

**CRITICAL SUCCESS FACTORS FOR JOINT VENTURE BETWEEN
LOCAL AND CHINESE FIRMS FOR PAKISTAN'S CONSTRUCTION
INDUSTRY**

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This is to certify that the
thesis titled

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ABSTRACT

Joint venture is an agenda of construction companies worldwide to stay strategically flexible, enhance competitiveness and reduces risks retained by each stakeholder. Firms with diverse territorial origin share equity, resources and experience acquired by their individual businesses in JV. International JVs in Pakistan's construction Industry have increased since inundation of Chinese firms in trail of foreign investment (majorly by International banks). However, it is yet not clear which factors influence the successful outcome of a JV between local and Chinese firms. This study intends to close that gap. Data has been collected from professionals involved in IJV in Pakistan w.r.t Chinese firms. This study provides a priority-based model using Analytical hierarchic process for local industry to adopt, for a higher probability of project success during strategic alliance with Chinese firms. Key findings of the study reveal that there are few success factors which play a critical role as compared to other trivial many for a successful JV. Priority based model has categories with CSFs in them which were prioritized using AHP through detailed field survey from experts and individuals who were involved in JV between local and Chinese firms. CSFs Priority model was further validated through field experts. Research in this case was limited to IJV between local and only Chinese firms which can be extended to firms from different country origin.

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LIST OF ABBREVIATIONS

Critical Success factors	CSF
Joint Venture	JV
International Joint Venture	IJV
Analytical Hierarchy Process	AHP
Analytical Network Process	ANP
Multi Criteria Decision Making	MCDM
China Pakistan Economic Corridor	CPEC
Pakistan Engineering Council	PEC
Construction Joint Venture	PEC
Chinese Firms	CF
Human Resource Development	HRD
Financial Year	FY
Gross Domestic Product	GDP

1. INTRODUCTION

1.1. Study Background

With an increasing competitiveness in the current industries, stakeholders face several complex technological challenges in form of hard and soft systems (Hameed and Abbott, 2017). Construction industry specially plays a crucial and critical role in a financial and social growth (Mba et al., 2014). For industrial success, individual firms should be strengthened and one way of achieving the necessary skills and knowledge is through formulation of joint ventures that allow individual firms to put their equity at stake in order to excel in competitive market (Hameed and Abbott, 2017). Pakistan is a developing country and has always faced law and order situation, financial and major power generation crisis which negatively impact the construction industry (Razzaq et al., 2018). Pakistan's construction industry is facing problems like other developing countries including shortage of material, skilled personal and equipment; inadequate technological development; domination of small and fragile local firms; stronghold of foreign firms on the large projects; faulty procedures and contract documentation (Masood et al., 2015). However, with the introduction of China Pakistan Economic Corridor being a part of The Belt and Road Initiative (BRI), a significant number of contractors from China have entered into the Pakistan construction industry through the formation of joint ventures with local firms (Visions and Hussain, 2017). In 2014, a Pew Research Center survey showed that eighty percent of local respondents have a very considerate and favored view towards Pakistan—the highest public opinion rating of China in the world (Verloes, 2014). This also enhances an opportunity for better and viable work environment for Chinese firms in Pakistan. Under CPEC 700,000 to 800,000 jobs are expected to be created in the next 15 years, in the infrastructure, energy and transportation sectors (Rizvi, 2020). CPEC is expected to be a golden opportunity for Pakistani firms to work in strategic alliance with Chinese firms and adapt their 'collaborative-business model' to generate environment and skill for efficient resource management and development (Mirza, Fatima and Ullah, 2019). The launch of CPEC in 2015 has introduced productive and durable opportunities through technology transfer, management practices, development of entrepreneurship etc, which will result in eventual increase in total productivity in construction industry of Pakistan (Mahmood, 2019).

A successful JV is to be evidently dependent on the working environment and synergy created by the alone contributions of each partner (Mba et al., 2014). International JV finds several rolling stones in its way in Pakistan due to variable change of economic and political conditions. Also, a major issue with IJVs is over opportunistic attitude of local partners eager to increase their profit margins unrealistically and treating working in an IJV as one-time prospect (Ahsen and Chotchai, 2014). The language barrier, difference in previous working environments, gap in technological advancements and difference in level of restrictions related to construction rules and regulations by local authorities of both Pakistan and China; creates a complex environment for local and Chinese firms to work on same platform (Razzaq et al., 2018). The experience of Pakistani clients/consultants/contractors in working with foreign organizations related to AEC (Architecture, Engineering and Construction) is also immature (Masood et al., 2015). This necessitates development of a priority-based model for Pakistani and Chinese construction firms to ensure an enhanced efficiency in their joint venture. For this purpose, this study's objective is towards the identification and prioritization of the Critical Success Factors (CSFs) which the local and Chinese contractors need to focus for achieving a defined goal successfully under a joint venture. These factors will then be used to develop a priority-based model. This research aims to provide a helping model for local firms in industry to focus on important critical success factors before and during the strategic alliance with the Chinese partners for construction projects.

1.2. Problem Statement

What are the factors which stakeholders at both sides of joint venture between a local and Chinese firm in construction industry needs to consider avoiding a delayed, increased cost or low quality project. Following are some sub-problems being experienced by the industry:

- a) Local firms and Chinese firms have difference in management and technical expertise.
- b) Joint venture between local and International firms requires proper planning and management for it to be successful.
- c) Local firm requires improvement to adopt to methods of Chinese construction firm.
- d) For Pakistan construction industry, no such study has been conducted which prioritize the critical success factors for International joint venture between local and Chinese

construction firm.

- e) (Naeem, Butt and Khanzada, 2018), (Mohamed, 2003), (PAKISTAN AND CHINA DIPLOMATIC RELATIONS – Ministry of Foreign Affairs, 2019).

1.3. Research Objectives

- a) Identification of Critical Success Factors (CSFs) for joint venture between local and Chinese construction firms using literature review and field survey.
- b) Categorization of CSFs using Literature review and Field survey for defining criteria for each set of factors identified.
- c) Development of an Analytical Hierarchic Process (AHP) based model for CSFs by comparative survey of factors identified for successful joint ventures between local and Chinese construction firms against each defined category.

1.4. Research Significance

Chinese consultancy and construction firms have entered Pakistani construction industry on a huge scale due to introduction of China Pakistan economic corridor (CPEC). This created an open viable environment for foreign investment to be induced with profitable future due to Chinese investment and loans (Journal, Social and Studies, 2015). These Chinese contractors and consultant are not only participating in the procurement of services by GOP for CPEC related projects but also in the projects which are not a part of CPEC either funded by GOP or by foreign entities (Visions and Hussain, 2017). Considering this current scenario and lack of experience of Pakistani clients/consultants/contractors in working with foreign organizations when it comes to AEC (Architecture, Engineering and Construction), this framework will provide a defined approach for parties involved in joint ventures for achieving a defined goal.

1.5. Advantages

- a) Ease of entering in a joint venture for local firms in construction industry with Chinese contractors/ consultants.
- b) Framework for successful Joint venture with Chinese construction firms.
- c) Human resource development.

- d) Increase in technical skills of local engineers.
- e) Inclination towards more consortiums between local and Chinese firms in construction industry following successful JVs.
- f) Increased Job Opportunities.
- g) Increased capabilities of local organizations.
- h) Local language incorporation.
- i) Cheaper safety training alternative.
- j) Modernization of the workforce by introducing them to the latest technology

1.6. Scope of Research

Major area of application for this research will be construction industry of Pakistan in which stakeholders of different construction companies will be able to thoroughly understand the factors involved in improving the quality of joint venture partnership and selection of partner.

1.7. Thesis Organization

This thesis has been divided in different chapters as follows:

- a. First chapter provides a study background regarding the topic of our thesis, informs about the problem at hand and what would be done to provide a solution for it is explained this it.
- b. Second chapter explains the literature study behind the CSFs for joint venture between local and Chinese firms in Pakistan in detail with explanation against each identified CSF from study.
- c. Third chapter provide the methodology or approach which will be taken for our research in detail with appropriate techniques being used for this research.
- d. Chapter four provides the details of research done and analysis of its data with end results providing us with a CSFs based priority model using AHP technique.
- e. Chapter five provides conclusion of this research and recommendations for future work related to this research.

2. LITERATURE REVIEW

2.1. Introduction

Collaboration in terms of business agreed upon or initiated by contractors/consultants to enhance their abilities and effective approach in major construction projects is called a joint venture. That is majorly being addressed as a method or approach for merging several attributes and financial powers of different organizations for completion of a single complex project at hand which in most cases need help of both (Akhund, 2018). Joint venture in construction industry specifically is both beneficial and stimulating due to differing technical skills, economic and political atmospheres, and cultural and legal backgrounds which leads to a successful completed task at hand. (Ozorhon *et al.*, 2007b). JV can be defined as the common risk both parties take for increased project success rate and enhanced financial stability for all stakeholders.(Deng *et al.*, 2016).

This study majorly identifies the critical success factors which are divine for a successful project which is to undertaken by joint venture between local and Chinese firm related to construction. This will help and increase the chances of having a positive outcome in terms of finance and technicalities related to the project at hand specially for local firms which are lacking experience and expertise for complex projects such as CPEC.

2.2. Construction Industry of Pakistan

According to (Azhar, Farooqui and M. Ahmed, 2008) Pakistan is now able to provide an offering platform for construction industry because of rapid growth of the country. As per the recent facts and figures of Economic survey of Pakistan (2016-2017) it is very clearly stated that construction industry has grown by 9.1% in FY17 and put its shared of 2.7% to the country's gross domestic product (GDP).

Pakistan as a evolving country is at the moment enjoys strong growth in construction related activities. As of now, this industry is 2nd biggest in Pakistan's economy after agriculture. Approximately about thirty percent of working population is attached with this industry either

directly or indirectly. (Azhar, Farooqui and M. Ahmed, 2008).

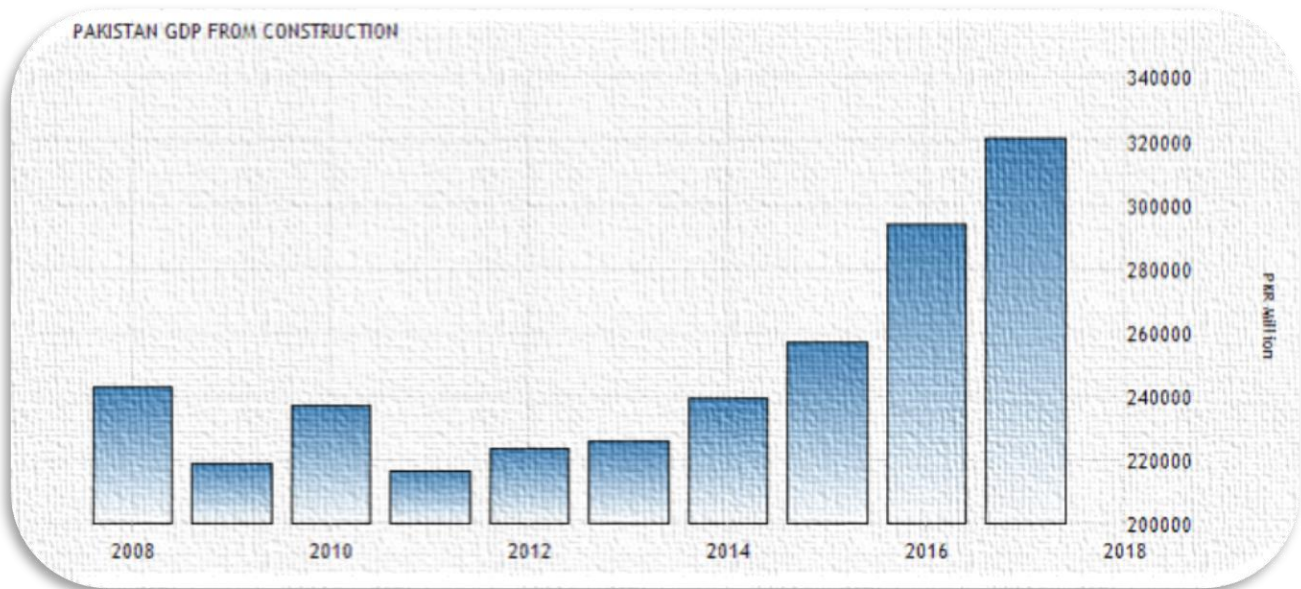


Figure 1 Pakistan's GDP from Construction Source: Tradingeconomics.com | State Bank of Pakistan

Moreover, the China-Pakistan Economic Corridor (CPEC) agreement was signed between Pakistan and China. But the need for enhancing the security mechanism and improvement in law in order situation was the actual requirement for giving a push to Pakistan's economy and its image. Also other countries will follow the interest of China because of its stake in international market.

By large infrastructure projects, the Government of Pakistan has responded to this opportunity in a viable and executable manner. These projects have the actual potential to lead the local Industry to establish respect, status and international recognition when the appropriate efforts are extended to achieve the same. According to a survey carried out of State Bank of Pakistan (2017), GDP from construction in Pakistan increased to PKR 320,769 Million in 2017 from PKR 294,154 Million in 2016. GDP from construction in Pakistan averaged PKR 239,361.33 Million from 2006 until 2017, reaching an all-time high of PKR 320,769 Million in 2017 and a record low of PKR 186,380 Million in 2006.

Construction industry of Pakistan have also been an significant receiver of foreign direct investment (FDI). This can be analyzed using latest facts and figures made public by the State Bank of Pakistan. The numbers provided show that the construction industry had a total influx of \$35.7 million in August 2017. Also for the financial year of 2017, attraction for foreign investors have increased significantly and numbers show a prominent increased of FDI in near future. (Visions and Hussain, 2017).

In addition to the economic share of Pakistani construction in the local and global economic market, the progress of the construction sector is not as per the market needs (Azhar, Farooqui and M. Ahmed, 2008). In the first two decades of the 21st century, Pakistan's economy has seen its highs and lows. Growth rates i.e. above seven percent were seen in the earlier years of the first decade, which however reduced down to the lowest 0.39 percent in the FY 2009. The economy has ever been ever since growing, although slowly, in recent years to 5.79 percent in the FY 2018 (Economic Survey of Pakistan, 2017-18). This, coupled with population growth rates of over 2.4 percent (Economic Survey of Pakistan, 2016-17), places an acute demand on basic and advanced infrastructure.

