce MOOCs.

Hence, following the hypotheses above, we proposed the research model below:

Testable model: $NMC = \alpha + \beta 1Factor1 + \beta 2Factor2 + \cdots + \beta 9Factor9 + \varepsilon$

Where, NMC = the number of MOOCs; α = the intercept of the regression equation; β = coefficients of independent variables; and ε = error term.

Methodology

Data Collection

The data considered for this study were all secondary data from university Web pages, accessed from September to December, 2021. This period was selected because September was the first month of a new academic year for Chinese universities and all the data would be updated and presented through the university Web pages. Furthermore, based on the extant literature and discussion with professors who were experts in the field of online learning and higher education management, this study followed previous empirical methods for selecting variables. The number of MOOCs was the dependent variable, with the following independent variables: (a) age of the university (Year); (b) number of teachers (NT); (c) number of students (NS); (d) number of bachelor programs (NBP); (e) number of master programs (NMP); (f) number of doctoral programs (NDP); (g) number of post-doctoral programs (NPDP); (h) distance to Beijing (political centre of China; DB); and (i) number of international students (NIS).

Examining Variance Inflation Factors (VIF)

Table 1 presents the results of examining VIF for the independent variables and indicates that the variables were highly correlated and the multicollinearity issue exists. Therefore, factor analysis was used to elicit the data.

Table 1

VIF Values

Variable	Year	NT	NS	NBP	NMP	NDP	NPDP	DB	NIS
VIF	1.76	2.00	2.69	2.13	9.20	11.67	5.18	1.15	1.49

Exploratory Factor Analysis

This study adopted exploratory factor analysis to elicit information regarding interrelationships among the variables. Conducting exploratory factor analysis considered three stages, namely to assess the suitability of data, extract factors, and rotate factors.

Regarding the adequacy of a sample size, the consensus is that the larger the sample size, the better. Later studies have confirmed the adequacy of a small sample size, less than 50, for evaluation research (Costello & Osborne, 2005; Mundfrom et al., 2005). Therefore, a sample size of 51 was considered adequate for this study. In terms of the interrelationship among the variables, the correlation matrix approach has been recommended to look for coefficient values, the more there are coefficient values higher than 0.3, the more acceptable the sample size (Ogunsanya et al., 2019). We used the approaches of correlation matrix, Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy, and Bartlett's test of sphericity to confirm the conditions above. KMO statistics vary from 0 to 1, with values greater than 0.5 considered acceptable, values between 0.5 and 0.7 mediocre, values between 0.7 and 0.8 good, and values between 0.8 and 0.9 considered superior (Kaisier, 1974).

This study adopted principal component factor analysis to extract factors, and the varimax approach for factor rotation. In terms of factor loadings, greater than 0.3 are considered significant, greater than 0.4 are considered more critical, and 0.5 or higher are considered very significant (Hair et al., 2003).

OLS Regression and Tobit Regression

OLS is a type of linear least square method for examining the unknown parameters in a linear regression model based on the assumption of independent observations (Kashki et al., 2021). OLS selects the parameters of a linear function of a set of explanatory variables according to the principle of least squares, which minimizes the sum of squares of the difference between the observed dependent variable and the linear function prediction in a given dataset (Ahmad et al., 2021). In this study, OLS was considered one of the methods to model a dependent variable regarding its relationship with a set of independent variables. In comparison, the Tobit model (Tobin, 1985) was designed for estimating linear relationships among variables when the dependent variable is either left-censored or right-censored (Kumari et al., 2021). Thus, following the methods of Schlup and Brunner (2018), Tobit regression analysis was further considered as a robust test for validating the estimating results.

Results

Data Description

Table 2 shows the general variable description of the number of MOOCs.

