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Critical Barriers to International Construction Joint Ventures Success: Multi-Experts Views and Contextual Disparities

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Abstract

International construction joint ventures (ICJVs) have evolved as an effective approach to sustainable development, given their myriad socio-economic and environmental benefits. Despite the benefits, the successful implementation of ICJVs is still hindered by several barriers. However, limited studies exist that have comprehensively analyzed the critical barriers to ICJVs success. This study aims to examine the criticality of barriers to ICJVs success. Through a comprehensive literature review, 36 barriers were identified, and an expert survey was conducted with 123 ICJV experts from 24 different countries/jurisdictions around the world. The results confirmed the criticality of 22 of the 36 barriers used for the survey. Most of the critical barriers were attributed to lack of attention to management and organizational issues during ICJVs implementation. In developed countries, the leading barriers are more collective (from the ICJV) than from individual partners; the reverse is rather true in developing countries. Mann-Whitney *U* test results showed some significant differences in the rankings of the barriers between the two contexts. Moreover, there was significant agreement on the ranking of the critical barriers between experts from the industrial sector and those from the academic sector. Five components were obtained through

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factor analysis, namely; knowledge limitation, operational and governance-related barriers, coordinating difficulties, system and cultural barriers, and interface-oriented and outlook barriers. This study contributes to deepening the understanding of barriers to ICJVs success and helping ICJVs' front liners (i.e., top team managers) and policymakers in developing suitable measures and policies to ensure successful implementation of ICJVs. It could also direct researchers toward examining the influences of these barriers on ICJVs overall performance goals to devise clear-cut frameworks, seeking their successful implementation in the future.

Keywords: International construction joint ventures; International joint ventures; Barriers; Sustainable development; Construction industry

Introduction

International construction joint ventures (ICJVs) are a form of hybrid collaborative contracting, created for undertaken Architectural Engineering and Construction (AEC) projects within a location distinct from where at least one partner's headquarter is situated (Ozorhon et al. 2008a; Hong and Chan, 2014). Interpreted from a range of theoretical perspectives, including resource dependency, transaction cost, organizational learning, strategic positioning, etc., diversified motivations drive ICJVs adoption. Thus, both developed and developing countries have profited and are continuously benefiting from this hybrid collaboration arrangement (Ozorhon et al. 2007a; Chan et al. 2020). Without ICJVs, numerous technically complex projects or large-scale infrastructure projects worldwide would not have been successful (Tetteh and Chan, 2019). Typical examples include the channel tunnel between the United Kingdom and France, the expressway system in Bangkok, the Taiwan high-speed railway, the Three Gorges Dam in China, and the Hong Kong-Zhuhai-Macau Bridge (Girmscheid and Brockmann, 2010; Liang et al. 2019).

While there are examples where ICJV has been successfully implemented, equally there are cases where it has not been able to deliver as expected and failed. This is attributed to the complex inter-organizational relationships, cultural and environmental complicatedness, and technical traits that characterize ICJVs (Ozorhon et al. 2008a). Tetteh et al. (2019) attribute ICJVs success to achieving their overall performance goals (i.e., perceived satisfaction – partners overall satisfaction with ICJV performance; partner/company performance – the extent to which pre-set organizational objectives are realized; project-based performance – the extent to which predetermined project goals are achieved; socio-environmental performance – the extent to which social and environmental performance of the ICJV has been realized; and performance of the ICJV management – the extent of having control power in ICJV operation). Whereas there are several studies on the possible risk factors influencing ICJVs success (Bing et al. 1999; Hwang et al. 2017), few studies have directly or indirectly highlighted some potential problems, issues, and challenges impeding ICJVs success (Alashwal and Ann, 2019; Lu et al. 2020). Besides, these studies were conducted with some limitations. First, there is a lack of thorough review or empirical examination on barriers to ICJVs success as a stand-alone concept and their criticality in ICJVs implementation. A better and deeper understanding of the barriers is crucial for the development of holistic and integrated strategies and robust action plans for successful future implementation. Second, these studies neglected the fact that different types of barriers may have different criticality rates yet are not isolated, but rather form multifaceted correlations in impeding ICJVs success. Thus, failing to examine the interrelationships between the barriers means failure to identify the high-priority barriers and develop suitable strategies to successfully implement ICJVs. Third, while there exist homogeneities of barriers to ICJVs success, yet diverse criticalities in different locations, there should be variations in the developments of action plans and analyzing the criticality of barriers to

ICJVs success from the standpoints of global experts representing both developed and developing countries remains a significant missing view that is worth investigating. Thus, conclusions drawn would contribute to the development of a more holistic approach in eliminating those barriers in homogenous locations.

To address these limitations, this study aims to investigate the critical barriers to ICJVs success from an international perspective. The survey was conducted to gather and analyze experts' views from various countries and jurisdictions around the world by comparing their views on a contextual comparative basis (i.e., developed and developing countries) to establish a common set of critical barriers to ICJVs success. Barriers in this study represent potential factors known to occur and with solely negative influence on ICJVs implementation. Thus, they are known with more certainties and require immediate management response. It is also defined to include challenges, difficulties, problems, obstacles, and issues impeding ICJVs success. The outcome of this research is a comprehensive list of possible barriers to ICJVs success, whose significance is ascertained in the empirical analysis. This study not only contributes to deepening the understanding of barriers to ICJVs success but also important to ICJVs' front liners (e.g., top team managers) and policymakers in developing strategic measures and policies to ensure successful implementation of ICJVs. It could also direct researchers to conduct further empirical studies toward investigating the influences of barriers on ICJVs overall performance goals to devise clear-cut frameworks, seeking their successful implementation in the future.

Barriers to ICJVs Success: Literature Review

In practice, ICJVs are always not free of uncertainties and challenges despite their myriad benefits and opportunities. As the most widely explored area in ICJV studies, many researchers have published papers summarizing these complications as risks for convenience sake (Bing et al. 1999;

Zhao et al. 2013) few studies have pointedly outlined some potential problems, challenges, issues, and obstacles to ICJVs success (hereafter, barriers). A comprehensive literature review of mostly peer-reviewed articles enabled the identification of 36 potential factors impeding ICJVs success as shown in Table 1. Among the factors, loss of management control, conflicting interest/competing objectives, language barrier, incomplete contract terms with a partner, etc., are well documented in prior research, and more applicable. Thus, this set of barriers factors have received relatively considerable attention in previous studies around the world. According to Chan et al. (2017), experts can respond well when they are familiar with the factors. The literature review indicates that these barriers can be categorized into six main groups: lack of expertise and confidence; lack of effective planning and suitable strategies; inter-organizational differences; lack of experiential knowledge of ICJV's fundamentals, management difficulties, and conflicts among entities. A careful analysis of the literature shows that barriers within each category are interrelated or a barrier in one category can influence a barrier in the other, and vice versa. For example, poor relationship management may create friction within both the internal and external ICJV teams, and in turn, reduce the mutual commitment level of partners (Panibratov, 2016). Fig 1 shows the conceptual framework for barriers to ICJVs success. These clusters share a similar ideological concept with Hong (2014). They are discussed in the following subsections.

Lack of Expertise and Confidence

The complex nature of large-scale infrastructure projects and the duration precision makes it very difficult to select the most suitable ICJV partner (Chan and Suen, 2005). Meanwhile, the capabilities of the parties involved play a significant role in completing the project successfully and building stronger ties. Several studies have demonstrated that inappropriate selection of a joint venture contractor (JVC) significantly impairs chances for the operation's survival (McIntosh and

McCabe, 2003; Liang et al. 2019). Zhao et al. (2013) reported that forming an ICJV with a company lacking managerial expertise and confidence greatly impact ICJVs success. Because large-scale infrastructure projects and the venture contract system normally bring trouble to the entire construction process, it is, therefore, relevant to ensure that all parties to the venture are competent and technically trained to effectively handle the complexities involved in the project and the contract system. Other critical barriers include fear of legal action, lack of confidence about experience and knowledge, etc.