2.3. Importance of International Joint Venture

International joint ventures (IJVs) are a very importance and significant type of international strategic collaboration and have been researched by scholars for decades now. This has resulted in abundance of empirical studies, publications, and reviews, yet an inadequate accumulation of knowledge exists, as a closer look reveals (Nippa and Reuer, 2019). In a world in which there is a rapid growth in global competition, entities partake in joint ventures in order to stay competitive and strategically sustainable to the upcoming challenges. (Mba *et al.*, 2014).

The drivers and motivational factors which are importance for an international joint venture for a firm to enter into an alliance or joint venture can be defined and explained by the figure 2.

Drivers and Motives for SAs and JVs

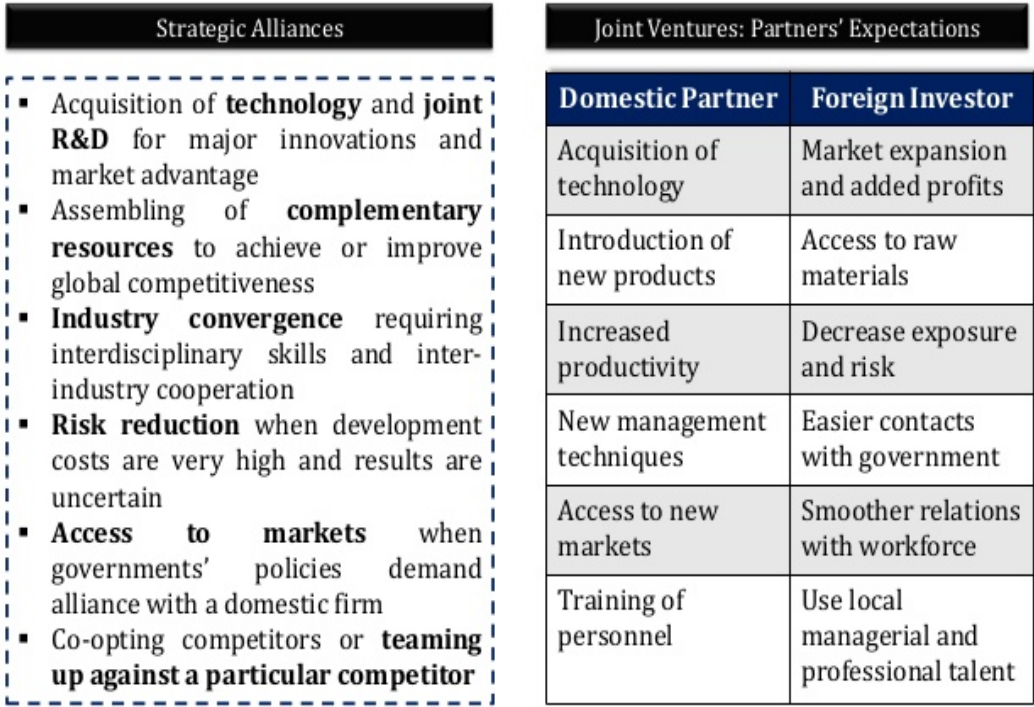


Figure 2 Summarizing the need and motivation towards need of Joint venture

The practice of international joint ventures between foreign and local construction organizations attempt in facing problems by local contractors like delays, lack of workers interest, hindrances with time and cost changes, also incompetency is the main problem as well. These issues can be catered for by forming joint ventures between entities/parties involved (Aydogan and Koksall, 2013).

The common purpose of joint venture specially with a foreign entity is to spread a risk inherent in large projects and gain expertise which was not available locally or using methods which are not conventionally used in the local industry. (Mba and Agumba, 2018). These are the few issues which have been mentioned according to general view of the industry, considering the world has become a global village, international joint ventures are being accepted and adopted more and more leading towards exceptional innovation day by day.

There are two majorly divided joint venture systems as defined in figure no. 4.

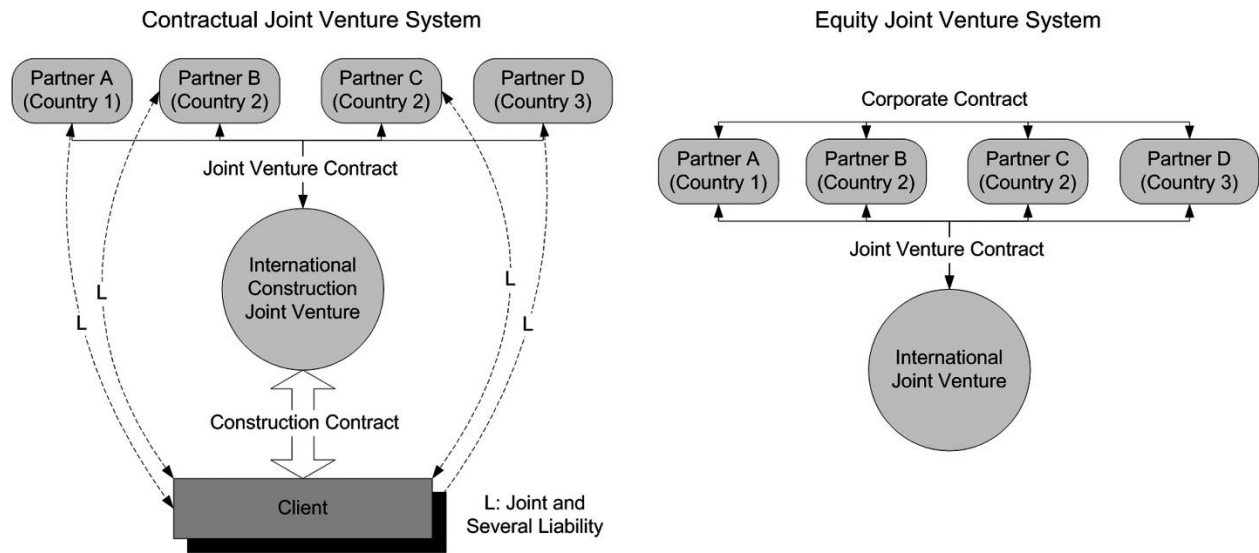


Figure 3 Types of Joint venture systems

Following are the lifecycles of IJV life cycles have been clearly defined in IJV literature which are shown in Table 1.

Table 1 Overview of IJV life cycles stages, Le (2009, p. 30)

Study	IJV life-cycle stages		
	Stage 1	Stage 2	Stage 3
Buechel (2000)	Formation	Adjustment	Evaluation
Heide (1994)	Relationship initiation	Relationship maintenance	Relationship termination
Wood & Gray (1991)	Precondition	Process	Outcome
Ott (2003)	Bargaining	Common agency	Repeated games
Kogut (2002)	Creation	Institutionalization	Termination

2.4. Induction of Chinese contractors/Consultants in Local Industry

The old and tradition friendship of Pakistan and China has taken an interesting turn which is to enhance the economic stake of their mutual concerns. It consists of trade and investment, further complete energy co-operation within a framework agreed upon by stakeholders at both sides. The result of this event and more inclination to initiate and execute the new economic framework is shown by both parties in part of Chinese major investment in Pakistan (Kumar, 2007).

In any case, there are signs that the exchange plan might be excessively yearning a bigger rebuilding of the Pakistani economy. Also the same economy at the same time requires significant investment. This is because it requires execution of strategy changes joined with interest in these activities from the business network of Pakistan. Meanwhile it fundamentally benefits Pakistan, exchange gives China admittance to another market for its merchandise. Hopefully this will be in the end do likewise for Pakistan. Vitality co-activity will profit China as it will access vitality supplies through Gwadar port, a backup course of action to the one through the Malacca waterways, and will serve to build up its western districts. Pakistan has thus picked up from the enormous scope framework improvement that has occurred in Gwadar and will keep on doing so once likely arrangements make progress (Kumar, 2007).

The Collective decision making or joint ventures makes contractual matters difficult to manage in International JVs. (Chan and Suen, 2008). Further Chinese construction companies will enter and grow into the global market, given China having a limited local construction industry (Smits et al. 2014).

China did raise significantly important concerns regarding the problem of energy prices and taxes along with implementation procedure of the China Pakistan Economic Corridor (CPEC) energy projects in Pakistan. This has also resulted in an agreement between both countries which has removed all the tariffs from the imported equipment (Visions and Hussain, 2017). This has also been one of the most significant reasons for major induction of Chinese investment in CPEC projects and later that interest has been broadened for the sleeping infrastructural opportunities in Pakistan attracting more and more investment in the projects which were not bound to start before the opportunity at hand.

CPEC has been a game changer for Pakistan particularly considering China will be an real accomplice for solidness and security inside Pakistan which ought to result in a win at both sides. This has majorly expanded the criteria and necessity for the feasible, steady and advancing advancement of Pakistan. Speculations by China will improve net residential item of rate by over 15 percent. Pakistan delighted in a more favorable financial circumstance compared to India by decreasing its budget shortfall to 4.7% of GDP in 2014 (as against India's 7%) and Pakistan is both competitive and cheaper as a rising advertise. China's financial and military help will offer assistance Pakistan an awesome bargain in narrowing its ever broadening crevice in economic-military-nuclear areas with India and in bettering its defense potential (Kiani, 2019). This clarifies the tall rate of acceptance of Chinese firms into Pakistan's development industry coming about primarily due to remote venture in Pakistan.

2.5. Critical Success factors for a successful Joint Venture

There are several critical success factors (CSFs) that should be taken into account by the partnered firms or parties involved in such agreement i.e. joint venture/ consortium in order to maintain a successful partnership throughout its implementation phase. (Dikmen *et al.*, 2008).

Infrastructure development related firms are capable of exploiting opportunities and adopt to different systems and markets abroad through the concept and implementation of JVs internationally. One of the major reasons why these kinds of international collaborative arrangements are hard to accommodate in existing environment. That is because the International joint venture exists in a different condition, i.e., a different host country and different project conditions. Further, in construction, joint ventures are unique and specific for each country host conditions. (Ozorhon *et al.*, 2007a).

There are 25 No. critical success factors which have been defined through extensive literature review, as they are important for success of a joint venture between two parties/firms.

Table 2 Enlisting critical success factors for joint ventures in construction industry through literature review

Sr no	Critical success factor for JV	Abbreviation	Literature Score
1	Selection of right partner	PS	0.041494
2	Cooperation among partners	CP	0.155602
3	Clearly defined goals b/w partners	DG	0.062241
4	Mutual Understanding	MU	0.093361
5	Mutual dispute resolution	MDS	0.093361
6	Commitment to objectives	CO	0.068465
7	Trust among partners	TP	0.099585
8	Support by Top management of Stakeholders	STM	0.037344
9	Monitoring and performance control	MPC	0.012448
10	Shared corporate Culture	SCC	0.062241
11	Knowledge transfer and Innovation	KTI	0.037344
12	Company size compatibility	SC	0.012448
13	Fair contract implementation among partners	FCI	0.031120
14	Financial Stability	FS	0.031120
15	Equity Control among partners	EC	0.062241
16	Team building	TB	0.020747
17	Fair risk allocation	RA	0.012448
18	Autonomy of joint venture	AJV	0.006224
19	Long Term Orientation towards JV	LTO	0.020747
20	Partner's Experience of Local Industry	PEL	0.018672
21	Location of the project	LO	0.002075
22	Timely Responsiveness	TR	0.004149
23	Adequate Resources for project	ARP	0.002075
24	Supplier and Subcontractor selection criteria	SSC	0.002075
25	Measuring Project Outcomes	MPO	0.010373

2.6. Defining of Categories for success factors using literature review

Factors have been categorized into further functional categories which will be used for further content analysis of the factors at hand. There were 7 categories made through detailed literature review and based on the factors identified as per table 2. These are 7 categories made based on literature review and have been discussed in detail as follows;

2.6.1. Pre partnering need

For a partnership to be strong and consortium to go the way all stakeholders want; requires few pre partnership conditions to be identified and analyzed to avoid non compatible partnerships i.e. partner's previous experience of local industry, financial stability of both parties involved and difference in size of both partnering companies (L., Heng and D., 2000). However, importance of pre partnering conditions with regard to any type of cooperation is agreed by the researchers. Also we can acknowledge the detail and amount of research analyzing the relationship between pre partnering conditions for partner selection and International joint venture performance in more detail is not as extensive as it should have been. Research by (Baroth *et al.*, 2012) has shown that the relative importance of the selection criteria between better and poorly performing IJVs.

2.6.2. Conflict Control among partners

When conflicts are managed in a joint venture then it ensures a bigger project scale and scope to be carried out by the companies involved in the future as they get motivated by the success of the project. Specially for international joint ventures still provide advantages in the improvement of a country's construction industry. Also it is important that the management of conflicts in a JV is being ensured for the success of a particular project for which the Joint venture is made. Failure of a joint venture will not only bring negative implications to the stakeholders involved but will also affect the future of construction business opportunities, improved environment for foreign contractors and investment among foreign stakeholders. It also affects the local people of that country as well. (Abd-Karim *et al.*, 2014). Conflict control can be sub categorized into different factors such as; mutual dispute resolution methods incorporated before joint venture of stakeholders, trust among the partners leading to an effective solution to problems at hand and clearly defined goal and objectives for the success of the project for proper distribution of responsibilities (Ren, Gray and Kim, 2009).

2.6.3. Interdependence of partners in Joint venture (Inter-partner fit)

In an infrastructure development project, managers or stakeholders will have depend on the partner for the success of project at hand (Leijie *et al.*, 2019). Interdependence of partners on each other

have major effect on the outcome of a joint venture and further probability of joint ventures in future among the same. The non-significant association between interdependence and conflict is the wrong hypothesis in the most joint ventures between partners. (Kemp and Ghauri, 2001). Cooperation, commitment and mutual understanding among partners leads to the result for either being positive or negative for success of a project.