Table 2

Data Description

Variable	Mean	Std. dev.	Min.	Max.
NMC	79.62745	68.33329	0	340
Year	90.23529	32.08837	11	128
NT	4,144.098	2,795.349	790	15,772
NS	3,6845.31	1,6401.76	8,024	73,677
NBP	86.13725	27.01779	29	141
NMP	106.2745	91.53209	7	398
NDP	70.17647	84.88574	3	337
NPDP	25.60784	12.95697	0	60
DB(km)	1,075.137	1,599.794	0	11,458
NIS	3,046.958	1,905.885	562	7,793

The Results of Exploratory Factor Analysis

Regarding the suitability of data, (see Appendix, Table A2) shows correlation coefficients and proves the inter-correlation strength among the variables in this study. Table A3 (see Appendix) indicates the data are appropriate for performing factor analysis with the KMO value of 0.703 and a significant P-value of 0,000. The values of communality (Table A4, see Appendix) further demonstrate the adequacy of a small sample size for this study since the average value is 0.729 and all the values are higher than 0.5.

Table 3 shows three values extracted with an eigenvalue of greater than 1, which explained 72.855% of the total variance, and the eigenvalue of the fourth factor is far from the reference value of eigenvalue of 1.

Table 3

Total Variance Explained

Component	Initial eigenvalue			Extraction sum of squared loading		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.915	43.498	43.498	3.915	43.498	43.498
2	1.467	16.301	59.799	1.467	16.301	59.799
3	1.175	13.056	72.855	1.175	13.056	72.855
4	0.800	8.889	81.744			
5	0.662	7.357	89.101			
6	0.472	5.249	94.350			
7	0.312	3.462	97.812			
8	0.149	1.650	99.462			
9	0.048	0.538	100.000			

Table 4 shows that three factors were generated, each impacting Chinese universities to produce MOOCs. Six variables were represented in the first factor, namely the (a) number of post-doctoral programs, (b) number of teachers, (c) years of existence, (d) number of students, (e) number of bachelor programs, and (f) number of international students. Given that the role of post-doctoral study is mainly for academic research, teachers were also required to conduct academic research. Size was the label we gave to this first factor. The second factor was represented by two variables—the number of master programs and the number of doctoral programs. We named this factor lifelong learning, given that the master programs (professional and academic) and doctoral programs were aimed at training people for pursuing careers (McCorkle et al., 2023). The third and final factor was represented by one variable, namely the distance to Beijing. Thus, we named this factor proximity to the political centre.

Table 4

Rotation Factors and Sums of Squared Loadings

Variable	Factor 1	Factor 2	Factor 3
NPDP	0.8496		
NT	0.7753		
NS	0.7095		
Year	0.6547		
NBP	0.6150		
NIS	0.5550		
NMP		0.9663	
NDP		0.9556	
DB			0.8188
Principal components statistics			
Eigenvalue	3.915	1.4670	1.1750
% of variance	43.498	16.301	13.056
Cumulative variance explained %	43.498	59.799	72.855

Results of OLS and Tobit Regression

Tables 5 and 6 both support the hypothesis of this study and show that the goodness of fit was considered. The two factors of size and proximity to the political centre indicated that the hypotheses as proposed were significantly supported except the number of master programs (H4) and the number of doctoral programs (H5). The positive correlation coefficients between the number of MOOCs and size indicated that the size of universities would increase the number of MOOCs produced. However, proximity to the political centre was found to be negatively correlated with the number of MOOCs, idicating that the closer universities were to the political centre, the fewer MOOCs they produced.

Table 5

OLS Regression Analysis Results

NMC	Coefficient	*SE*	*t*	*P* > |*t*|	[95% CI]	
Factor 1	0.5857016	0.1130429	5.18	0.000***	0.3578785	0.8135246
Factor 2	0.1365193	0.1130429	1.21	0.234	-0.0913038	0.3643424
Factor 3	-0.3113383	0.1130429	-2.75	0.009***	-0.5391614	-0.0835153
_cons	0.0408178	0.1118592	0.36	0.717	-0.1846196	0.2662552

Note. Prob > F = 0.0000; R^2 = 0.4492; Adj-R^2 = 0.4117.