Lack of Effective Planning and Suitable Strategies

The drive of ICJVs toward achieving their set goals and objectives is through effective planning and vice versa (Lee and Do, 2015). The project-based nature of ICJVs means time limitation. Thus, there is a need for adequate planning and deliberations even at the pre-conception stage of the venture-formation (Hung et al. 2002). Prior studies have recorded that lack of effective project planning and budgeting significantly impede ICJVs success (Walker and Johannes, 2003). Shen et al. (2001) confirmed this barrier as one of the difficulties facing Sino-foreign CJVs in China. Lee and Do (2015) emphasized that the failure to carefully analyze international joint venture (IJV) projects using appropriate protocols have caused completed and current ICJVs project failure.

Inter-organizational Differences

The difficulties that ICJVs faces often find their genesis in the differences between parties involved in location customs and legal requirements (Gunhan and Arditi, 2005). The lack of understanding of the host country's statutory requirement and language frailty weakens the contractual regulations and creates serious problems for the contract objectives from the inception. Therefore, it’s seen as a major barrier to the cause of failure in ICJVs (Ozorhon et al. 2008a). Complicated problems occasioned by organizational cultures, differing policies and procedures among entities, and social

sense of superiority are among other factors that are known to impede ICJVs success. Ozorhon et al. (2008a) found a strong correlation between organizational cultures and ICJVs success. Likewise, Sridharan (1995) identified that cultural impact on JV organization is implicit and manifests its presence through conflicts in a clash of cultures. Thus, the wider the cultural gap, the more difficult it will be to create the necessary cohesion (Gale and Luo, 2004).

Lack of Experiential Knowledge of ICJV's Fundamentals

It is well acknowledged in the literature that ICJVs are always successful when the fundamentals of their administrative structures are right (Ozorhon et al. 2008b). Thus, the lack of understanding and without knowing the ICJVs' administrative structures in areas such as communication, contract terms, coordination, etc. often impede ICJVs success (Prasitsom and Likhitruangsilp, 2015). Sometimes, merely out of the intention of participating in a construction project, due to time limitation leads to the ICJV parties not fully evaluating and understanding how well an ICJV should be operated in a desirable manner, which results in their failure. The dearth of basic knowledge of the essential terms of and key functions for the operation of ICJVs limits the effectiveness of the parties to fulfill the overall goal of the ICJV.

Management Difficulties

As one of the topical barriers affecting this hybrid arrangement, management difficulties, have caused many ICJVs projects to fail (Girmscheid and Brockmann, 2010). The provenance of this barrier is from the complex structures involving at least two partner firms commonly of different cultures, either as competitors or as collaborators (Ozorhon et al. 2008b). Most often, there is a boundless pressure on the parties to make rapid decisions following the project-based nature of ICJV operations. According to Hung et al. (2002), such a limitation in time frequently results in management difficulties. Panibratov (2016) reported that, in Russia, several ICJVs have failed to

156 achieve their goal due to management difficulties. Further, inflexible organizational structures that
157 fail to accommodate varying adjustments during the venture operation often leads to the
158 dissatisfaction of parties.

159 ***Conflicts Among Entities***

160 There is no conflict-free ICJV relationship (Gale and Luo, 2004; Ho et al. 2009). The complex
161 inter-organizational relationships – for example, partners' opportunistic behavior, management
162 style, organizational culture, and policy often lead to conflicts during the operation of ICJVs,
163 which in turn results in an unsuccessful relationship (Han et al. 2018). Mostly, goal incongruences
164 among parties may originate from the disparity in the primary benefits expected by the parent
165 firms. As the venture agreement stipulates the overall goal of the partners, yet, in operation,
166 partners deviate from the original agreement due to their opportunistic behaviors which lead to
167 conflicts and consequently the venture failure. It is also important to note that, unfair distribution
168 (e.g. pain and gain) and execution of authority contribute significantly to the failure of ICJVs.

169 **Knowledge Gaps**

170 Overall, aside from the limited number of studies on barriers to ICJVs success, there is lack of
171 systematic research to classify those barriers. Thus, systematic classification based on empirical
172 studies and/or quantitative/statistical analyses is still lacking. A notable exception is Lu et al.
173 (2020) yet it did not analyze joint ventures in construction from an international perspective.
174 Moreover, it did not distinctively define the outlook and focused on a very few countries. The
175 coexistence of undefined factors presents theoretically flawed assumptions, hence failing to lead
176 to robust strategies and action plans for future implementation (Girmscheid and Brockmann,
177 2010). As such, there is a current need for studies that focus specifically on barriers to ICJVs
178 success, investigating the critical barriers impeding the successful implementation of ICJVs. The

knowledge of such critical factors can help ICJVs' management teams dedicate the required resources to address them, thus minimizing or eliminating the barriers and improving the overall ICJVs performance.

<**Please Insert Table 1 here**>

<Please Insert Fig 1 here>

Methodological Framework

Questionnaire Survey

Grounded on a comprehensive literature review, a questionnaire survey capturing 36 potential barriers to ICJVs success was developed. The intention of the survey was first to determine the criticality of each barrier in the context of developed and developing countries/jurisdictions and find out the level of agreement between experts from the academic domain and those from the industrial sector and finally, cluster the critical barriers having similar underlying effect into for easy identification and, perhaps more importantly, identify possible or anticipated future discoveries. Using a questionnaire as an instrument for empirical data collection allowed for data to be collected from 24 different countries/jurisdictions (including the US, Singapore, UK, Hong Kong, Ghana, Thailand, China, Nigeria, Germany, Canada, etc.) and ensured respondents' anonymity data confidentiality. The 7-point rating scale from 1 (strongly disagree) to 7 (strongly agree) was adopted. The scale has the merits of providing respondents a broader explanation to each barrier in terms of evaluation, making the dataset suitable for different statistical analysis and reducing central tendency and leniency concerns in ordinal scales (Chan and Tam, 2000, p. 429; Ameyaw and Chan, 2015, p. 194). Considerately, the factors were deliberately not grouped in the questionnaire (i.e., lack of expertise and confidence; lack of effective planning and suitable strategies; inter-organizational differences; lack of experiential knowledge of ICJV's

fundamentals, management difficulties, and conflicts among entities.) to ensure a clear and impartial insight of the respondents on individual factors. A sample of the questionnaire is provided in Appendix to have a better understanding of the survey. Before the final survey, a pilot study was conducted to test the appropriateness and validity of the questionnaire (Chan et al. 2017).

The pilot study involved a team of two professors, a senior lecturer, two postgraduate research fellow, and three JV managers on the Hong Kong-Zhuhai-Macau Bridge construction. The population of the study comprised all international experts (both academics and industry practitioners) with relevant practical knowledge and/or experiences in ICJV implementation. Cabaniss (2002) defined an expert as someone qualified to hold a position or someone having an exclusive expertise or skills that is indisputable by that person's leadership in professional organization or someone with publications in a recognized journal. Since there was no central global database for ICJV experts (sampling frame), a nonprobability sampling technique, purposive sampling method, was employed to select relevant experts for this study. In purposive sampling, sample selection is done contingent on a purpose (Braimah and Ndekugri, 2009); thus, by targeting respondents with knowledge and experience in the issue under investigation. Due to the difficulty of obtaining a large number of and diverse expertise in the construction domain, purposive sampling has frequently been used in construction research (e.g., Choi et al. 2017; Chan et al. 2017; Wuni and Shen, 2020). Experts were only eligible if (1) they had extensive research experience and theoretically verse in ICJV implementation; (2) they had sufficient direct hands-on ICJVs globally; and (3) they had been involved in at least one implementation of ICJV project. While academic experts were identified from highly recognized journal papers with research titles and overall content of publication containing terms which include but are not limited to international construction joint venture, construction joint venture and international joint venture,

industry practitioners were identified from construction industry councils, institutes, international bodies, associations worldwide (such as Hong Kong Construction Association, Turkish Construction Association, etc.), and lists obtained through government agencies such as Ghana Investment Promotion Centre. These statutory registered bodies effectively provided a proxy for the population of the industry practitioners. The questionnaire was distributed via personalized emails, attaching a Microsoft *Word* file, and providing a web link (produced by survey monkey) to allow online responses. The total number of distributions cannot be determined, as potential respondents, in the humble appeal were requested to distribute the questionnaire to any other experts deemed appropriate (i.e., experts knowledgeable in the area under discussion). However, approximately 300 questionnaires were distributed. As one of the most effective ways to enhance the response rate, the respondents were informed in the survey that the outcome can be shared with them (Li et al. 2011). Consequently, due to several constraints such as the busy schedule of experts, 123 responses were gathered worldwide. This could be regarded as representative and acceptable. Besides, this response rate compares favorably with similar international surveys in the construction management domain (see, for instance, Chan et al. 2017; Owusu and Chan, 2019;). Likewise, this satisfies the central limit (minimum sample size of 30) of any group as recommended by Sproull (1995) and Longnecker (2015). Fig 3 shows the responses obtained from the various countries/jurisdictions. Most of the responses were gathered from the developed countries with the highest response from Singapore, the US, Hong Kong, and the UK. The overall research roadmap is depicted in Fig 2.