2.6.4. Joint venture Performance Indicators

Performance indicators of a joint venture can be defined as the measure to outcome of a project (Mohamed, 2003). Joint venture performance depends upon few factors such as timely responsiveness from the stakeholders involved regarding events and problems occurring during the execution of the project. This also includes control over the project outcomes and measuring them before hand for a proactive approach towards the project success (Dikmen *et al.*, 2008). Monitoring and supervision of all the activities during the consortium for better control and risk management.

2.6.5. Organization development

Development and adoption of an organization to the new working environment involved in joint venture is one of the key factors for the success of the consortium. Technology transfer, innovation, team building, and top management support helps in organization development which produces effective outcome for a project. The proponent of commitment of host partner to knowledge, skills and technology acquisition is that the local partnering company should also show commitment to the same cause (Rwelamila and Mkandawire, 2013).

2.6.6. Contractual factors

After project procurement and selecting a partner, it is important that contract is made between stakeholders/ partners encompassing each and every aspect of risk involved in the project. Equity in case of profit or loss should be defined clearly for each involved partner. It is also important to ensure proper contract implementation during the project execution using the binding of the contract. (Maro and Mnyigumbi, 2019). For a megaproject specially, it is for almost all cases that

there is an International construction joint venture for a project based on contractual factors implemented globally (Brockmann and Brezinski, 2013).

2.6.7. Project Specific Factors (External Factors)

Project specific or external factors can be a major impact for success of a joint venture as well and its success with successful completion of the project at hand (Mohamed, 2003). (Ozorhon *et al.*, 2007a). Project based factors include adequate resources available for the project, location of the project, supplier and sub-contractor selection criteria etc.

Table 3 References for the Categories Defined

Sr.	Category	Reference for category
1	Pre partnering need	(Ozorhon <i>et al.</i> , 2007b), (Perdana, 2018), (Baroth <i>et al.</i> , 2012), (L., Heng and D., 2000)
2	Conflict control	(Ren, Gray and Kim, 2009), (Dikmen <i>et al.</i> , 2008), (Abd-Karim <i>et al.</i> , 2014)
3	Interdependence	(Suwannarat, 2015), (Demirbag and Mirza, 2002), (Ren, Gray and Kim, 2009), (Perdana, 2018), (Leijie <i>et al.</i> , 2019), (Kemp and Ghauri, 2001)
4	Joint venture performance	(Mba and Agumba, 2018), (Dikmen <i>et al.</i> , 2008), (Demirbag and Mirza, 2002), (Mohamed, 2003), (Ozorhon <i>et al.</i> , 2007a),
5	Organization Development	(Rwelamila and Mkandawire, 2013), (Ren, Gray and Kim, 2009), (Dulaimi and Selvaraj, no date),
6	Contractual factors	(Maro and Mnyigumbi, 2019), (Brockmann and Brezinski, 2013), (Leijie <i>et al.</i> , 2019), (Ozorhon <i>et al.</i> , 2007a),
7	Project Specific - External Factors	(Mohamed, 2003), (Ozorhon <i>et al.</i> , 2007a), (Dikmen <i>et al.</i> , 2008), (Ozorhon <i>et al.</i> , 2007b), (Ozorhon <i>et al.</i> , 2007a),

2.7. Identification of Categories for identified success factors using literature review and Preliminary survey

Following the selection of most appropriate categories for all the identified factors, these factors required to be put under different categories defined in the previous step. Identified categories are as follows:

1. Pre partnering need
2. Conflict control
3. Interdependence
4. Joint venture performance
5. Organization Development
6. Contractual factors
7. Project Specific -External Factors

For this purpose, a survey was conducted based on option of selection of most appropriate category against each identified category. Survey was conducted from the respondents involved in construction industry of Pakistan and there were 22 responses against 110 who were sent the survey for categorization. However, for 12 of the factors, results were less than simple majority as there were different diverse categories defined by the respondents. For the identified factors defined against each category, there were 13 factors which were selected against a category out of 7 categories through simple majority i.e. Response of above 50%. Remaining 12 of the factors were selected against a category using literature review in detail. Table below shows the categories selected against each factor through survey against categories identified.

Table 4 Selection of category against each factor through field survey

Sr no.	CSFs	Category Selected by Respondents	Percentage Response
1	Selection of right partner	Pre partnering need	59.1
2	Cooperation among partners	Interdependence	36
3	Clearly defined goals b/w partners	Conflict Control	36.4
4	Mutual Understanding	Interdependence	40.9
5	Mutual dispute resolution	Conflict Control	72
6	Commitment to objectives	Interdependence	36
7	Trust among partners	Conflict Control	36.4
8	Support by Top management of Stakeholders	Organization Development	51
9	Monitoring and performance control	Joint Venture Performance	71.4
10	Shared corporate Culture	Joint Venture Performance	40
11	Knowledge transfer and Innovation	Organization Development	52
12	Company size compatibility	Pre partnering need	40.7
13	Fair contract implementation among partners	Contractual Factor	58
14	Financial Stability	Pre partnering need	58
15	Equity Control among partners	Contractual Factor	40.6
16	Team building	Organization Development	71.4
17	Fair risk allocation	Contractual Factor	54.5
18	Autonomy of joint venture	External Factor	36
19	Long Term Orientation towards JV	Interdependence	36.4
20	Partner's Experience of Local Industry	Pre partnering need	59.1
21	Location of the project	External Factor	68
22	Timely Responsiveness	Joint Venture Performance	52
23	Adequate Resources for project	External Factor	40.7
24	Supplier and Subcontractor selection criteria	External Factor	38.1
25	Measuring Project Outcomes	Joint Venture Performance	59

(Highlighted factors are to put against each category through literature review in the next step)

Considering the factors which were selected against categories through field survey with <50% response against the selected category. So these factors will be put into the appropriate categories through literature review as shown in the table below.

Table 5 Category Selection by Literature Review for CSFs

Factors	Abbr.	Category for Factor Selected	Reference
Company size compatibility	SC	Pre partnering need	(Mohamed, 2003), (Chen <i>et al.</i> , 2016), (Adnan <i>et al.</i> , 2018), (Baroth <i>et al.</i> , 2012), (Larimo and Rumpunen, 2006), (Ozorhon <i>et al.</i> , 2007b), (Perdana, 2018)
Trust among partners	TP	Interdependence	(Girmscheid and Brockmann, 2010), (Hameed and Abbott, 2017), (Abd-Karim <i>et al.</i> , 2014),
Clearly defined goals between partners	DG	Conflict control	(Dikmen <i>et al.</i> , 2008), (Ren, Gray and Kim, 2009), (Groot and Merchant, 2000),
Mutual Understanding	MU	Conflict Control	(Manitshana, 2012), (Suwannarat, 2015), (Demirbag and Mirza, 2002), (Dikmen <i>et al.</i> , 2008)
Long Term Orientation towards JV	LTO	Interdependence	(Zhang, 2004), (Ozorhon <i>et al.</i> , 2008), (Kemp and Ghauri, 2001), (Leijie <i>et al.</i> , 2019),
Cooperation among partners	CP	Interdependence	(Ozorhon <i>et al.</i> , 2007b), (Hameed and Abbott, 2017), (Perdana, 2018),
Commitment to objectives	CO	Interdependence	(Ozorhon <i>et al.</i> , 2007b), (Ren, Gray and Kim, 2009),
Shared corporate Culture	SCC	Joint venture performance	(Demirbag and Mirza, 2002), (Journals and Studies, 2010), (Mohamed, 2003b), (Journals and Studies, 2010), (Dikmen <i>et al.</i> , 2008),
Equity Control among partners	EC	Contractual factors	(Leijie <i>et al.</i> , 2019), (Maro and Mnyigumbi, 2019), (Adnan, Chong and Morledge, 2011)
Adequate Resources for project	ARP	External Factors	(Ozorhon <i>et al.</i> , 2007b), (Ozorhon <i>et al.</i> , 2007a),
Supplier and Subcontractor selection criteria	SSC	External Factors	(Adnan, Chong and Morledge, 2011), (Dikmen <i>et al.</i> , 2008), (Tidd and Izumimoto, 2002),

2.8. Literature score for Categories identified

Defined categories have their weights as per the score of the factors involved in each category. This literature score against each factor was received by a preliminary field expert survey by 20 respondents with experience of more than 5 years as shown below in the pie chart.

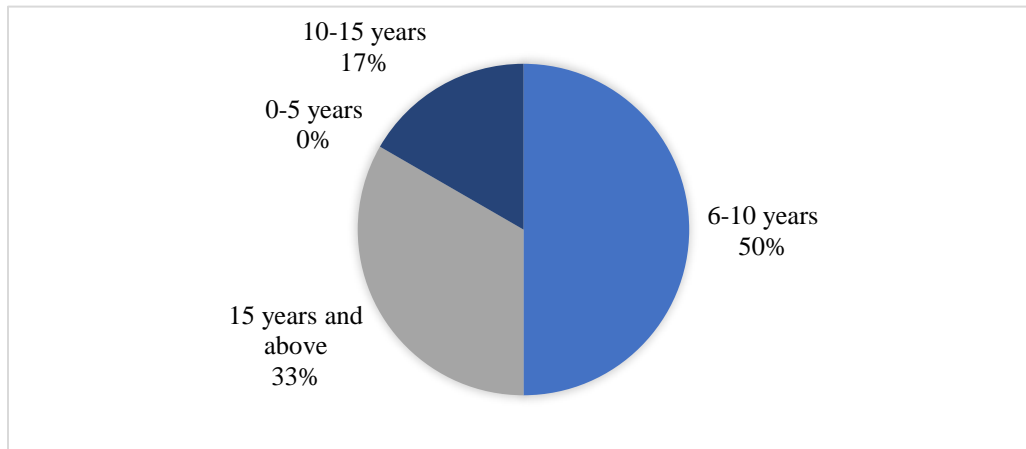


Figure 4 Preliminary survey respondents experience

Categories defined have been given weightages using weights of factors in each category. Literature score of Factors have been used for this purpose. As shown in the table below weightages of the categories will be used further for the research.

Table 6 Literature score for each category

Sr no	Categories	Factors	Abbreviations	Literature Score	Percentage
1	Pre partnering need	Selection of right partner	PS	0.041494	11.57767
		Partner's Experience of Local Industry	PEL	0.037972	
		Company size compatibility	SC	0.037344	
		Financial Stability	FS	0.031100	
2	Conflict Control	Mutual dispute resolution	MDS	0.093361	25.98332
		Mutual Understanding	MU	0.093361	
		Clearly defined goals between partners	DG	0.062241	

3	Interdependence	Trust among partners	TP	0.099585	39.16782
		Long Term Orientation towards JV	LTO	0.021236	
		Cooperation among partners	CP	0.155602	
		Commitment to objectives	CO	0.068365	
4	Joint venture performance	Timely Responsiveness	TR	0.024149	10.09774
		Monitoring and performance control	MPC	0.032241	
		Shared corporate Culture	SCC	0.062240	
		Measuring Project Outcomes	MPO	0.010373	
5	Organization Development	Support by Top management of Stakeholders	STM	0.019408	6.35617
		Knowledge transfer and Innovation	KTI	0.020747	
		Team building	TB	0.020747	
6	Contractual Factors	Fair contract implementation among partners	FCI	0.031120	5.84291
		Equity Control among partners	EC	0.012416	
		Fair risk allocation	RA	0.012448	
7	External factors	Location of the project	LO	0.002075	0.97437
		Adequate Resources for project	ARP	0.002075	
		Supplier and Subcontractor selection criteria	SSC	0.002075	
		Autonomy of joint venture	AJV	0.006224	

As shown in the pie chart below, Interdependence of both firms during joint venture has the most significance for the successful JV and completion of project at hand.

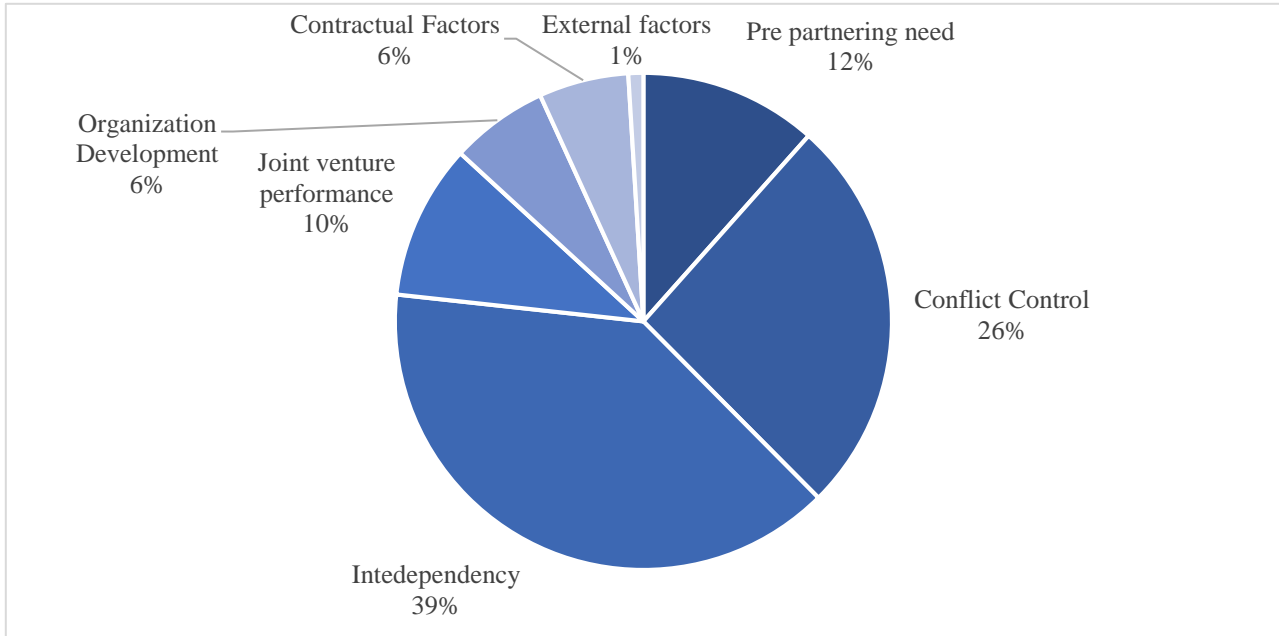


Figure 5 Pie Chart of Literature score for each category

2.9. Summary

Literature review for selection of appropriate factors and then categorization of the Factors has been done in detail as per tables shown before. Preliminary survey for categorization of the factors was conducted in detail by 30 field experts with 20% responses. Further analysis and survey have been conducted with the detail provided below.