* $p < 0.1$. ** $p < 0.05$. *** $p < 0.01$.

Table 6

Tobit Regression Analysis Results

NMC	Coefficient	*SE*	*t*	P > |*t*|	[95% CI]	
Factor 1	0.5857016	0.1082304	5.41	0.000***	0.3677144	0.8036887
Factor 2	0.1365193	0.1082304	1.26	0.214	-0.0814678	0.3545064
Factor 3	-0.3113383	0.1082304	-2.88	0.006***	-0.5293255	-0.0933512
_cons	0.0408178	0.107097	0.38	0.000	-0.1748867	0.2565223
Var(e.y)	0.7419901	0.075729			0.589464	0.8945161

Note. Prob > Chi^2= 0.0000; pseudo R^2 = 0.2102.

*** $p < 0.01$.

Discussion and Conclusions

Size

In this study, the determinant of size (i.e., NPDP, NT, NS, Year, NBP, NIS) was considered the university's intangible resource within the RBV framework. The role of size should be stressed due to its impact on supply chain integration and sustainable performance. Studies have accentuated that size is an essential determinant for an organization, impacting the level of implementation for sustainability-oriented strategies and practices (Gallo & Christensen, 2011). Besides, many operational or strategic resources are associated with size, which could significantly impact the organization's ability to deliver projects (Carr and Pearson, 1999; Hong et al., 2019).

In China, MOOCs as the educational products of higher education involve high resource consumption, because MOOCs not only need to satisfy the diverse needs of students looking for alternative means to acquire new knowledge and skills, but also must strengthen universities' competitive advantage in the higher education industry. Size is an important factor analyzed in higher education management (Martínez, 2013) and is critical for promoting sustainability management and producing new projects (Hörisch et al., 2015). According to Williams (2014) size was considered one of the essential resources for universities, viewed as a proxy for the institution's operational and marketing capabilities. Therefore, big universities had an advantage in producing MOOCs to further implement their operational and marketing capabilities to meet the demands of students, as well as to reinforce their competence among HEIs. This was consistent with Ospina-Delgado et al. (2016) who found that size played an essential role in the production of MOOCs.

Lifelong Learning

The interface between lifelong learning and higher education has become increasingly important for updating professional skills. With the expansion of higher education, an increased proportion of the labour

force is comprised of graduates (Brooks & Everett, 2008). Lifelong learning emphasizes the learning process wherein people can formally or informally engage in learning activities related to knowledge and skills necessary for personal, social, and employment-related demands (Taşçi & Titrek, 2019).

MOOCs could be seen as an opportunity to redesign dynamic environments with current learning styles, thus contributing to improving learning and lifelong learning (Ospina-Delgado et al., 2016). However, this determinants off NMP and NDP were confirmed as insignificant in impacting HEIs to produce MOOCs. As the existing literature has demonstrated, lifelong learning participants are mainly graduates rather than other groups of people (Brooks & Everett, 2008). Furthermore, graduate programs are aimed at training people for pursuing academic careers (McCorkle et al., 2023), which have been traditionally offered through face-to-face instruction rather than virtual. Additionally, academic procrastination has been one of the barriers for lifelong learning in HEIs (Barnová & Krásna, 2018).

Proximity to Political Centre

Proximity is often interpreted as geographical proximity, defined as the spatial distance between individuals or organizations, and considered as an external variable that stimulated the formation and evolution of institutions (Boschma, 2005; Christensen & Pedersen, 2018). There is a causal relationship between proximity to the political centre, and managerial and innovative operations (Funk, 2014). The political geography has a pervasive effect on investment in organizations, and those located in areas with strong control by the ruling party could experience greater opportunities, and more risk as well (Kim et al., 2012).

Our study has confirmed that proximity was a determinant that significantly impacted HEIs to produce MOOCs. This was consistent with the literature that organizational outcomes such as communication, social ties, innovation, and knowledge creation are positively associated with proximity to the political centre (Boschma 2005; Catalini, 2018). Furthermore, this study found that the coefficient of proximity to the political centre was negative—HEIs closer to the political centre produced fewer MOOCs than those farther away. This finding did not concur with previous studies, in which a positive relationship was observed between political proximity and the rate of investment.