<Please Insert Fig 2 here>

Respondents' Profile

Figs. 4 – 7 present the background information of the experts and distribution by country/jurisdiction. Overall, experts from the academic sector constitute approximately 57%, and nearly 65% are from developed countries/jurisdictions. The experts have specialties in areas including architecture, quantity surveying, project management, and engineering, which account for about 84%. Most of the experts had between 5-10 years (38.2%) and over 20 years (35.8%) of experience in ICJV either by research and/or industry experience; only a few (9.8%) had less than 5 years of experience. Likewise, more than half of the experts (54.5%) have been involved in 3 ICJV projects, and 20.3% have been involved in more than 5 ICJV projects. These diversified dispositions of experiences from both the developed and developing countries fuse well and render the data more reliable and representative.

Data Analysis

Data collected were analyzed by using International Business Machines_Statistical Package for Social Sciences (*IBM_SPSS*) software, version 23. First, the Cronbach's alpha coefficient (α) was used to estimate the internal consistency between items in the test, that is, how closely related a set of survey items are as a group (Cronbach, 1951). According to Nunnally and Bernstein (1994) an α value of 1indicates a strong internal consistency and reliability of the data and vice versa. However, a threshold of 0.7 is acceptable (Santos, 1999; George and Mallery, 2016). The overall alpha value is shown in Table 2. Further, the Shapiro-Wilk test was performed to determine the data normality, and this aided the usage of nonparametric tests like the Mann-Whitney *U* test and Spearman Correlation (SC) due to the nonnormal distribution of the data. Descriptive means, normalization analysis, rank agreement analysis, and factor analysis were used to analyze the data. The mean score (MS) and normalization analysis were used to determine how a barrier is more critical than another in each context. Thus, the barriers were ranked and compared between the

groups using the MS and a normalized value of ≥ 0.50 (Adabre et al. 2020). To determine the level of agreement between experts from the academic domain and those from the industrial sector on the ranking of the barriers, the agreement analysis was used. Factor analysis (FA) was used to cluster the barriers into underlying components. To better interpret the FA results and to determine the correlation among the barriers as stated in the literature (see, Fig 1.), the Spearman Correlation (SC) was employed.

Contextual Disparities Test

The Mann-Whitney *U* test has been used in this study to assess the degree of association of rankings of various barriers to ICJVs success from the perspective of experts in developed countries/jurisdictions and developing countries/jurisdictions (Owusu and Chan, 2019). The test is appropriate for determining any statistically significant differences between any two independent groups providing their opinion on any continuous variable. The flexibility attached to employing this method is that it requires no prior postulation on data distribution, and the number of representative groups can be varied (Darko et a. 2017). Using the Mann-Whitney *U* test, the *H0* is that "there are no significant disparities vis-à-vis the level of criticality of barriers in the two countries/jurisdictions. The *H0* can, therefore, be rejected if the test value exceeds its critical value at a significant level (0.05). Table 2 summarizes the results for the identical comparisons of the barriers.

Rank Agreement Analysis of Barriers to ICJVs success

As previously mentioned, the rank agreement analysis was conducted to determine the level of consensus between the two groups of experts (i.e., the academic and the industry) on the ranking of the barriers to ICJVs success. Previous studies, especially in the construction management literature, this quantitative approach has been used to establish unanimity among different

categories of stakeholders and mostly among two groups. For example, Zhang (2005) used this approach to measure the consensus between the academic sector and the industry sector on a list of critical success factors (CSFs) for the Private-Public Partnership (PPP) in infrastructure development. With this same method and focus, Adabre and Chan (2019) determined the results from the two groups on sustainable affordable housing. Recently, Adabre et al. (2020) analyzed the level of agreement among experts from developed countries and developing countries on the critical barriers to sustainability attainment in affordable housing using the same method. This merit the attention that agreement analysis is a suitable approach to determining a consensus among at least two groups on a specific issue. It is a quantitative method that uses the "rank agreement factor" RAF, which shows the average absolute difference in the ranking of the factors between the two groups (Zhang, 2005). The higher the value of RAF is, the lower agreement between the two groups. Thus, a RAF of zero is an indication of perfect agreement. With those from the academic sector and the industry sector being the two groups under discussion, let the rank of a barrier in the academic sector be R_{i1} and in the industry sector be R_{i2} and N be the number of barriers (in the interest of brevity, only the barriers with normalized values ≥ 0.05 were considered) and $j = N - i + 1$. Therefore, $(R_{i1} - R_{i1})$ of a barrier denotes the difference in ranks obtained by the two groups. R_i of a barrier represents the sum of the ranks of the barrier from the academic and industry sectors. According to Okpala and Aniekwu, (1988), the RAF is defined as:

$$\mathrm{Ri} = \sum_{i=1}^{N} R_{ij} \quad (1)$$

R_{ij} represents the sum of the ranks given to a barrier by the two different groups.

The mean value of the total ranks (R_{j2}) is given by

$$R_{j2} = \frac{1}{N} \sum_{i=1}^{N} R_{ij} \quad (2)$$

The RAF is defined as

$$\text{RAF} = \frac{\sum_{i=1}^{N}|R_{i1} - R_{i2}|}{N} \quad (3)$$

The maximum rank agreement factor ($\text{RAF}_{\max}$) is given by

$$\text{RAF}_{\max} = \frac{\sum_{i=1}^{N}|R_{i} - R_{j2}|}{N} \quad (4)$$

The percentage disagreement (PD) is given by

$$\text{PD} = \frac{\sum_{i=1}^{N}|R_{i1} - R_{i2}|}{\sum_{i=1}^{N}|R_{i} - R_{j2}|} \times 100 \quad (5)$$

PD = 35.714 = 36%

The percentage agreement (PA) is given by

$$\text{PA} = 100 - \text{PD} \quad (6)$$

PA = 64%

<Please Insert Fig 4 here>

<Please Insert Fig 5 here>

<Please Insert Fig 6 here>

<Please Insert Fig 7 here>

<Please Insert Table 2 here>

Survey Results

The criticality of Barriers in Overall Sample and Both Contexts

The inferences made by the experts on the barriers genuinely prove that barriers to ICJVs success are formidable and dynamic in contexts (i.e., developed and developing countries). Table 2 presents the experts' ratings for the barriers for both context and the combined results in the two contexts. Overall, both countries believed that all the 36 barrier factors are critical given their high ratings (i.e., MSs of 3.50, which is above the average of the ranking scale). However, based on the calculated normalization values, 22 barriers factors were identified as critical, with normalization

values ≥ 0.50. Among the 22 factors, the top five critical barriers include loss of management control (b1), unstructured problems, issues, and risk management protocols (b25), inappropriate partner selection process (b15), different organizational cultures (b5) and inconsistent project objectives among entities (b13). Unsurprisingly, the criticality of these barriers is attributed to the lack of attention given to management and organizational issues during the implementation of ICJVs. Due to the uncertainties that naturally pervade at the launch of an ICJV irrespective of contexts, parties may focus more on the contractual agreement, while neglecting or underrating the management routine and operational aspects that define the venture process. These barriers are most often traced directly to the partner selection process (Liang et al. 2019). For instance, while companies give thorough and structured consideration to evaluating the financial and technical strength of potential partners, their evaluation of their relationship aspects (i.e., organizational cultures, company philosophy, etc.) tend to be superficial.