3. RESEARCH METHODOLOGY

3.1. Introduction

Research methodology selected is based on AHP (Analytical hierarchic process) and followed the process showed in the image below:

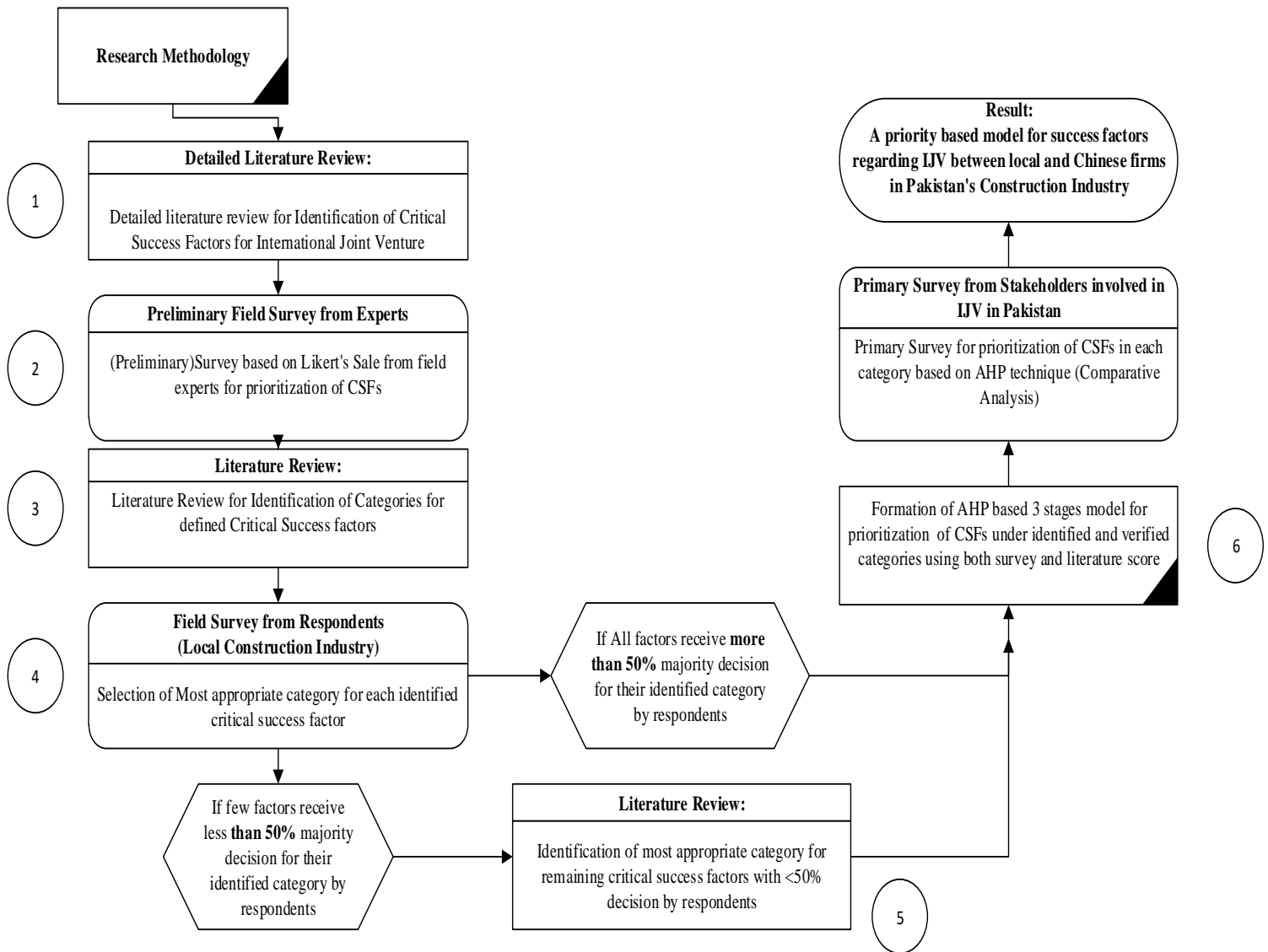


Figure 6 Research Methodology

3.2. Preliminary questionnaire from Field Experts

As per the requirement of opinion of experts from the construction industry field, we will have the survey score which will be added into the literature score of 25 factors identified. For this purpose; initial survey based on likert's 5-point scale was used i.e. In its last frame, the Likert Scale could be a five (or seven) point scale, this scale utilizes to permit the person to specific how much they concur or oppose to this idea with a specific articulation. Different responses were collected. At least 15 expert opinions were the requirement. For this purpose, 20 field expert opinions were taken from the field and using the literature and survey score, further statistical evaluation was done. Normalized literature and Survey score has been listed in table below.

Table 7 Survey score for Identified factors from field experts using Likert's scale

Sr no	Categories	Factors	Abbreviations	Survey Score
1	Pre partnering need	Selection of right partner	PS	0.045623
		Partner's Experience of Local Industry	PEL	0.0381962865
		Company size compatibility	SC	0.0429708223
		Financial Stability	FS	0.0397877984
2	Conflict Control	Mutual dispute resolution	MDS	0.042440
		Mutual Understanding	MU	0.040849
		Clearly defined goals between partners	DG	0.041910
		Trust among partners	TP	0.040849
		Long Term Orientation towards JV	LTO	0.0360742706
		Cooperation among partners	CP	0.045623
		Commitment to objectives	CO	0.047215
4	Joint venture performance	Timely Responsiveness	TR	0.0381962865
		Monitoring and performance control	MPC	0.0403183024
		Shared corporate Culture	SCC	0.0445623342
		Measuring Project Outcomes	MPO	0.0408488064
5	Organization Development	Support by Top management of Stakeholders	STM	0.044562
		Knowledge transfer and Innovation	KTI	0.0328912467

		Team building	TB	0.0307692308
6	Contractual Factors	Fair contract implementation among partners	FCI	0.0344827586
		Equity Control among partners	EC	0.0360742706
		Fair risk allocation	RA	0.0397877984
7	External factors	Location of the project	LO	0.0344827586
		Adequate Resources for project	ARP	0.0403183024
		Supplier and Subcontractor selection criteria	SSC	0.0413793103
		Autonomy of joint venture	AJV	0.0397877984

3.3. Survey weighted score for Categories identified

Categories defined have been given weightages using weights of factors in each category. Survey score of Factors have been used for this purpose. As shown in the table below weightages of the categories will be used further for the research.

Table 8 Weights of Categories based on Survey score

Sr no	Categories	Factors	Abbr.	Survey Score	Percentage
1	Pre partnering need	Selection of right partner	PS	0.045623	14.94526
		Partner's Experience of Local Industry	PEL	0.0381962865	
		Company size compatibility	SC	0.0429708223	
		Financial Stability	FS	0.0397877984	
2	Conflict Control	Mutual dispute resolution	MDS	0.042440	14.97700
		Trust among partners	TP	0.040849	
		Clearly defined goals between partners	DG	0.041910	
3	Interdependency	Mutual Understanding	MU	0.040849	15.23084
		Long Term Orientation towards JV	LTO	0.0360742706	
		Cooperation among partners	CP	0.045623	
		Commitment to objectives	CO	0.047215	

4	Joint venture performance	Timely Responsiveness	TR	0.0381962865	14.70728
		Monitoring and performance control	MPC	0.0403183024	
		Shared corporate Culture	SCC	0.0445623342	
		Measuring Project Outcomes	MPO	0.0408488064	
5	Organization Development	Support by Top management of Stakeholders	STM	0.044562	12.94622
		Knowledge transfer and Innovation	KTI	0.0328912467	
		Team building	TB	0.0307692308	
6	Contractual Factors	Fair contract implementation among partners	FCI	0.0344827586	13.20006
		Equity Control among partners	EC	0.0360742706	
		Fair risk allocation	RA	0.0397877984	
7	External factors	Location of the project	LO	0.0344827586	13.99334
		Adequate Resources for project	ARP	0.0403183024	
		Supplier and Subcontractor selection criteria	SSC	0.0413793103	
		Autonomy of joint venture	AJV	0.0397877984	

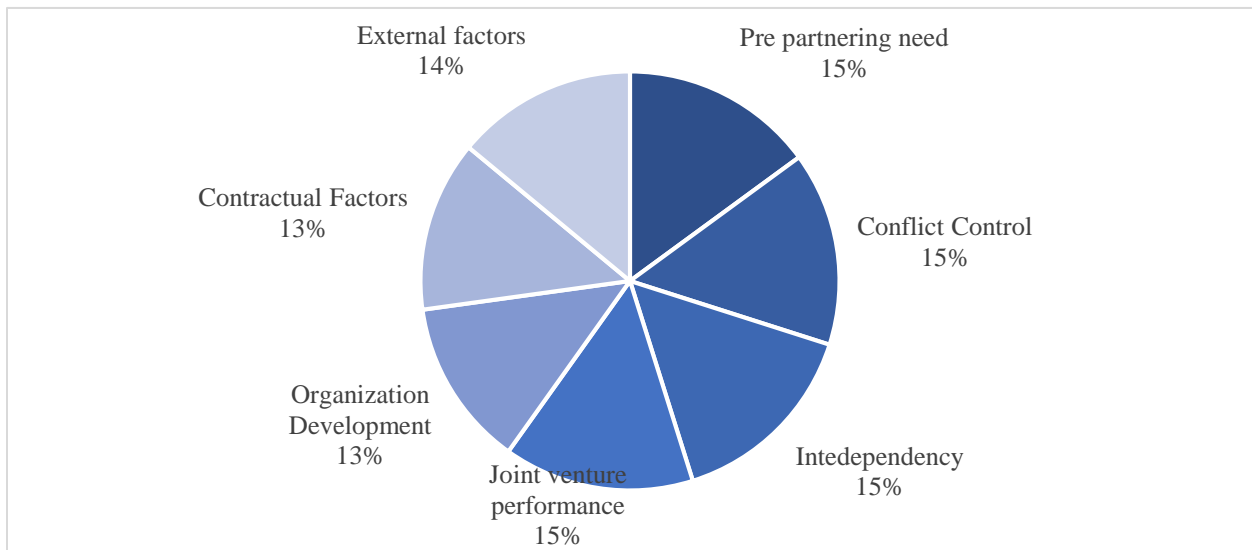


Figure 7 Survey Based Weightages of Identified Categories

3.4. AHP Introduction

The process of analytical hierarchy helps to create decision matrices through a classification with both qualitative in detail and quantitative elements of a set of data. Qualitatively, AHP degrades a problem of decision from the top overall objective to the end level, most of the time with cases that include several clusters, sub clusters and so on. Sub clusters/ clusters may include forces, characteristics, criteria, activities, targets, etc. Quantitatively, this calculates ' global' weights for assessment at the final level, by means of a comparison on pairs of elements at the cluster and sub-cluster levels. The relativity of the elements within a cluster is measured by a ratio scale in each pair-wise comparison. One of AHP's main functions is to calculate the consistency of the matrices so that they can be appropriate for evaluation (Saaty, 2004).

3.5. AHP Methodology

This study focuses mainly on the crucial effects by adopting the SMCP to keep the project within the budget, in accordance with schedule and the requirements. The Multi-Criteria Decisions Technique (MCDM) is extremely useful in resolving difficult issues which are not directly resolved. MCDM's key rule is that the strategy should be based on simple criteria that take more than one attribute into consideration (Podvezko, 2009). Since there are multiple factors which contribute towards more than one project success criterion. AHP is an approach to mathematical decisions (Saaty, 2004) to solving complex and ambiguous decision-making issues. AHP helps break down the complicated problem into a hierarchy of simplistic factors and sub-factors and makes measurement easier with the help of a comparative analysis. One or more of AHP's most important characteristics is that both subjective and objective problem types can be applied (Saaty, 2004). This technique was primarily developed by decomposing a multi-criteria problem into distinct hierarchy levels with top hierarchy, mid-level as the criteria and sub-criteria and lower levels as an alternative design in the formation of the hierarchy (Saaty, 2004). Existing literature gives the appearance of how AHP is used in particular in the classification and priority of the various criteria and sub criteria (Podvezko, 2009).

3.5.1. AHP steps

The stages of the AHP which are to be followed are as follows:

Step 1:

The first step is to clearly define and indicate the goals of the complex and ambiguous problem. The aim of this research is therefore to determine the success factor which will have a greater impact when the SMCP management system is implemented.

Step 2:

With help of group decision or survey technique, the multifaceted problem is broken up into a hierarchical structure. The hierarchical composition is broken down into several levels. The highest level-level hierarchy constitutes the objective of the problem that is evaluation of the selection of best practice management. In the next level, this target is sub-divided into different criteria. The criteria in current research correspond with cost, time and quality criteria for the success of the project. The criteria were further broken up into sub-criteria that show details of the criteria. All critical affecting factors are recognized as substrates of analysis in this research.