In the current educational context in China, although the government is committed to improving education, there are considerable flaws in current educational processes; these affect educational equality, cost, and educational resources (Tang & Carr-Chellman, 2016). The universities located in Beijing can benefit from more opportunities and fundings brought by political geography, which highlights the issue of educational equality. However, after the COVID-19 pandemic, there has been a significant increase in the number of MOOCs and students have become accustomed to online learning. MOOCs, as an educational innovation, bridge the gap in educational equality. They offer hope to HEIs that are far from political centre without adequate educational resources to garner educational information and resources, address the inequality in HEIs, and further decrease educational cost. This represents the line regarding producing MOOCs that proximity for Chinese universities far away from political centre cannot be only viewed as the geographical disadvantage, but the opportunity to increase competence among the demand side of students and universities.

Conclusions

Following the COVID-19 pandemic, there was a significant increase in the number of MOOCs worldwide. In the educational industry, the sustainability and competitiveness benefits of delivering MOOCs are known, but among Chinese universities, the determinants that successfully impact MOOC production are diverse because different factors are responsible. Therefore, this study focused on the question of what determinants drive universities to produce MOOCs and aimed to identify and interpret the determinants affecting Chinese universities to produce MOOCs based on the RBV framework. In terms of results, except for lifelong learning, size and proximity to political centre were confirmed as significant determinants driving Chinese university to produce MOOCs.

Regarding the two perspectives of students' demand side and the competence among universities, the findings lent support to and aligned with studies in strategical management regarding higher education management. Therefore, it is recommended that efforts to increase the size of universities should be intensified; bigger universities perform better generating new competing projects such as producing MOOCs to satisfy the student's needs and strengthen their competitive capability. Awareness of proximity should also be intensified by those universities far away from the political centre to remedy the disadvantages of uneven resource allocation due to lack of geographic proximity.

Implications, Limitations, and Future Research Directions

This study was the first to explore and summarize the essential determinants behind MOOCs' operation in Chinese universities. In terms of theoretical implications, this study addressed the research gap of HEIs strategic management in the MOOC context and provided considerable variables for HEIs with respect to MOOC production.

This study further expanded the research scope of RBV in strategic management of HEIs by providing empirical evidence. As well, this study has extracted three new variables for future studies to explain the performance and strategy of universities regarding MOOCs. Focusing on managerial implications, size was proven to be a crucial determinant driving universities to produce MOOCs, indicating institutional resources are essential to operate new objectives for HEIs. Thus, this study suggested the universities should invest in fundamental resources and leverage their size to improve comprehensive competitive advantages and capabilities. Furthermore, proximity was also confirmed as a significant determinant influencing Chinese university to operate MOOCs. Thus, universities that are far away from the political centre with fewer educational resources, especially the universities located in the northern and western parts of China (e.g., Xinjiang Uygur Autonomous Region and Tibet Autonomous Region) could consider MOOCs to be a way to expand their profile regarding students' demands and marketing competence. Additionally, in light of the findings related to Chinese universities, universities outside China could further leverage their profile worldwide through MOOCs; the indicator of international students was positively involved in the determinant of size.

Addressing the limitations of this study, first, the sample size may have been a limitation, since we considered only Chinese universities from the QS ranking 2021, in line with Chuang and Ho (2016) and Zakharova (2019). Therefore, the future research could involve more Chinese universities from outside the QS ranking. The second limitation relates to data collection. University Web pages could not provide us

enough detailed information such as the types of MOOCs these universities provided. The third limitation concerns the variables selected for this study. The literature has demonstrated both the lack of empirical evidence and the operationalisation of variables regarding MOOCs. The variables selected for measuring MOOC operations would differ, depending on country contexts and history due to cultural differences and parameters adopted for measuring success, which has also been advocated by a range of scholars (Welter, 2011). Thus, in future research, it would be interesting to establish a standard measurement for universities or HEIs, even if they have different contexts and are located in other latitudes. Given the increase in MOOCs, it is worth knowing the impact of these at regional, national, or international levels.