In the case of the developed world, the wide adoption of ICJVs puts a great emphasis on the advancement of ICJV practice and studies (Tetteh and Chan, 2019). It is, therefore, not surprising that most of the responses came from this location. When observed critically, in the developed contexts, the leading barriers are more collective (from the ICJV than from individual partners.). They are more of post-formation and organization stage barriers. This means that barriers that are traced directly to the venture failure within the early stages are minimal. Unstructured problems, issues, and risk management protocols (b25), difficulty in measuring ICJVs success (b6), and management control challenges (b1) appeared as the top three barriers, respectively, with their corresponding MS and normalization values at 6.00;1.00, 5.78;0.91 and 5.78;0.91. In the developed context, the degree of similarity in terms of know-how and financial strength among companies have a dual impact on their collaborative performance. Positively, the similarity-

attraction archetype and the theory of relational demography suggest that homogenous parties in collaboration are known to experience fewer conflicts, higher performance and contribute to an atmosphere of team effectiveness (Adobor, 2004). Conversely, excessive homogeneity may result in faster accord on issues, which normally lead to indiscriminating acceptance of views; thus, contribute to an atmosphere where the quality of decisions suffers. Such a situation may give rise to unstructured management protocols and control, and other critical barriers such as poorly formulated governance structure (b8), etc. The two least barriers are lack of preparedness to accept company philosophy (b28) and fear of exposure of strength and weakness (b22), which are also the only barriers with MSs below the average of the ranking scale 3.50, demonstrating the overall criticality of the barriers considered in the survey.

The reverse is true in developing contexts. The failure rate of ICJVs in the developing countries/jurisdictions is high due to numerous hindering factors (Tetteh and Chan, 2019, p. 7). Aside from the loss of management control (b1) been the most critical barrier impeding ICJVs success in the developing contexts with a MS of 6.40, conflicting interest/competing objectives (b2), poorly formulated decisions in assigning limited resources (b14), inconsistent project objectives among entities (b13) and lack of understanding and knowledge at the onset (b9) also had mean values greater than 6.00, demonstrating a general criticality of the barriers. Literature pronounces that the greater the socio-environmental dissimilarities, the greater the myriad of operational and managerial challenges. Overall, the implication or inference that can be drawn is that in this context, ICJVs are formed between the developed firms (mostly from the developed world) and local companies. Thus, there is a wide dissimilarity gap (i.e., the difference in size, organizational complexity, unequal venturing experience, and different perspectives on the details

383 of a venture's activities). These varied strengths erect barriers to the venture success right from the
384 inception to the stage deemed complete by the venture.

385 ***Individual Comparability***

386 As mentioned already, the Mann-Whitney *U* test has been used to identify any statistically
387 significant differences in the ranking of the barriers between the two contexts (i.e., developed and
388 developing). The results from the test indicate that these 10 barriers: b3, b6, b8, b11, b15, b23,
389 b25, b27, b33, and b36 have significant differences among the two contexts. The developed
390 contexts regarded these barriers as more critical than developing contexts. Particularly with barrier
391 b6 and b25, although the MS gap is marginal across the two contexts, yet the difference between
392 the normalized values and mean ranks is large. Whereas the developed context ranked b6 and b25
393 as second and fourth with a MS of 5.78 and 6.00, respectively, the developing context ranked b6
394 and b25 as fourteenth and tenth with a MS of 5.74 and 5.86, respectively. This justifies the
395 conclusion that although different countries may have homogenous barriers when implementing
396 ICJVs, the criticality of each barrier might be different due to context-specific characteristics. The
397 remaining 26 barriers showed no significant differences between the two contexts on their
398 rankings. This is as a result of the relatively close values of means among the two contexts for
399 those 26 barriers. It also confirms the suitable quality of the collected data and a rationally low
400 degree of diffusion resulting and reliable findings (Darko et al. 2017).

401 ***Agreement Analysis***

402 In the previous section, the percentage of agreement (PA) has been calculated for the barriers that
403 were deemed critical from the overall perspective (i.e., both the developed and developing
404 contexts) depending on the normalization values (≥ 0.50). In all, the PA for the 22 barriers is 64%,
405 which shows a relatively good agreement between respondents from the industrial sector and those

406 from the academic sector on their ranking of the barriers. This confirms the practical nature of
407 ICJV application and practical translation of ICJV research for continuous development and
408 implementation. Moreover, this gives a firm ground to ICJVs' font liners (e.g., top team managers)
409 to support and further explore how these issues can be minimized or eliminated through research.

410 **<Please Insert Table 3 here>**

411 ***Results of Factor Analysis (FA) with Spearman Correlation (SC)***

412 The FA and SC were conducted using the 22 critical barriers identified from the total sample.
413 Principal component analysis, with varimax rotation, was adopted. To determine the suitability of
414 the FA, the Kaiser-Meyer-Olkin (KMO) and Bartlett's test of sphericity was first assessed. An
415 acceptable KMO of 0.672 and a large value (566.855) of Bartlett's test of sphericity (see, for
416 instance, Adabre et al. 2020), and a high level of significance was obtained (see, Table 4).
417 Consequently, factor loadings ≥ 0.50 were considered appropriate, following previous studies
418 (Rahman, 2014; Chan et al. 2017; Adabre et al. 2020). Four factors (b14, b20, b30, and b35) were
419 deleted as their factor loadings and communalities were relatively below the threshold. Overall,
420 18 barriers were finally considered, from which five components are extracted based on a common
421 theme of their underlying barriers. The five components explain 63.777% of the total variance.
422 Thus, a model with these five components could satisfactorily represent the data from developed
423 and developing countries. The following paragraphs discuss the components in detail.

424 Component 1 (knowledge limitation) features three critical barriers (b9, b27, and b36)
425 reflecting more on the lack of understanding present in ICJVs implementation. Although b27 is
426 not directly related yet constitute a behavioral aspect that without a clear frame of reference can
427 undermine the venture foundation. As stated earlier, the lack of understanding of ICJVs
428 fundamentals and organizational structures in areas like managerial and operational aspects of the

arrangement can challenge the effectiveness of the venture and eventually lead to the failure of the ICJV project (Munns et al. 2000). When contracting parties have little or no understanding of ICJV operations, they may have no confidence and have reservations that ICJV relationships are too cozy and unstructured. Such knowledge gaps may prevent parties from reaping the overall performance goal of the collaboration. Lu et al. (2020) verified that mutual understanding among parties in terms of their working style, professional field, culture, etc. is a prerequisite for a successful ICJV. Further, a good understanding of the host/local building regulations or requirements is key because the establishment of the venture operational standards and performance is highly dependent on that. The correlation matrix in Table 5 displays some significant relationships among some of the critical barriers as hypothesized in Fig 1. For example, there is a significant correlation between 'lack of understanding and knowledge at the onset' (b9, identified in Fig 1 as lack of experiential of ICJVs fundamentals) and 'improper project feasibility studies' ($r = .390$, $p = 0.05$), and 'improper project planning and budgeting' ($r = .396$, $p = 0.05$), which are both identified as lack of effective planning and suitable strategies in the literature; and finally between 'lack of understanding and knowledge at the onset' (b9, lack of experiential of ICJVs fundamentals) and 'differing policies and procedures among entities' (inter-organizational differences) ($r = .421$, $p = 0.05$). overall, this factor was ranked fourth among the five components, with a MS of 5.31.

Component 2 (Operational and governance-related barriers) consists of four factors (b25, b8, b12, and b17) highlighting the working and governance-related issues of the venture. These issues often occur as a result of deficient preparation and faulty assumptions of managers in ICJV. Unstructured problems, issues, and risk management protocol (b25) is quite prevalent in most business. The failure to systematically analyze and manage these factors separately and effectively

often causes extending complexities that lead to unsatisfactory performance or complete failure of ICJVs. Also, formulated governance structures (b8) that fail to accommodate varying adjustments during the venture operation often leads to the dissatisfaction of IJV parties (Hong, 2014). As Ozorhon et al. (2008a) noted, lack of mutual commitment of parties (b12) in ICJVs breed opportunistic behavior, which eventually deteriorate the overall performance goal of the venture. Some significant correlations exist among the barriers. For example, in Table 5, there are significant correlations between 'poorly formulated governance structure' (b8, lack of effective planning and suitable strategies) and 'high social sense of superiority' (b27, lack of expertise and confidence by ICJV contracting parties) ($r = .298$, $p = 0.05$); between 'lack of mutual commitment of partners' (b12, lack of experiential of ICJVs fundamentals) and 'improper project planning and budgeting' (b16, lack of effective planning and suitable strategies) ($r = .386$, $p = 0.05$), etc. This component was ranked third with a total MS of 5.49.