Step 3:

A comparison can be made by decision matrix in pairs to show the importance of one criterion compared with another. The decision-making matrix is based on a nine-point scale (Saaty, 2004). With the help of decision makers and experts the elements underlying the common node are compared to the other elements of that same node in the hierarchical structure. For example, if the

$$Z = \begin{matrix} & X_1 & X_2 & \cdots & X_n \\ \begin{matrix} X_1 \\ X_2 \\ \vdots \\ X_n \end{matrix} & \begin{pmatrix} \frac{W_1}{W_1} & \frac{W_1}{W_2} & \cdots & \frac{W_1}{W_n} \\ \frac{W_2}{W_1} & \frac{W_2}{W_2} & \cdots & \frac{W_2}{W_n} \\ \vdots & \vdots & \ddots & \vdots \\ \frac{W_n}{W_1} & \frac{W_n}{W_2} & \cdots & \frac{W_n}{W_n} \end{pmatrix} \end{matrix} \quad \text{Equation one}$$

$$Z = \begin{matrix} & X_1 & X_2 & \cdots & X_n \\ \begin{matrix} X_1 \\ X_2 \\ \vdots \\ X_n \end{matrix} & \begin{pmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \ddots & \ddots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{pmatrix} \end{matrix} \quad \text{Equation two}$$

node contains "n" elements, then n (n-1)/2 node is compared under that node. Let X1, X2, X3, Xn elements below the node "M" and their weight numbers are w1, w2, w3, ... Wn. The pairwise comparison of these components in accordance to their comparative weights are shown in the form of a matrix, where Z is the comparison matrix (n xn) that represents pairwise comparisons among the components X1, X2, X3, Xn:

Where $a_{ij} = w_i/w_j$ (i, j = 1, 2 ... n) represents the explicit comparative significance among the pair of factors Xi and Xj. If i = j then $a_{ij} = 1$ and $a_{ij} = 1/a_{ji}$ for $a_{ij} > 0$.

Step 4:

The next step is to define the priority weights of elements through the maximum eigenvectors and eigenvalues after the formation of the decision-making matrix.

As mentioned by (Saaty, 2004): λ_{max}

$$\lambda_{max} = \sum_{i=1}^n a_{ij} \frac{W_j}{W_i}$$

Step 5:

This step checks the consistency of the parallel comparisons. Comparing pairwise, the inconsistency is measured by the Consistency Index (CI) and the consistency ratio (CR) is measured and calculated with the help of given formula:

$$CI = \frac{\lambda_{max} - n}{n - 1}$$

$$CR = \frac{CI}{RI}$$

Table 9 Respective values of RI

N	2	3	4	5	6	7	8	9
RI	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45

Where n is the rank of matrix and consistency index (CI) and random index (RI) of matrices are generated randomly. The extreme acceptance limit of CI and RI is 0.1 (Saaty, 2004). If the values exceed 0.1, this highlights that the pairwise comparison is inconsistent and hence it would be discarded. For different values of 'n', the values of RI are depicted in the figure above (Saaty, 2004).

Step 6:

Once the priority weights of every element, which is local weights of elements, are identified, the next step is to identify the overall weights which is global weights of all elements in relation to the objective defined in the AHP model.

Step 7:

Lastly but not the least, after calculating the global weights elements are repositioned in the ascending order rendering to the global prioritization.

3.6. Literature Score for Identified Factors and Weights of Categories

Literature study has been done in detail and score for each identified factor is used for finding the weights of the categories and in the pie chart below (as explained in chapter 2).

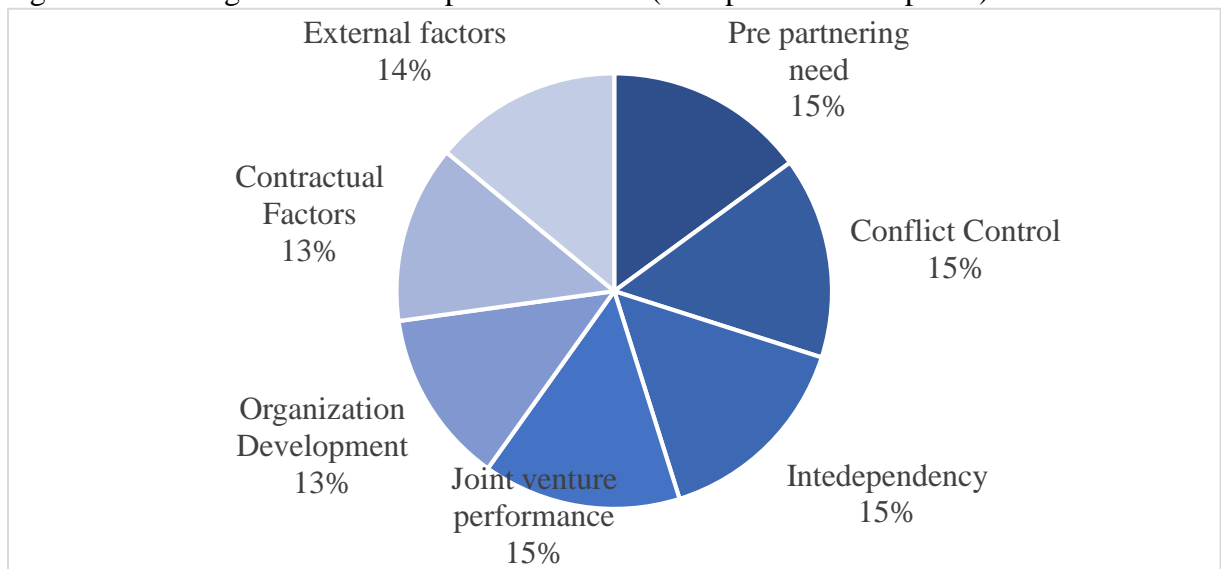


Figure 8 Pie Chart of Literature score for each category

3.7. Pilot Survey for Identification of Factors and Weights of Categories

Result of Preliminary survey have been shown in the tables in Chapter 3 part a and b, with the survey score result from 20 experts of the field and details have been provided in the previous chapter. Further categories have been given weights as per the survey score also shown in the pie chart below.

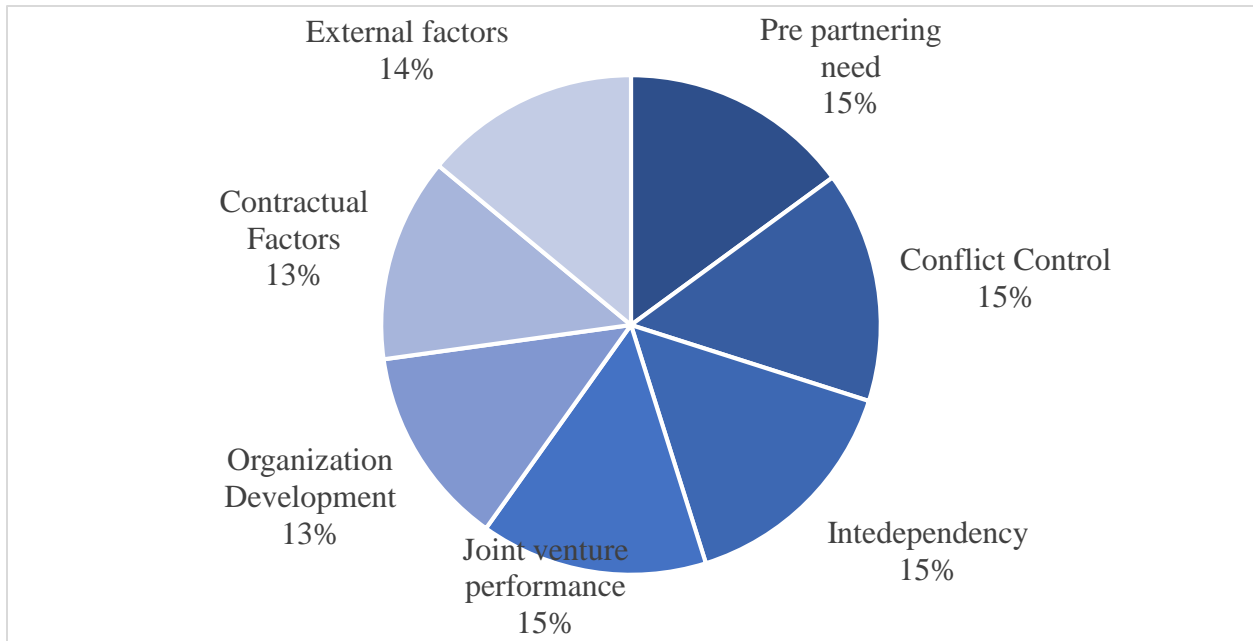


Figure 9 Pie Chart of Survey score for each category

3.8. Spearman's Rank Correlation Test

Spearman's Rank correlation coefficient is being used only to distinguish and analyze the type of a relationship between two random sets of information during study. It is used for logic and fact based strategy to help demonstrating or discrediting a theory. The equation utilized to calculate

$$r_s = 1 - \frac{6 \sum D^2}{n(n^2 - 1)}$$

Spearman's Rank is appeared below:

Where r = spearman's co-efficient

d = difference in ranks

n = number of samples

Table below demonstrates the spearman test regarding the ranking of criteria.

Table 10 Application of Spearman's Correlation Test

Sr no	Categories	Factors	Abbr.	Ranking by Survey	Ranking by Literature	Difference	D ²
1	Pre partnering need	Selection of right partner	PS	3	3	0	0
		Partner's Experience of Local Industry	PEL				
		Company size compatibility	SC				
		Financial Stability	FS				
2	Conflict Control	Mutual dispute resolution	MDS	2	1	1	1
		Trust among partners	TP				
		Clearly defined goals between partners	DG				
3	Interdependence	Mutual Understanding	MU	1	2	-1	1
		Long Term Orientation towards JV	LTO				
		Cooperation among partners	CP				
		Commitment to objectives	CO				
4	Joint venture performance	Timely Responsiveness	TR	4	4	0	0
		Monitoring and performance control	MPC				
		Shared corporate Culture	SCC				
		Measuring Project Outcomes	MPO				
5	Organization Development	Support by Top management of Stakeholders	STM	5	5	0	0
		Knowledge transfer and Innovation	KTI				
		Team building	TB				
6	Contractual Factors	Fair contract implementation among partners	FCI	6	6	0	0

		Equity Control among partners	EC				
		Fair risk allocation	RA				
7	External factors	Location of the project	LO	7	7	0	0
		Adequate Resources for project	ARP				
		Supplier and Subcontractor selection criteria	SSC				
		Autonomy of joint venture	AJV				
		Sum					2
		Sumx6					12
		n3 -n					336
		(Sum X 6) / (n3 -n)					0.035714
		r					0.964286

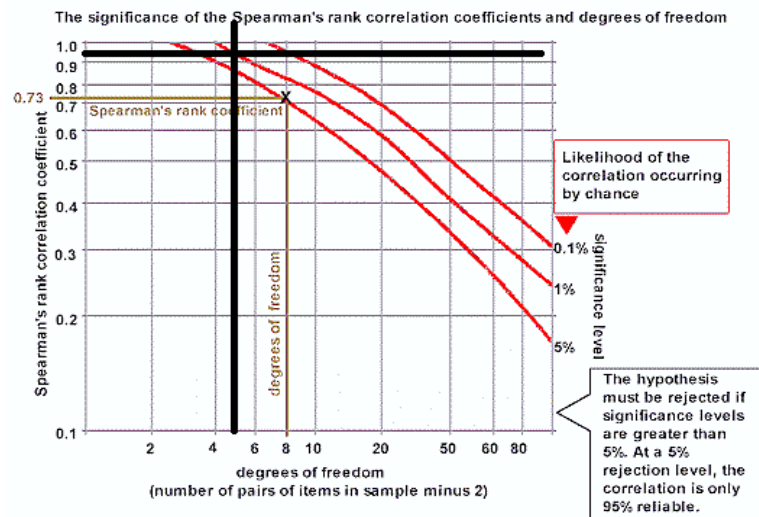


Figure 10 Spearman's Correlation Test - Significance against degree of Freedom

Using the above equation, the value of 'r' comes out to be .9642 up to 4 decimal places or .96 up to 2 decimal places.

Significance of 'r' value:

To see if this r value is significant, a Spearman's Rank significance graph must be used. Degree of freedom is calculated in order to do this.

Degree of freedom = n-2

In this example: 7-2 = 5

Using this number and your value 'r' you can use the table below to work out the significance level of data (the green lines).

As it can be seen from Figure above that the black line meets the red line at 1% significance level, this means that there is around 99% chance that the relationship is significant and not random. The percentages from literature and pilot survey show a slight variation in ranking of criteria. The Spearman test is performed to measure the significance of data. After performing the test, it has been confirmed that both ranking of criteria from literature and pilot survey are significant.

3.9. Total Criteria Score

The ranking from both literature and survey show some similarities and differences at various points. Therefore, spearman correlation test has been performed that has shown that our results are significant. To get a clear picture of criteria, a cumulative score is taken by multiplying the score from literature and survey.

Total Criteria Score (T.C.S) = L.S x S.S: Where: T.F.S = Total factor score, L.S = Score from Literature, S.S = Score from Survey.

As a result of the combined score the ranking of criteria that significantly affecting the decision making are identified (Hasnain, 2015). The ranking of criteria along with their total score as table shown below.

Table 11 Total Score for Criteria

Sr no	Categories	Factors	Abbreviations	Percentage Score for Literature	Percentage for Survey Score	Total Score
1	Pre partnering need	Selection of right partner	PS	11.58%	13.91%	1.61%
		Partner's Experience of Local Industry	PEL			

		Company size compatibility	SC			
		Financial Stability	FS			
2	Conflict Control	Mutual dispute resolution	MDS	25.98%	13.94%	3.62%
		Trust among partners	TP			
		Clearly defined goals between partners	DG			
3	Interdependency	Mutual Understanding	MU	39.17%	21.10%	8.26%
		Long Term Orientation towards JV	LTO			
		Cooperation among partners	CP			
		Commitment to objectives	CO			
4	Joint venture performance	Timely Responsiveness	TR	10.10%	13.69%	1.38%
		Monitoring and performance control	MPC			
		Shared corporate Culture	SCC			
		Measuring Project Outcomes	MPO			
5	Organization Development	Support by Top management of Stakeholders	STM	6.36%	12.05%	0.77%
		Knowledge transfer and Innovation	KTI			
		Team building	TB			
6	Contractual Factors	Fair contract implementation among partners	FCI	5.84%	12.29%	0.72%
		Equity Control among partners	EC			
		Fair risk allocation	RA			
7	External factors	Location of the project	LO	0.97%	13.03%	0.13%
		Adequate Resources for project	ARP			
		Supplier and Subcontractor selection criteria	SSC			
		Autonomy of joint venture	AJV			

3.10. Prioritization of Critical Success factors (CSFs) for Joint Venture between Local and Chinese Firms in Pakistan's Construction Industry

A hierarchy can be formulated using the analysis done till this process enhanced thought proces, recollection and specially using people's perception (Saaty, 2004). Now after putting forward the objective of the think about, related criteria and sub-criteria distinguished in prior stages were organized into a hierarchal shape beginning at the beat with the objective and different criteria and sub-criteria in consequent levels (Saaty, 2004). Saaty moreover suggested the methods for the determination of distinctive levels of criteria and improvement of various leveled structure. With the assistance of these rules, an AHP framework is constituted to achieve the objective of think about. Figure underneath illustrates a three-level choice progression joining these criteria and sub-criteria.