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Appendices

Table A1

Study Sample

International rank	University	Number of MOOCs
15	Tsinghua University	430
23	Peking University	208
34	Fudan University	123
47	Shanghai Jiao Tong University	161
53	Zhejiang University	363
93	University of Science and Technology of China	56
124	Nanjing University	184
246	Wuhan University	298
256	Tongji University	118
260	Harbin Institute of Technology	181
263	Sun Yat-sen University	62
279	Beijing Normal University	163
303	Xi'an Jiaotong University	298
323	Southern University of Science and Technology	17
377	Nankai University	62
387	Shanghai University	148
387	Tianjin University	84
392	Beijing Institute of Technology	152
396	Huazhong University of Science and Technology	121

432	Xiamen University	128
446	University of Science and Technology Beijing	82
449	Beihang University	61
462	South China University of Technology	78
485	Shandong University	441
493	Jilin University	170
493	Southeast University	166
501–510	East China Normal University	125
531–540	Northwestern Polytechnical University	95
531–540	Sichuan University	255
571–580	China University of Geosciences	17
581–590	Renmin University of China	85
591–600	Dalian University of Technology	231
601–650	East China University of Science and Technology	150
601–650	Hunan University	98
601–650	Jinan University	97
601–650	Shenzhen University	10
651–700	Beijing University of Technology	102
651–700	Central South University	169
651–700	Soochow University	97
701–750	China Agricultural University	104
701–750	Nanjing University of Science and Technology	67
701–750	University of Electronic Science and Technology of China	144

751–800	Beijing Jiaotong University	253
751–800	Chongqing University	143
751–800	Northwest University (China)	160
801–1000	Beijing Foreign Studies University	23
801–1000	Harbin Engineering University	41
801–1000	Lanzhou University	27
801–1000	Shanghai International Studies University	61
801–1000	Wuhan University of Technology	152
801–1000	Xi'an Jiaotong Liverpool University	0

Table A2

Correlation Matrix

	NMC	NIS	Year	NT	NS	NBP	NMP	NDP	NPDP	DB
NMC	1.0000									
NIS	0.4607*	1.0000								
Year	0.5226*	0.3324*	1.0000							
NT	0.4848*	0.2818*	0.2679*	1.0000						
NS	0.3031*	0.2416*	0.2273*	0.5961*	1.0000					
NBP	0.2641*	0.3174*	0.4042*	0.4337*	0.6646*	1.0000				
NMP	0.2598*	0.2626*	0.1885*	0.1262*	0.2880*	0.4501*	1.0000			
NDP	0.3122*	0.3334*	0.2126*	0.2108*	0.3802*	0.5183*	0.9370*	1.0000		
NPDP	0.6191*	0.5376*	0.5423*	0.6551*	0.6965*	0.6290*	0.4513*	0.5642*	1.0000	
DB	-0.1433*	-0.0974	-0.0754	-0.0184	0.1983*	0.0943	-0.0746	-0.0842	0.0239	1.0000

Note. * means variables related.

Table A3

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy	Bartlett's Test of Sphericity		
	Chi-square (approx.)	*df*	Sig.

KMO = 0.703	240.763	36	0.000

Table A4

Communalities Values

Variable	Description	Initial Communality	Extraction Communality
Year	Years of existence	1.000	0.552
NT	Number of teachers	1.000	0.617
NS	Number of students	1.000	0.764
NBP	Number of bachelor programs	1.000	0.642
NMP	Number of master programs	1.000	0.942
NDP	Number of doctoral programs	1.000	0.961
NPDP	Number of post-doctoral programs	1.000	0.863
DB	Distance to Beijing	1.000	0.687
NIS	Number of international students	1.000	0.529
Average Values		1.000	0.729