<Please Insert Table 4 here>

<Please Insert Table 5 here>

Component 3 (Coordinating difficulties) consists of three factors (b13, b34, and b1) that relate to issues over the respective roles and responsibilities of parties. Difficulties encountered normally radiate from the unbalance power and responsibilities among parties (b34) and loss of management control (b1) (Lin and Ho, 2012; Mohamed, 2003). It is important to mention that effective coordinating of ICJVs requires distinct organizational arrangements and work processes. According to Zhang and Zou (2007) role ambiguity causes apathy and conflict in an ICJV as people trip over or blame each other. This factor appeared second with a MS of 5.50. There exist some statistically significant correlations between 'inconsistent project objectives among entities' (b13, conflicts among ICJV entities) and 'improper project planning and budgeting' (b16, lack of

effective planning and suitable strategies) and 'high social sense of superiority' (b27, lack of expertise and confidence by ICJV contracting parties); between 'unbalanced distribution of authorities' (b34, ICJV management difficulties) and 'conflicting interest/competing objectives' (b2, inter-organizational differences) ($r = .223$, $p = 0.01$); between 'loss of management control' (b1, ICJV management difficulties) and 'friction created within ICJV's internal management and client organization and local people' (b33, conflicts among ICJV entities) ($r = .256$, $p = 0.05$), etc. These correlations are coherent because they emerge as a ripple effect on ICJV success. Therefore, a systematic approach is needed to eliminate or minimize its effect.

Component 4 (System and cultural barriers) contains four factors (b3, b15, b16, and b6) summarizing problems with organization and cultural differences in ICJVs implementation. This component was ranked fifth. While this component is the least ranked construct with a MS of 5.24, the underlying barriers have been reported in many studies to impede ICJVs success (i.e., b3 – language barrier, and b15 – inappropriate partner selection) (Ozorhon et al. 2007a; 2008b; Zhao et al. 2013). Cultural differences can lead to a myriad of operational problems. For example, it can increase coordination and transaction costs (Ozorhon et al. 2008). Thus, ICJV front liners should possess strong interpersonal skills to compensate for organization and cultural barriers. There have always been difficulties when measuring ICJVs performance (b6) due to the long and complex chain of management tasks coupled with the varied goals of parties involved (Tetteh et al. 2020). Parties then fail to efficiently evaluate their venture performance due to the inadequate systems and measures. In Table 5, there exist some positive correlations among the barriers as postulated in the literature review.

Component 5 (Interface-oriented and outlook barriers) contains four factors (b33, b5, b11, and b2) focusing more on poor coherence and opposing views in ICJVs implementation. This factor is

the top-ranked with a MS of 5.53, indicating the criticality of the underlying factors. The presence of competition, goal incongruence, and opportunistic behavior among parties produce serious coalition problems, which result in ICJVs failure (Sillars and Kangari, 2004; Hwang et al. 2017). Therefore, friction among the internal and external team members (b33) and an unstable agreement are bound to happen (b11). Getting a joint activity up requires a devoted effort from all parties to the venture. Without joint objectives, parties would pursue their own goals irrespective of the project goal, leading to numerous conflicts. As a result, this would get worsened, and eventually, the relationship fails. Significant correlations exist among the barriers as hypothesized in the literature review. For example, between 'b33' – conflicts among ICJV entities and 'b1' – ICJV management difficulties ($r = .256$, $p = 0.05$); between 'b11' – conflicts among ICJV entities and 'b2' – inter-organizational differences ($r = .239$, $p = 0.05$), etc.

Limitations and Future Works

While the study's aim was achieved, certain limitations and future directions are imperative to explain and provide, respectively. First, the number of responses received from both contexts are relatively low, which could affect their generalizability. Likewise, given the mixed hands-on experiences as projected; it is clear that developed countries have progressed more in the ICJV implementation learning curve than developing countries, thus, the hands-on ICJV experience in these two different contexts could influence the perception of the respondents. This should be considered when interpreting the results of the study. Whereas future studies may employ larger samples from both contexts to validate the findings, multiple case design by using secondary data from literature could also be adopted to increase both the internal and external research validity. This opportunity can support the collection of greater volume of evidences (internal validity), which can drive to better "triangulation" of the results. Besides, with a larger sample size, more

522 rigorous statistical tools could be used to test the correlation among the various barriers to deepen
523 the understanding of the barriers that create multiple chains of complexity in ICJV implementation.
524 Regardless of the homogeneity of multiple barriers in different markets, more detailed studies on
525 the critical barriers in specific countries are needed because the findings cannot be attributed to
526 one specific country however serve as a frame of reference for more comparative analysis. Further,
527 future research work should focus on modeling the influences of the critical barriers to ICJVs
528 overall performance goals to devise appropriate and practical solutions for successful
529 implementation.

530 More importantly, the dynamic evolution of ICJVs equally means different barriers in different
531 stages of their progression. Therefore, future studies should consider categorizing the barriers in
532 stages of the ICJV lifecycle. This would assist practitioners to plan even before they enter ICJVs.
533 Also, through an empirical validation of these factors, the development of a more dynamic
534 management process that integrates the stagewise progression of ICJV lifecycle for the barriers;
535 using more robust computer modeling techniques such as system dynamics , and the use of
536 artificial intelligence techniques such as random forest, k-nearest neighbour, artificial neural
537 network, extreme gradient boosting, decision tree, etc. for stagewise predictions is probably a
538 promising research direction.

539 **Conclusions**

540 This research examined the criticality of barriers impeding ICJVs success. Through a
541 comprehensive literature review and questionnaire survey, data on barriers were collected from
542 123 ICJV experts from 24 different countries/jurisdictions around the world. Statistical analyses
543 revealed that 22 critical barriers impede ICJVs success. The top five critical barriers include loss
544 of management control followed by unstructured problems, issues, and risk management

545 protocols, inappropriate partner selection mechanisms, differing policies and procedures among
546 entities, and inconsistent project objectives. Mann-Whitney *U* test results showed that 10 barriers
547 (b3, b6, b8, b11, b15, b23, b25, b27, b33, and b36) have significant differences among the two
548 contexts. There was also a relatively good agreement between experts from the industrial sector
549 and those from the academic sector on their ranking of the critical barriers. Five components were
550 obtained through factor analysis, namely; knowledge limitation, operational and governance-
551 related barriers, coordinating difficulties, system and cultural barriers, and interface-oriented and
552 outlook barriers.

553 Albeit the limitations, the research findings have both theoretical and practical values.
554 Theoretically, it contributes to both ICJV and IJV literature by conducting a systematic review of
555 the barriers and empirically examining their criticality. As academic and industrial researchers
556 continue to develop frameworks and strategies for ICJV implementation, this study provides a
557 frame of reference for more applied measures to be developed. It could also direct researchers
558 toward examining the influences of these barriers on ICJVs overall performance goals. The
559 knowledge of such critical factors can help ICJVs' management teams dedicate the required
560 resources to address them, thus eliminating the barriers and improving the overall ICJVs
561 performance. Practically, this study contributes to deepening the understanding of barriers to
562 ICJVs success and helping ICJVs' front liners (i.e., top team managers) and policymakers in
563 developing suitable measures and policies to ensure successful implementation of ICJVs. It could
564 also direct researchers toward examining the influences of these barriers on ICJVs overall
565 performance goals to devise clear-cut frameworks, seeking their successful implementation in the
566 future.

567 **Data Availability Statement**

Some or all data, models, or code used during the study are available from the corresponding author by request.