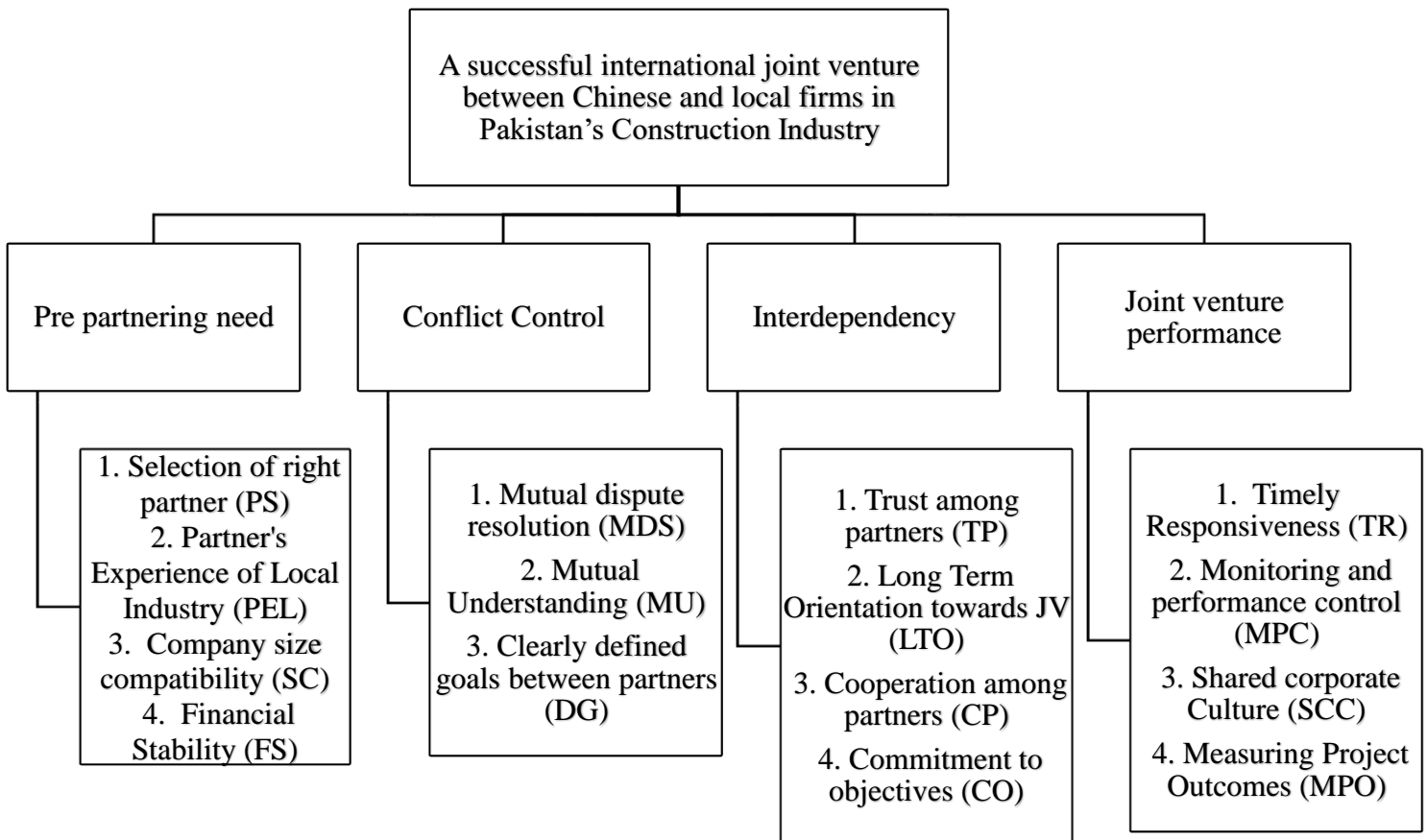


Figure 11 An AHP based model for prioritization of Critical Success factors for International Joint venture Between local and Chinese Firms in Pakistan

4. RESULTS AND ANALYSIS

4.1. Assigning Relative Weights

In analytical hierarchic process, decision factors are compared with each other by allotting a weight to their relative importance. A comparison matrix is to be established after hierarchy is clear for a three-stage model. This matrix is a priority statement from the individual experts. The experts evaluated the relative importance of all the criteria and sub-criteria. All field experts were asked to relatively compare the criteria and factors keeping consistency in mind by allotting a relative value on a 9-point scale proposed by Saaty (1988), keeping goal or objective of the model in mind. The comparison is based on the relative importance of ‘ith’ factor over the ‘jth’ factor. The outcome of this pairwise comparison was a positive reciprocal matrix, where the diagonal $a_{ii} = 1$, and another factor has the reciprocal property. For example, if factor ‘i’ is “*p*-times” important than Factor ‘j’, then according to the rule of reciprocity, factor ‘j’ is “ $1/p$ times” more important than Factor ‘i’. The comparison done on the 1-9 scale has two features. First, it provides a specific range of comparison, and second, people have enough thoughtfulness to differentiate between two points. The 1-9 scale is used to come out with the relative importance of a pair of factors.

Table 12 Scoring Values for AHP based survey

Intensity of Importance	Definition
1	Equal Important
3	Somewhat more Important
5	Much More Important
7	Very Much More Important
9	Absolutely More Important
2,4,6,8	Intermediate Values

4.2. Preliminary survey

Preliminary survey was done from within Pakistan’s Construction industry and it was done through individual experts which are or have been involved in projects with a Joint venture between Local and a Chinese firm working on a construction project within Pakistan. This reduced the population

size and sample size was subjected to the same restricted specialized group of experts with condition. Questionnaire was prepared online and also in handwritten form for purpose of this survey.

4.3. Sample Size

Primary survey through individual experts which are or have been involved in projects with a Joint venture between Local and a Chinese firm working on a construction project within Pakistan was done with an unknown population size. Purposive sampling method was applied, and respondents were selected based on their past experience related to working as a party in International joint venture between local and Chinese construction firms because of limited stakeholders related to Joint venture between local and Chinese construction firms (Kim, Lee and Choi, 2018). Purposive sampling, also called or can be defined as judgmental, selective or subjective sampling. Purposive sampling is a kind of non-probability sampling in which researchers rely on their own judgment when choosing members of the population to participate in their study.

Also taking the research done previously related to AHP based priority model of factors related to success of Joint ventures, number of respondents have been very low due to lengthy AHP based survey and limited number of stakeholders related to International joint ventures (in some cases). As a research by (Gudiene *et al.*, 2014) “Identification and evaluation of the critical success factors for construction projects in Lithuania: AHP approach”, response from only 5 experts was used with more than 10 years of experience. In another study by (Hasnain, 2015), 36 field experts with experience of more than 5 years were approached for finalization of AHP based survey with topic of “Best-Value Contract Award Mechanism : A multi- criteria decision making model for construction projects” based in Pakistan.

In a study by (Melillo and Pecchia, 2016) with topic “WHAT IS THE APPROPRIATE SAMPLE SIZE TO RUN ANALYTIC HIERARCHY PROCESS IN A SURVEY-BASED RESEARCH” it was deduced that “The simulation showed that the sample size needed to achieve a margin error of 5% with an alpha level of 0.05 varied according to the expected weights from 19 to more than 400 subjects. Smaller sample sizes were required in case of equally important alternative (e.g. with expected weight of 0.333 for all the three alternative the required sample size is 19; with expected

weight of 0.058 for alternative A, 0.278 for alternative B, 0.663 for alternative C a sample size larger than 400 is required)". Based on this study, it was deduced that surveys ranging from 40 to 70 were basic requirement for our study as the expected difference between factors and categories.

Based on the aforementioned references, detailed AHP based survey and use of purposive sampling because of limited stakeholders, 62 consistent responses were received from construction industry of Pakistan from experts who have been involved in International Joint venture between Local and Chinese Contractor.

4.4. Respondents Characteristics

Characteristics of the respondents can be defined following categories.

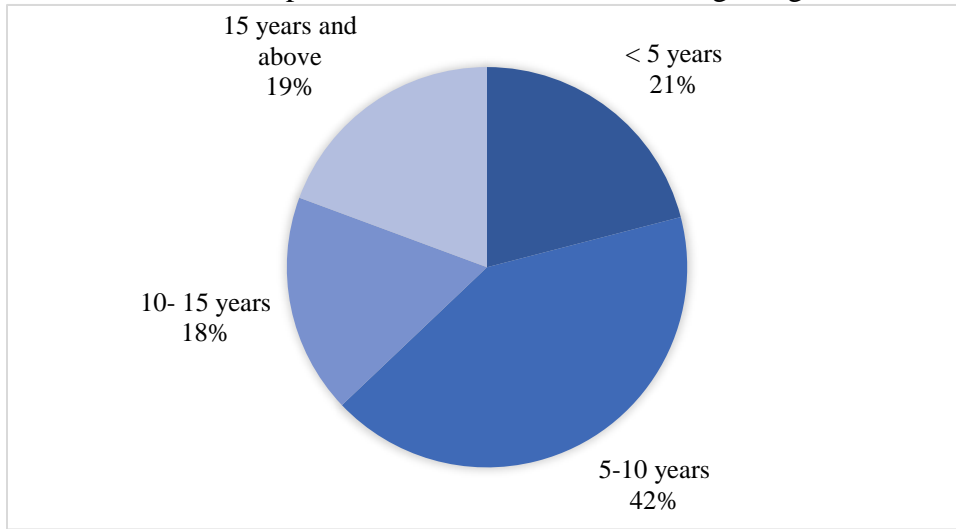


Figure 12 Experience of Respondents in Primary Survey

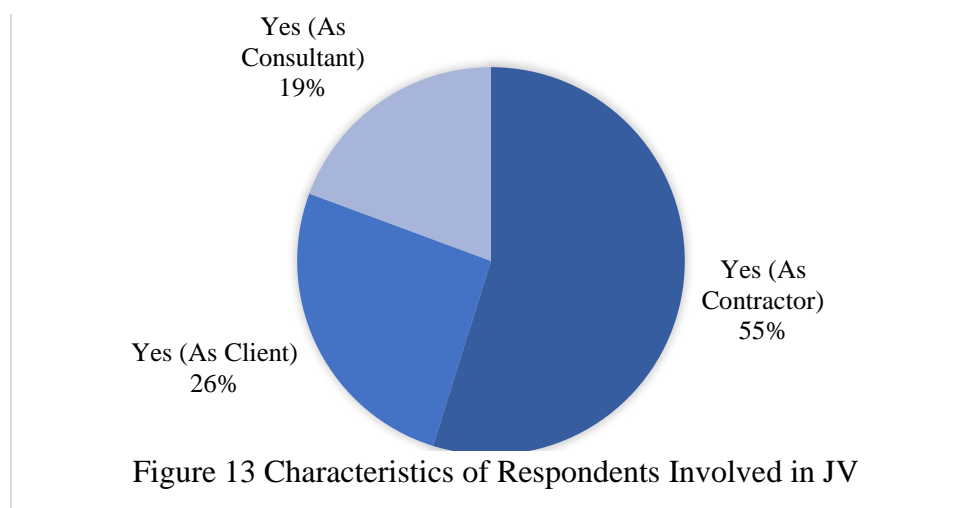


Figure 13 Characteristics of Respondents Involved in JV

4.5. Application of Geometric mean method

Next problem which needed to be resolved was that how to take an average response matrix from all responses collected from respondents. For that purpose, weighted geometric mean prioritization method for data aggregation was used which one of the most popular method of data aggregation in literature using AHP. (Dong et al., 2010).

$$\left(\prod_{i=1}^N x_i \right)^{1/N} = \sqrt[n]{a_1 a_2 \cdots a_n}$$

4.6. Pairwise comparison of Criteria Matrix

The pairwise comparison of all four criteria of this study with respect to the goal that is prioritization of critical success factors for International Joint venture between local and Chinese contraction firms is carried out. It highlights the relative importance of each criteria against the goal of the model. The synthesized matrix is shown in Table below.

Table 13 Pairwise Comparison Matrix for Category Comparison

Consistency Ratio: 0.004497664	Pre partnering Need	Conflict Control	Interdependence	JV performance
Pre partnering Need	1	0.985579978	1.3382795	0.46519869
Conflict Control	1.014631002	1	1.4870132	0.58100381
Interdependence	0.747228078	0.672488977	1	0.47823888
JV performance	2.149619144	1.721159124	2.0910052	1

4.7. Pairwise Comparison of Factors

There are factors in each category which are to be prioritized based on AHP preliminary survey have been put in a pairwise matrix form using geometric method against each category as per the hierarchy below.

Table 14 Pairwise Comparison Matrix for factors within Category "Pre Partnering Need"

Consistency Ratio : 0.006695622	Selection of Right Partner	Partner's Experience of Local Industry	Company size compatibility	Financial Stability
Selection of Right Partner	1	1.44693975	1.9778381	0.42876211
Partner's Experience of Local Industry	0.691113782	1	1.5484114	0.42206928
Company size compatibility	0.505602553	0.64582319	1	0.31110982
Financial Stability	2.332295659	2.36927931	3.214299	1

Table 15 Pairwise Comparison Matrix for factor within Category "Conflict Control"

Consistency Ratio: 0.00034	Mutual dispute resolution	Mutual Understanding	Clearly defined goals between partners
Mutual dispute resolution	1	0.935496203	1.37744536
Mutual Understanding	1.068951426	1	1.37625539
Clearly defined goals between partners	0.725981608	0.726609327	1

Table 16 Pairwise Comparison Matrix for factor within Category "Interdependence"

Consistency Ratio: 0.006111994	Trust among partners	Long Term Orientation towards JV	Cooperation among partners	Commitment Towards Objectives
Trust among partners	1	1.72234661	1.8817122	0.59108278
Long Term Orientation towards JV	0.580603229	1	1.1615392	0.53013527
Cooperation among partners	0.531430894	0.86092662	1	0.37218922
Commitment Towards Objectives	1.691810397	1.88631102	2.6868054	1

Table 17 Pairwise Comparison Matrix for factor within Category "Joint Venture Performance"

Consistency Ratio: 0.008335058	Timely Responsiveness	Shared corporate Culture	Monitoring and performance control	Measuring Project Outcomes
Timely Responsiveness	1	1.46502932	1.66944472	0.500286612
Shared corporate Culture	0.682580193	1	1.12920363	0.513717137
Monitoring and performance control	0.599001564	0.88557987	1	0.464320958
Measuring Project Outcomes	1.998854207	1.94659654	2.15368267	1

4.8. Normalized Matrices

Normalization is a procedure of computing numbers that put into consideration the general numbers/ values. Normalized matrix is formulated in two stages: First is the summation of each column of the reciprocal matrix. Then we divide each element of matrix with the sum of its column and obtain a normalized matrix. The sum of each column is 1. This matrix of criteria and factors as per the initial hierarchy are as follows based on pairwise comparison matrices:

Table 18 Normalized Matrix for Category Comparison

Consistency Ratio: 0.004497664	Pre partnering Need	Conflict Control	Interdependence	JV performance
Pre partnering Need	0.20360469	0.225057923	0.2262022	0.18427787
Conflict Control	0.20658363	0.228350746	0.2513418	0.23015144
Interdependence	0.152139141	0.15356336	0.1690246	0.18944345
JV performance	0.437672539	0.39302797	0.3534314	0.39612724

Table 19 Normalized Matrix for factor within Category "Pre Partnering Need"

Consistency Ratio: 0.006695622	Selection of Right Partner	Partner's Experience of Local Industry	Company size compatibility	Financial Stability
Selection of Right Partner	0.220798709	0.26490819	0.2555165	0.19832274
Partner's Experience of Local Industry	0.152597031	0.1830817	0.200039	0.19522699
Company size compatibility	0.111636391	0.11823841	0.1291898	0.143903
Financial Stability	0.51496787	0.43377169	0.4152547	0.46254727

Table 20 Normalized Matrix for factor within Category "Conflict Control"

Consistency Ratio: 0.00034	Mutual dispute resolution	Mutual Understanding	Clearly defined goals between partners
Mutual dispute resolution	0.357790326	0.351412141	0.36695663
Mutual Understanding	0.382460479	0.375642509	0.36663961
Clearly defined goals between partners	0.259749196	0.27294535	0.26640376

Table 21 Normalized Matrix for factor within Category "Interdependence"

Consistency Ratio: 0.006111994	Trust among partners	Long Term Orientation towards JV	Cooperation among partners	Commitment Towards Objectives
Trust among partners	0.262891923	0.31489534	0.2795983	0.23705826
Long Term Orientation towards JV	0.152635899	0.18282925	0.1725898	0.21261479
Cooperation among partners	0.13970889	0.15740257	0.1485872	0.14926932
Commitment Towards Objectives	0.444763288	0.34487283	0.3992248	0.40105763

Table 22 Normalized Matrix for factor within Category "Joint Venture Performance"

Consistency Ratio: 0.008335058	Timely Responsiveness	Shared corporate Culture	Monitoring and performance control	Measuring Project Outcomes
Timely Responsiveness	0.233621063	0.27656644	0.28046907	0.201864837
Shared corporate Culture	0.15946511	0.18877877	0.1897078	0.207284032

Monitoring and performance control	0.139939382	0.16717868	0.16800141	0.187352753
Measuring Project Outcomes	0.466974445	0.36747611	0.36182172	0.403498378

4.9. Local and Global Weightages Analysis

As we have completed the pairwise matrices and normalization of matrices for both criteria and factors within them, next step is now to calculate the local weights of each criteria and factors within each criterion.

We can define local weights by comparative weightage of the item with reference to the element that is available at just above its hierarchic level.

By calculation of the comparative value with reference to the immediate above level in hierarchy is main aspects to be focused on by the decision maker for identification of comparative value of each element with reference to the goal of the priority model. These values are global weightages (Saaty, 2004).

Global priorities for any hierarchical elements are calculated by weighing their local priorities by the global priorities assigned to the elements they originate from (i.e. at the preceding level), called their parents (Davies, 1994).

4.10. Ranking the criteria and sub-criteria:

To clearly distinguish the effect of all basic victory variables on the objective or objective of the pecking order show, it is vital to improve the basic victory variables within the decreasing order arrange since it'll be simple for the choice producers to distinguish which components are influencing the choice making most essentially.

Criteria and factors against each criterion have been subjected to the statistical analysis for AHP methodology using consistency method. Using the pairwise comparison matrix and normalized

matrix, factors have been given local and global weightages. However conditional check for global weights is that the sum should be equal to 1 for global weights of all factors.

Furthermore, these local and global weightages are used for calculation of consistency against each matrix. Now as defined above, the priority weights of factors are shown in Table below. Also the factors are prioritized as per the local weights in each category.

Table 23 Composite priority weights for criteria and factors

Sr no	Categories	Local Weight of Criteria	Factors	Local Weights	Global Weights
1	Pre partnering need	0.2098	Financial Stability	0.4566	0.0958
			Selection of right partner	0.2349	0.0493
			Partner's Experience of Local Industry	0.1827	0.0383
			Company size compatibility	0.1257	0.0264
2	Conflict Control	0.2291	Mutual Understanding	0.3749	0.0859
			Mutual dispute resolution	0.3587	0.0822
			Clearly defined goals between partners	0.2664	0.0610
3	Interdependency	0.1660	Commitment to objectives	0.3975	0.0660
			Trust among partners	0.2736	0.0454
			Long Term Orientation towards JV	0.1802	0.0299
			Cooperation among partners	0.1487	0.0247
4	Joint venture performance	0.3951	Measuring Project Outcomes	0.3999	0.1580
			Timely Responsiveness	0.2481	0.0980
			Monitoring and performance control	0.1863	0.0736
			Shared corporate Culture	0.1656	0.0654

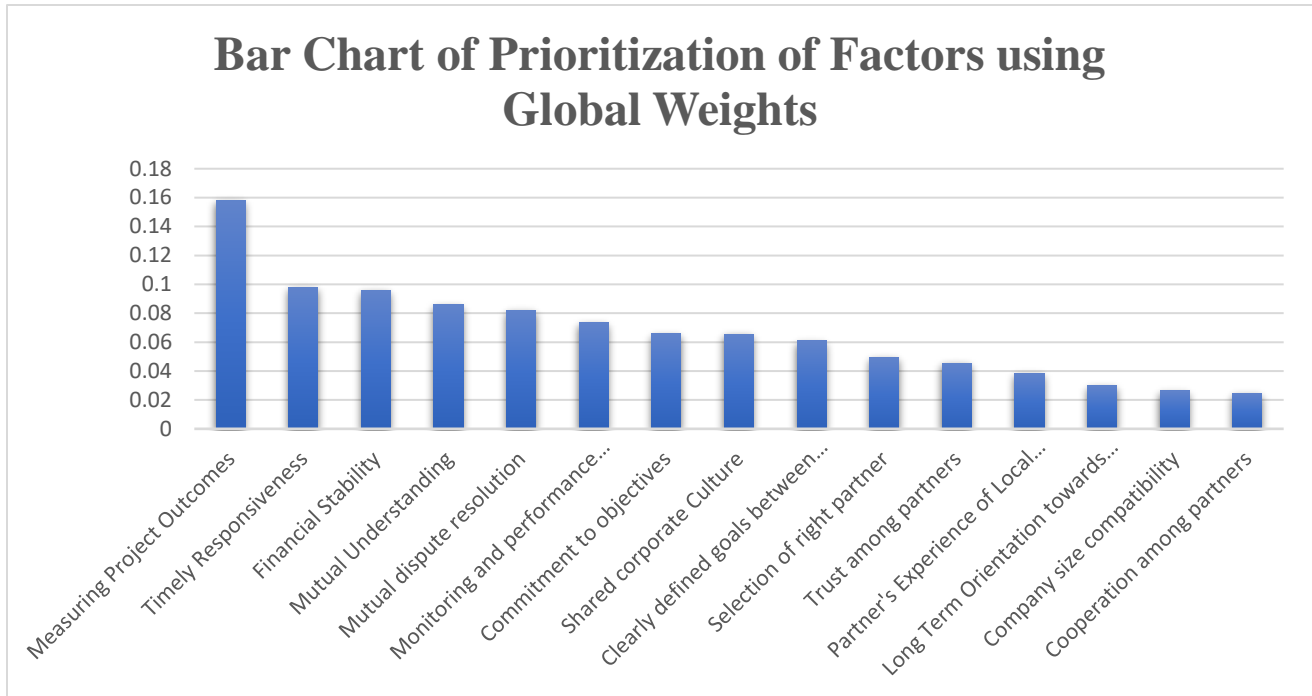


Figure 14 Bar Chart of Prioritization of Factors using Global Weights

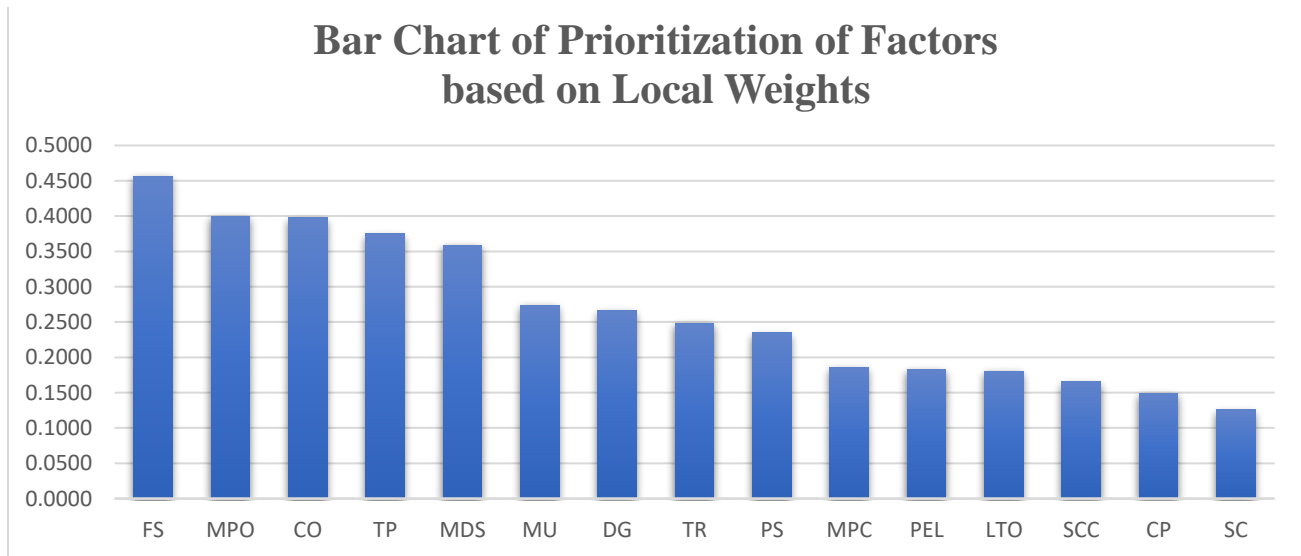


Figure 15 Line Chart for Prioritization of Factors using Local Weights

In this research we have used the Analytical hierarchic process method for development of a model for prioritization of critical success factors for a successful international joint venture between local and Chinese construction firms in Pakistan’s Construction Industry. For this purpose, analytical hierarchy process is used to rank those factors by comparing their significance upon each other. This technique seems to accomplish sophisticated results that are based purely on the

assignation of experts of the absolute priorities of each criterion. The priorities of Factors are shown in following chart:

4.11. Sensitivity Analysis

“AHP sensitivity analysis is to explore how sensitive the rankings of the most criteria and their related sub-criteria are to alter in case the weights of the criteria and its related sub-criteria

Table 24 Change in Ranks of Factors using Sensitivity Analysis

Sr no	Categories	Local Weight of Criteria	Factors	Abbreviations	Local Weights	Global Weights	Old Rank	Increased By	New Weight	New Rank
1	Pre partnering need	0.209786	Selection of right partner	PS	0.235	0.049	10	0.025	0.074	7
			Partner's Experience of Local Industry	PEL	0.183	0.038	12	0.025	0.063	11
			Company size compatibility	SC	0.126	0.026	14	0.025	0.051	12
			Financial Stability	FS	0.457	0.096	3	0.025	0.121	2
2	Conflict Control	0.229107	Mutual dispute resolution	MDS	0.359	0.082	5	0.033	0.115	3
			Mutual Understanding	TP	0.375	0.086	4	0.033	0.119	2
			Clearly defined goals between partners	DG	0.266	0.061	9	0.033	0.094	6
3	Intedependency	0.166043	Trust among partners	MU	0.274	0.045	11	0.025	0.070	8
			Long Term Orientation towards JV	LTO	0.180	0.030	13	0.025	0.055	11
			Cooperation among partners	CP	0.149	0.025	15	0.025	0.050	12
			Commitment to objectives	CO	0.397	0.066	7	0.025	0.091	4
4	Joint venture performance	0.395065	Timely Responsiveness	TR	0.248	0.098	2	0.025	0.123	2
			Monitoring and performance control	MPC	0.186	0.074	6	0.025	0.099	3
			Shared corporate Culture	SCC	0.166	0.065	8	0.025	0.090	5
			Measuring Project Outcomes	MPO	0.400	0.158	1	0.025	0.183	1

are subjected to alter, to realize that, the percentages of each main criteria is aiming to be increased by 10% and after, that for the sub-criteria, it is getting to be disseminated equally so that the full whole is kept up adjusted, and at long last figure out the changes in positioning. It is worth saying that, in sensitivity examination, one figure is changed at a time whereas the other variables are remained unaltered to see what the impacts or changes would happen to this particular primary basis and its related sub-criteria” (Sulistio *et al.*, 2018).