Acknowledgment

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<Please Insert Appendix l here>

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Appendix I. Sample of the survey questionnaire

Please indicate your level of agreement on each of the following barriers impeding ICJVs success. Use the following scale: 1 = strongly disagree; 2 = disagree; 3 = disagree somewhat; 4 = neither agree nor disagree; 5 = agree somewhat; 6 = agree; 7 = strongly agree.

Table 6. Barriers impeding ICJVs success

No.	Barriers	Level of agreement Low <<<----------->>>High
1	Loss of management control	☐1; ☐2; ☐3; ☐4; ☐5; ☐6; ☐7
2	Conflicting interest/competing objectives	☐1; ☐2; ☐3; ☐4; ☐5; ☐6; ☐7
3	Language barrier	☐1; ☐2; ☐3; ☐4; ☐5; ☐6; ☐7
4	Incompetence of project management team of the domestic firm	☐1; ☐2; ☐3; ☐4; ☐5; ☐6; ☐7
5	Differing policies and procedures among entities (different organizational cultures)	☐1; ☐2; ☐3; ☐4; ☐5; ☐6; ☐7
6	Difficulty in measuring ICJVs success	☐1; ☐2; ☐3; ☐4; ☐5; ☐6; ☐7
7	Incomplete contract terms with partner	☐1; ☐2; ☐3; ☐4; ☐5; ☐6; ☐7
8	Poorly formulated governance structure	☐1; ☐2; ☐3; ☐4; ☐5; ☐6; ☐7
9	Lack of understanding and knowledge at the onset	☐1; ☐2; ☐3; ☐4; ☐5; ☐6; ☐7
10	Problems associated with relationship management	☐1; ☐2; ☐3; ☐4; ☐5; ☐6; ☐7
11	Unstable agreement for a limited time period	☐1; ☐2; ☐3; ☐4; ☐5; ☐6; ☐7
12	Lack of mutual commitment of partners	☐1; ☐2; ☐3; ☐4; ☐5; ☐6; ☐7
13	Inconsistent project objectives among entities	☐1; ☐2; ☐3; ☐4; ☐5; ☐6; ☐7
14	Poorly formulated decisions in assigning limited resources	☐1; ☐2; ☐3; ☐4; ☐5; ☐6; ☐7
15	Inappropriate partner selection	☐1; ☐2; ☐3; ☐4; ☐5; ☐6; ☐7
16	Improper project planning and budgeting	☐1; ☐2; ☐3; ☐4; ☐5; ☐6; ☐7
17	Improper project feasibility studies	☐1; ☐2; ☐3; ☐4; ☐5; ☐6; ☐7
18	Fear of legal actions	☐1; ☐2; ☐3; ☐4; ☐5; ☐6; ☐7
19	Poor spirit of cooperation	☐1; ☐2; ☐3; ☐4; ☐5; ☐6; ☐7
20	Lack of confidence about experience and knowledge from the local partners	☐1; ☐2; ☐3; ☐4; ☐5; ☐6; ☐7
21	Fear of exposure of strength and weakness	☐1; ☐2; ☐3; ☐4; ☐5; ☐6; ☐7
22	Lack of strategic planning for the ICJV operation	☐1; ☐2; ☐3; ☐4; ☐5; ☐6; ☐7
23	Blaming habits	☐1; ☐2; ☐3; ☐4; ☐5; ☐6; ☐7
24	Inadequate engagement of partnering firms due to their external workloads	☐1; ☐2; ☐3; ☐4; ☐5; ☐6; ☐7
25	Unstructured problems, issues and risk management framework	☐1; ☐2; ☐3; ☐4; ☐5; ☐6; ☐7
26	Lack of continuous improvement	☐1; ☐2; ☐3; ☐4; ☐5; ☐6; ☐7
27	High social sense of superiority	☐1; ☐2; ☐3; ☐4; ☐5; ☐6; ☐7
28	Lack of preparedness to accept company philosophy	☐1; ☐2; ☐3; ☐4; ☐5; ☐6; ☐7
29	Poor problem-solving culture	☐1; ☐2; ☐3; ☐4; ☐5; ☐6; ☐7
30	Reluctance in training local staff/No standardized training	☐1; ☐2; ☐3; ☐4; ☐5; ☐6; ☐7
31	Human resource management problems	☐1; ☐2; ☐3; ☐4; ☐5; ☐6; ☐7
32	Use of outdated skills and technologies	☐1; ☐2; ☐3; ☐4; ☐5; ☐6; ☐7
33	Friction created in ICJV's internal management and client organization and local people	☐1; ☐2; ☐3; ☐4; ☐5; ☐6; ☐7
34	Unbalanced power and responsibility between local and foreign partners	☐1; ☐2; ☐3; ☐4; ☐5; ☐6; ☐7
35	Difference in salary package between foreign and local employees	☐1; ☐2; ☐3; ☐4; ☐5; ☐6; ☐7

36	Overseas partner's lack of understanding of local statutory requirements/building regulations	☐1; ☐2; ☐3; ☐4; ☐5; ☐6; ☐7
If there are any barriers omitted by this questionnaire, please list and rate them		
1	Click or tap here to enter text.	☐1; ☐2; ☐3; ☐4; ☐5; ☐6; ☐7
2	Click or tap here to enter text.	☐1; ☐2; ☐3; ☐4; ☐5; ☐6; ☐7
3	Click or tap here to enter text.	☐1; ☐2; ☐3; ☐4; ☐5; ☐6; ☐7

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779 **Table 1.** List of barriers impeding ICJVs success

s/n	Barriers	References
b1	Loss of management control	Ozorhon et al. (2007a; 2008a), Lin and Ho (2012), Lu et al. (2020)
b2	Conflicting interest/competing objectives	Shen et al. (2001), Zhang and Zou, (2007), Ozorhon et al. (2008a), Lu et al. (2020)
b3	Language barrier	Williams and Lilley (1993), Drouin et al. (2009)
b4	Incompetence of project management team of domestic firm	Walker and Johannes (2003), Zhao et al. (2013)
b5	Differing policies and procedures among entities (different organizational cultures)	Ozorhon et al. (2007a), Ozorhon et al. (2008a), Lu et al. (2020)
b6	Difficulty in measuring ICJVs success	Mohamed, (2003), Ozorhon et al. (2010b), Almohsen and Ruwanpura, (2016),
b7	Incomplete contract terms with partner	Gale and Luo (2004), Ozorhon et al. (2010a), Zhao et al. (2013)
b8	Poorly formulated governance structure	Munns et al. (2000), Ho et al. (2009)
b9	Lack of understanding and knowledge at the onset	Munns et al. (2000), Maemura et al. (2018)
b10	Problems associated with relationship management	Zhang and Zou, (2007), Ho et al. (2009)
b11	Unstable agreement for a limited period	McIntosh and McCabe (2003)
b12	Lack of mutual commitment of partners	Gale and Luo (2004), Ozorhon et al. (2008a), Lu et al. (2020)
b13	Inconsistent project objectives among entities	Hwang et al. (2017), Lu et al. (2020)
b14	Poorly formulated decisions in assigning limited resources	Zhao et al. (2013)
b15	Inappropriate partner selection	Gale and Luo (2004), Liang et al. (2019)
b16	Improper project planning and budgeting	McIntosh and McCabe, (2003),
b17	Improper project feasibility studies	Zhang and Zou, (2007), Maemura et al. (2018)
b18	Fear of legal actions	Shen et al. (2001), Hwang et al. (2017)
b19	Poor spirit of cooperation	McIntosh and McCabe, (2003), Maemura et al. (2018)
b20	Lack of confidence about experience and knowledge from the local partner	McIntosh and McCabe, (2003), Zhang and Zou, (2007)
b21	Lack of strategic planning for ICJVs operations	Shen et al. (2001), Zhang and Zou, (2007)
b22	Fear of exposure of strength and weakness	Ling and Hoi, (2006), Ling and Gui (2009)
b23	Blaming habits	Williams and Lilley (1993), Maemura et al. (2018)
b24	Inadequate engagement of partnering firms due to their external workloads	Ozorhon et al. (2008a), Ozorhon et al. (2010a)
b25	Unstructured problems, issues and risk management framework	Lu et al. (2020)
b26	Lack of continuous improvement	Maemura et al. (2018)
b27	High social sense of superiority	Swierczek (1994)
b28	Lack of preparedness to accept company philosophy	Lu et al. (2020)
b29	Poor problem-solving culture	Lu et al. (2020)
b30	Reluctance in training local staff/No standardized training	Mansfield and Sasillo (1990)
b31	Human resource management problems	Drouin et al. (2009)
b32	Use of outdated skills and technology	Hwang et al. (2017)
b33	Friction created within ICJV's internal management and client organization and local people	Norwood and Mansfield (1999)

b34	Unbalanced power and responsibility between local and foreign partners	Walker and Johannes (2003), Lu et al. (2020)
b35	Differences in salary packages between foreign and local partners	Mansfield and Sasillo (1990), Sillars and Kangari (2004)
b36	Overseas partner's lack of understanding of local statutory requirements/building regulations	Lu et al. (2020)

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807 **Table 2.** Descriptive and Mann-Whitney *U* test statistics of the barriers to ICJVs success

	Overall					Developed countries				Developing countries				Mann-Whitney *U* test statistics			
s/n	Mean	SD	*p*-value	Rank	*N*-value	Mean	SD	Rank	*N*-value	Mean	SD	Rank	*N*-value	*U* stat	*W*	*Z*	*p*-value
b1	6.07	0.791	0.001	1	1.00[a]	5.78[b]	0.875	3	0.91[a]	6.40	0.528	1	1.00[a]	1133.000	3278.000	-4.090	0.000[a]
b2	5.41	0.734	0.000	16	0.66[a]	5.49	0.773	12	0.78[a]	6.16	0.875	2	0.90[a]	1324.000	3469.000	-3.038	0.002[a]
b3	5.21	0.969	0.000	19	0.55[a]	5.02	1.082	24	0.59[a]	5.43[b]	0.775	20	0.60[a]	1631.000	3776.000	-1.366	0.172
b4	4.80[b]	1.121	0.000	29	0.34	5.25	1.076	19	0.68[a]	4.31	0.959	32	0.13	970.000	2681.000	-4.800	0.000[a]
b5	5.84	0.900	0.000	4	0.88[a]	5.65[b]	0.891	9	0.85[a]	6.05	0.867	5	0.85[a]	1456.500	3601.500	-2.290	0.022[a]
b6	5.76	0.714	0.000	7	0.84[a]	5.78[b]	0.838	2	0.91[a]	5.74	0.548	14	0.73[a]	1789.500	3500.500	-0.540	0.589
b7	4.60	1.206	0.000	32	0.24	4.91	1.320	28	0.54[a]	4.26	0.965	34	0.11	1253.000	2964.000	-3.297	0.001[a]
b8	5.59[b]	0.808	0.000	12	0.75[a]	5.66[b]	0.871	5	0.86[a]	5.52	0.731	18	0.63[a]	1742.000	3453.000	-0.819	0.413
b9	5.59[b]	0.612	0.000	11	0.75[a]	5.23[b]	0.425	20	0.68[a]	6.00	0.530	6	0.83[a]	635.000	2780.000	-7.101	0.000[a]
b10	4.51	1.357	0.000	34	0.19	4.97	1.250	26	0.57[a]	4.00	1.298	36	0.00	1133.000	2844.000	-3.931	0.000[a]
b11	5.61	0.754	0.000	10	0.76[a]	5.63	0.928	8	0.84[a]	5.59	0.497	15	0.66[a]	1790.000	3501.000	-0.529	0.597
b12	5.63	0.729	0.000	9	0.77[a]	5.37	0.802	16	0.73[a]	5.91	0.506	7	0.80[a]	1077.000	3222.000	-4.528	0.000[a]
b13	5.79	0.871	0.000	5	0.85[a]	5.51	0.886	11	0.79[a]	6.10	0.742	4	0.86[a]	1177.000	3322.000	-3.788	0.000[a]
b14	5.75	0.972	0.000	8	0.83[a]	5.40	0.981	15	0.75[a]	6.14	0.805	3	0.89[a]	1101.500	3246.500	-4.180	0.000[a]
b15	5.89	0.960	0.001	3	0.91[a]	5.65[b]	0.975	10	0.85[a]	5.31	0.681	23	0.55[a]	1666.500	3377.500	-1.244	0.213
b16	5.11	1.161	0.000	21	0.50[a]	4.51[b]	1.134	30	0.37	5.79[b]	0.744	13	0.75[a]	658.500	2803.500	-6.459	0.000[a]
b17	5.23	1.023	0.000	18	0.56[a]	4.94	1.074	27	0.55[a]	5.55	0.862	17	0.65[a]	1258.500	3403.500	-3.331	0.001[a]
b18	4.73	1.438	0.000	31	0.31	4.34	1.735	33	0.30	5.17[b]	0.819	25	0.49	1396.000	3541.000	-2.584	0.010[a]
b19	5.01	1.134	0.000	23	0.45	5.74	0.756	4	0.89[a]	4.19	0.907	35	0.08	426.500	2137.500	-7.638	0.000[a]
b20	5.36	0.976	0.000	17	0.63[a]	5.68	0.970	7	0.86[a]	5.00	0.858	27	0.42	1097.000	2808.000	-4.228	0.000[a]
b21	4.94	1.058	0.000	25	0.41	5.43	0.951	14	0.76[a]	4.40	0.897	29	0.17	859.000	2570.000	-5.396	0.000[a]
b22	4.54	1.450	0.000	33	0.21	3.49	1.541	35	0.05	5.43[b]	0.565	19	0.60[a]	692.500	2837.500	-6.249	0.000[a]
b23	4.40	1.233	0.000	35	0.13	4.42	1.435	32	0.33	4.38	0.970	30	0.16	1796.000	3507.000	-0.467	0.640
b24	4.93[b]	1.069	0.000	27	0.41	4.51[b]	1.120	29	0.37	5.41	0.773	21	0.59[a]	985.000	3130.000	-4.761	0.000[a]
b25	5.93	0.765	0.000	2	0.93[a]	6.00	0.935	1	1.00[a]	5.86[b]	0.511	10	0.76[a]	1627.000	3338.000	-1.435	0.151
b26	4.79	1.118	0.000	30	0.34	4.45	1.358	31	0.35	5.17[b]	0.566	24	0.49	1383.000	3528.000	-2.897	0.004[a]
b27	5.18	1.033	0.000	20	0.54[a]	5.03	1.274	25	0.59[a]	5.34	0.637	22	0.56[a]	1765.000	3910.000	-0.685	0.493
b28	4.14	1.148	0.000	36	0.00	3.43	1.330	36	0.00	4.71	0.459	28	0.30	905.000	3050.000	-5.252	0.000[a]
b29	4.96	1.369	0.000	24	0.42	4.14	1.424	34	0.22	5.88	0.329	9	0.78[a]	490.000	2635.000	-7.537	0.000[a]
b30	5.10	0.979	0.000	22	0.50[a]	5.12	1.305	23	0.63[a]	5.07	0.368	26	0.45	1578.000	3289.000	-1.859	0.063
b31	4.93[b]	1.110	0.000	26	0.41	5.45	1.046	13	0.77[a]	4.34	0.870	31	0.14	805.000	2516.000	-5.259	0.000[a]
b32	4.80[b]	1.120	0.000	28	0.34	5.26	1.149	18	0.69[a]	4.29	0.838	33	0.12	895.500	2606.500	-5.259	0.000[a]
b33	5.46	0.880	0.000	15	0.68[a]	5.35	1.096	17	0.73[a]	5.57	0.534	16	0.65[a]	1623.500	3768.500	-1.422	0.155
b34	5.52	0.970	0.000	13	0.72[a]	5.22	1.038	22	0.67[a]	5.86[b]	0.760	11	0.76[a]	1244.500	3389.500	-3.450	0.001[a]
b35	5.50	1.003	0.000	14	0.70[a]	5.23[b]	1.235	21	0.68[a]	5.79[b]	0.522	12	0.75[a]	1347.000	3492.000	-2.963	0.003[a]

b36	5.77	0.982	0.000	6	0.84[a]	5.66[b]	1.163	6	0.86[a]	5.90	0.718	8	0.79[a]	1688.000	3833.000	-1.057	0.291

Note: Overall Cronbach's alpha = 0.891; Normalization (*N*) value = (actual mean-minimum mean)/ (maximum mean-minimum mean); SD = standard deviation; SWT = Shapiro-Wilk test, which indicate a statistically significant data. Grouping variable = developed and developing countries; *W* = Wilcoxon W; and MWU = Mann-Whitney *U* at significant level of 0.05.

[b]Represents equal mean, wherein factors with low SD are ranked higher in that order

[a]Significant *p*-values and *N*-values

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Table 3. Agreement analysis on the ranking of the barriers to ICJVs success

	Academic			Industry			Agreement		
code	Mean	SD	Rank	Mean	SD	Rank	R_i	$(R_{i1} - R_{i2})$	$\lvert(R_i - R)\rvert$
b1	6.31	0.468	1	6.30	0.696	1	2	0	21
b2	5.97	1.007	3	6.28	0.968	2	5	1	18
b3	5.53[b]	0.503	11	5.19	1.257	15	26	4	3
b5	5.31[b]	0.498	16	5.81	0.810	7	23	9	0
b6	5.79	0.447	7	6.09	0.791	3	10	4	13
b8	5.27	0.536	18	5.53	0.846	12	30	6	7
b9	5.49	0.558	14	5.45	0.798	13	27	1	4
b11	5.61	0.490	10	4.94	1.117	18	28	8	5
b12	5.76	0.600	8	5.58	0.663	11	19	3	4
b13	5.63	0.569	9	6.06	0.602	4	13	5	10
b14	4.51	0.775	22	4.06	1.183	22	44	0	21
b15	6.11	0.401	2	5.87[b]	0.590	5	7	3	16
b16	5.31[b]	0.468	15	5.15	0.841	16	31	3	8
b17	5.07	0.354	20	5.09	0.883	17	37	3	14
b20	4.87	0.635	21	4.23	1.219	21	42	0	19
b25	5.93	0.520	4	5.77	1.250	8	12	4	11
b27	5.50	0.737	13	4.68	1.566	19	32	6	9
b30	5.31[b]	0.568	17	4.45	1.539	20	37	3	14
b33	5.53[b]	0.675	12	5.43	1.029	14	26	2	3
b34	5.83	0.380	6	5.87[b]	0.735	6	12	0	11
b35	5.90	0.542	5	5.62[b]	1.228	10	15	5	8
b36	5.16	0.862	19	5.62[b]	0.713	9	28	10	5
							$\sum_{i=1}^{n}(R_{ij}) = 506$	$\sum_{i=1}^{n}(R_{i1} - R_{i2}) = 80$	$\sum_{i=1}^{n}\lvert(R_{i1} - R_{j2})\rvert = 224$

[b]Represents equal mean, wherein factors with low SD are ranked higher in that order

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Table 4. Factor analysis results

	Component					
s/n	1	2	3	4	5	$\bar{x} = \sum xi/n$
Knowledge limitation	1					5.31*
b9	0.736	-	-	-	-	5.23
b27	0.655	-	-	-	-	5.03
b36	0.631	-	-	-	-	5.66
Operational and governance-related barriers		2				5.49*
b25	-	0.737	-	-	-	6.00
b8	-	0.713	-	-	-	5.66
b12	-	0.655	-	-	-	5.37
b17	-	0.508	-	-	-	4.94
Coordinating difficulties			3			5.50*
b13	-	-	0.681	-	-	5.51
b34	-	-	0.630	-	-	5.22
b1	-	-	0.520	-	-	5.78
System and cultural barriers				4		5.24*
b3	-	-	-	0.716	-	5.02
b15	-	-	-	0.707	-	5.65
b16	-	-	-	0.656	-	4.51
b6	-	-	-	0.528	-	5.78
Interface-oriented and outlook barriers					5	5.53*
b33	-	-	-	-	0.690	5.35
b5	-	-	-	-	0.623	5.65
b11	-	-	-	-	0.607	5.63
b2	-	-	-	-	0.501	5.49
Eigenvalues	2.953	2.456	1.960	1.547	1.496	
Variance explained	24.586	11.166	8.908	7.031	6.799	
Cumulative variance (%)	24.586	33.494	47.890	53.659	63.777	
KMO measure of sampling adequacy						0.672
Bartlett's test of sphericity approximated Chi-square						566.855
Degree of freedom						231
Significance						0.000

Note: $\bar{x} = \sum xi/n$, where $\bar{x}$ = mean, $\sum xi$ = summation of sampled values, n = number of variables or items in each component/construct.
Extraction method: Principal Component
Analysis Rotation Method: Varimax with Kaiser Normalization

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Table 5. Spearman Correlation (SC) Matrix of critical barriers

Code		b1	b2	b3	b5	b6	b8	b9	b11	b12	b13	b14	b15	b16	b17	b20	b25	b27	b30	b33	b34	b35	b36
b1	r	1.000																					
b2	r	.343[a]	1.000																				
b3	r	.110	.324[a]	1.000																			
b5	r	.370	-.133	.038	1.000																		
b6	r	.072	.103	-.071	.240[a]	1.000																	
b8	r	-.096	.055	.031	-.065	.020	1.000																
b9	r	.200[b]	-.125	-.042	.116	-.057	.217[b]	1.000															
b11	r	.271[a]	.239[a]	.116	.420[a]	-.087	-.036	-.066	1.000														
b12	r	.252[a]	.017	.011	.121	-.162	.220[b]	.134	-.022	1.000													
b13	r	-.006	.038	-.082	-.040	-.031	.013	.224[b]	.011	.125	1.000												
b14	r	.032	-.077	.152	-.148	.240[a]	.085	.401[a]	.245[a]	.332[a]	.121	1.000											
b15	r	.013	.021	.153	-.009	-.108	-.117	.421[b]	.130	.086	.218[b]	.258[a]	1.000										
b16	r	.132	-.164	.119	.087	-.001	-.043	.396[a]	.118	.386[a]	.299[a]	.227[b]	.186[b]	1.000									
b17	r	-.010	-.096	.150	-.067	.276[a]	.042	.390[a]	.066	.146	.155	.370[a]	.362[a]	.315[a]	1.000								
b20	r	.102	.014	-.106	.036	.031	-.051	.290[a]	-.115	.011	-.024	-.133	.247[a]	-.339[a]	.318[a]	1.000							
b25	r	.030	-.122	-.174	-.155	-.089	-.129	.039	.104	.106	-.168	.179[b]	-.049	-.209[b]	.025	.069	1.000						
b27	r	.041	.211[b]	.014	.221[b]	.125	.298[a]	-.065	.167	.122	.204[b]	.003	-.015	.016	-.118	.041	.098	1.000					
b30	r	.074	.112	.098	.128	.050	-.161	.303[a]	-.062	.181[b]	.029	-.171	-.043	-.002	-.163	.337[a]	.066	.023	1.000				
b33	r	.256[a]	.291[a]	-.036	.257[a]	.227[b]	-.111	-.125	-.064	-.108	.185[b]	-.056	.151	-.071	-.103	.040	.134	-.084	.412[a]	1.000			
b34	r	.312[a]	.223[b]	.138	.278[a]	.320[a]	.184[b]	.132	-.142	.201[b]	.070	.085	.032	.224[b]	.047	.218[b]	.240[a]	-.105	.027	.056	1.000		
b35	r	.084	.230[b]	.058	.225[b]	.108	-.033	.298[a]	-.266[a]	-.001	.009	.002	.069	.190[b]	.230[b]	.225[b]	.108	.364[a]	.026	.142	.231[b]	1.000	
b36	r	.298[a]	.142	.085	-.103	.055	-.018	.289[a]	.142	.085	-.103	.055	-.018	.089	.108	.116	.083	.072	.185[b]	.108	.089	.156	1.000

r = value for Spearman Correlation
p = value of significance
[a] Correlation is significant at 0.05 level (2-tailed).
[b] Correlation is significant at 0.01 level (2-tailed).