As show in the table above, by changing or increasing the percentages/ weights of each factor by 10 percent, we have deduced the new ranks for these factors. This shows that variation by 10 percent can change the ranking order quite significantly. As this much change in response of respondents is highly likely so it might be considered for our research.

4.12. Priority Model for Critical Success factors for IJV between local and Chinese firms in Pakistan's Industry based on the AHP Based survey

After detail Analytical heirarchic Process, we have based on the local weights of factors in each criteria and global weights of criteria, a Priority Model for Critical Success factors for IJV between local and Chinese firms in Pakistan's Industry as below. Based on this model the most important

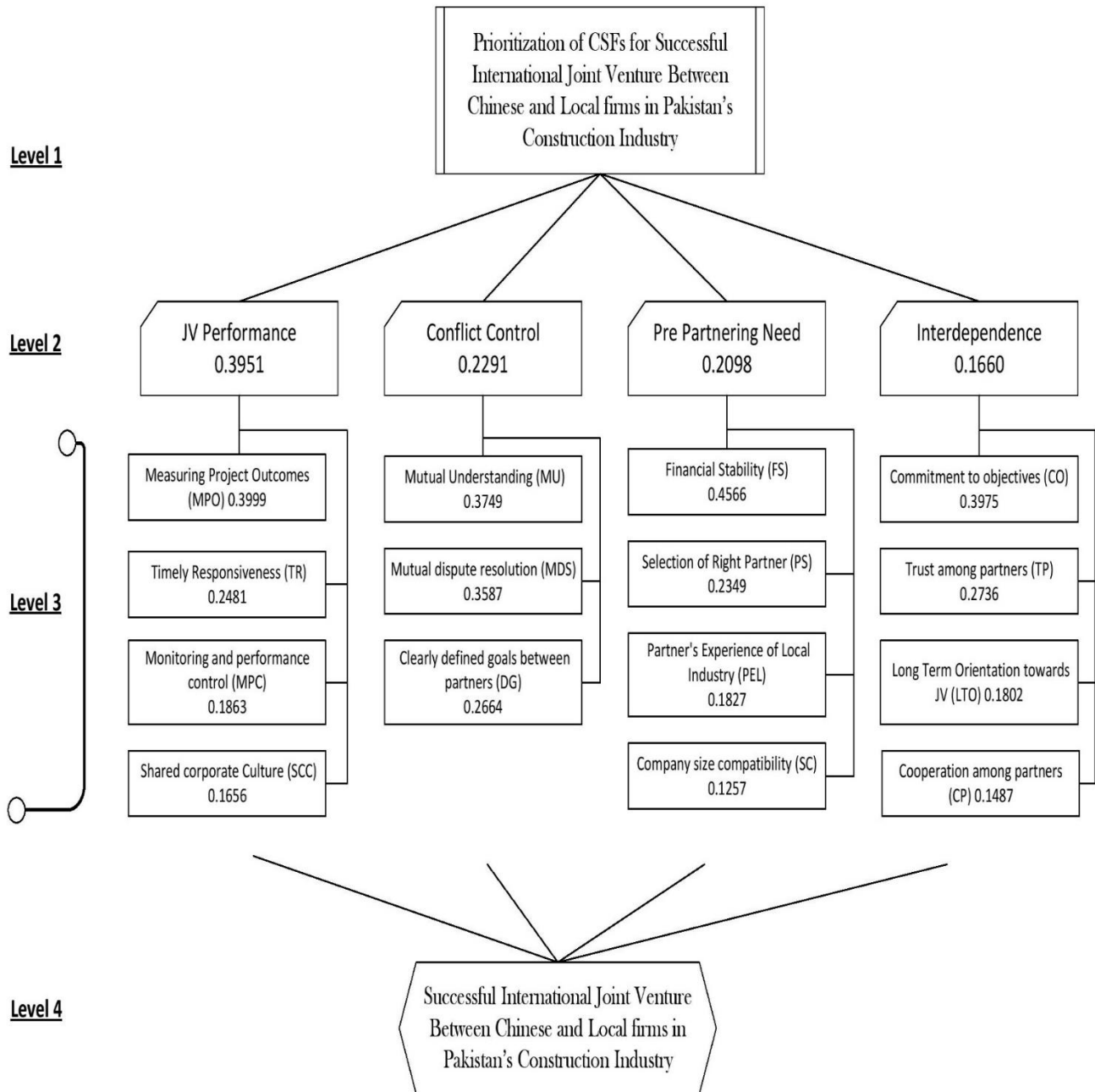


Figure 16 Priority Model for Critical Success factors for IJV between local and Chinese firms in Pakistan's Industry based on the AHP Based survey

factor criteria for a successful joint venture between local and chinese firm is “Joint venture Performance” following “Conflict Control”, “Pre partnering need” and “Interdependence” respectively. Further in the Joint venture performance criteria, factors which are the most important are “Measuring Project Outcomes”, “Timely Responsiveness”, “Monitoring and Performance Control” and “Shared Corporate Culture” in the order. Further in criteria “Conflict Control”, factors in order of importance are “Mutual Understanding”, “Mutual Dispute Resolution” and “Clearly defined goals between partners”. In the criteria of “Pre partnering need”, we have “Financial Stability”, “Selection of Right Partner”, “Partner’s Experience of Local Industry” and “Company Size Compatibility” in order of priority as factors. Final criteria is “Interdependence” in which factors are “Commitment to objective”, “Trust Among partners”, “Long term orientation towards JV” and “Cooperation among partners” in order of priority.

4.13. Validation of Model

For Validation of the priority model developed for CSFs and Categories was further validated for reliability check of collected responses. When dealing with an AHP based survey, only consistent responses are taken under considering which is a precision and accuracy test in itself taken as initial validation of data (Saardchom, 2012). Further after statistical analysis of 80 percent of responses, mean response matrix became consistent which shows that deep saturation was achieved which is one of the validation techniques showing that adequate data has been received for detailed analysis (Saunders et al., 2018). However using respondent validation technique, 8 expert from field were approached which included program manager of major CPEC projects, CEO of major local contractor firm, Project manager from Chinese firms and few other field experts, for validation of the model and their opinion on it which is further discussed in the discussion section (Birt et al., 2016).

4.14. Discussions

As shown in the figure 19, priority model shows the criteria with highest weightage at the top. Local weightages of CSFs in each category is also shown and CSFs are arranged in descending order based those weightages. With the inflow of foreign investment due to introduction of CPEC

created a platform for infrastructure development projects to reach its boom for public development.

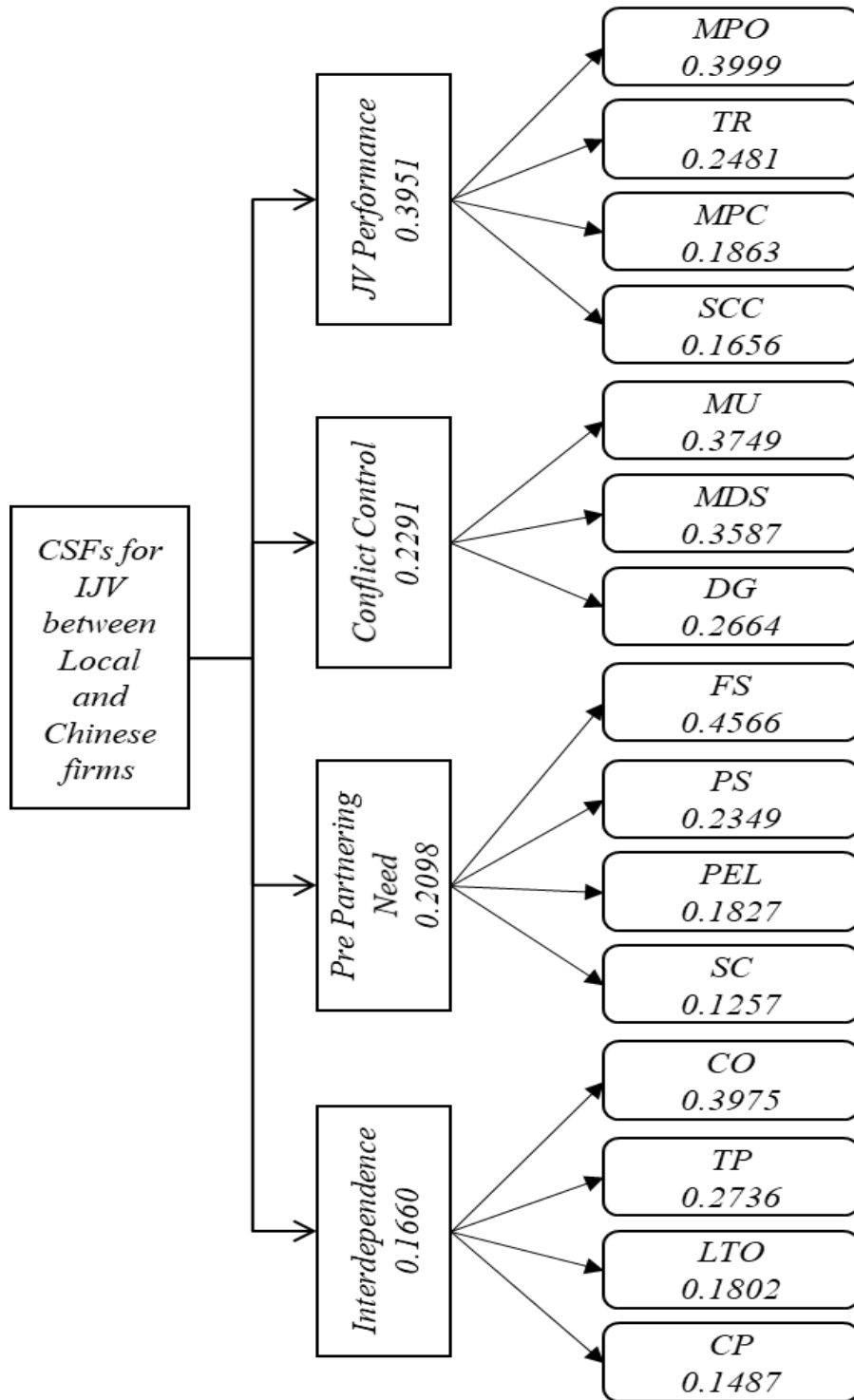


Figure 17 AHP based Priority Model: CSFs for IJV in Pakistan b/w Chinese and Local firms

During validation of the model and detail analysis by experts specially involved in those projects, they highlighted several points of views regarding industry's trend for improvement. They also elaborated the importance of this model for local firms in Pakistan for their individual strengthening. The Program Manager of six major CPEC projects highlighted the fact that communication and coordination between partners for timely response is the key for effective project progress. Timely responsiveness in our model has second highest global weightage. Forecasting the project outcomes and their proactive measurement can provide a comparison of project progress by each individual partner at a specific stage. Measuring project outcomes has the highest global weightage when it comes to successful partnership. As informed by General Manager of a CPEC motorway project, major delay in project was because of financial constraints of both local and Chinese contractor (which were in a Joint venture). Contractors continuously tried to get secured advance from client even with no provision in contract agreement of the project because of financial instability. This shows that having a strong financial strength can provide a solid platform for both partners to exercise their strength in project at hand. Financial stability of other firm while selection of appropriate partner for JV is considered to be one of the most important CSFs as per our research. Even with perfect working conditions, in a JV, partners can have difficulty in practical execution of the project because of lack of understanding. Mutual understanding and monitoring of performance by both parties is a major requirement of successful completion of project at hand. As this model was presented for review of CEO of a local contractor firm who have worked with several Chinese firms in joint ventures in Pakistan. His major concern was that local contractors tends to ignore the need of proper research towards background and experience of Chinese firms in local industry, before advancing towards partnership. He further reiterated that local contractors leap towards partnership with Chinese firms with largest setup within Pakistan for taking up large projects. This practice leads to devastating results because of difference in financial capabilities, management, approach and process of both firms. This problem was identified as keeping company size compatibility a serious concern for selection of right partner for Joint venture. When discussing the priority model with a project manager working for CCCCL (China Communication and Construction Company Ltd.) in Pakistan, a Chinese based company, he identified that managing conflicts beforehand is their top priority when they do consortium with a local firm. With proper provision of dispute resolution methods and clear goals of individual partner can lead to an undisputed partnership till the completion of project. However,

better dispute resolution methods provide a platform for better understanding between partners. Validation process of the AHP based priority model for CSFs has proved that major concerns of field experts have been addressed in our model for practical implementation in the construction industry.

5. CONCLUSION AND RECOMMENDATIONS

5.1. Introduction

This research has achieved its goal by identifying the main CSFs for successful IJV in Pakistan's Construction Industry between local and Chinese firms and it also calculated a rank for each main category and each CSFs with the help of AHP tool and technique. There is an indeed necessity to identify and prioritize the CSFs for successful IJV in Pakistan. Following are the conclusion and recommendations with reference to the completed research.

5.2. Conclusion

It provides practitioners with a tool to evaluate and prioritise Critical success factors for IJV between local and Chinese firms working in Pakistan

Pair-wise comparison based on AHP used in this research reduces the dependency of priority model on the human judgment, in another way of describing it; a model provides more precise results when factors are compared based on their goal rather than independent judgment. Consistency test of AHP provides an accurate evaluation procedure, which allows decision makers to re-evaluate their judgments. Following are the few recommendations from this research:

5.3. Recommendations

Decision makers in Pakistan especially who are a stakeholder in IJVs between local and Chinese firms, are recommended to use the results of this research in any future development plan for the ICT sector.

This priority based heirarchic model can be used in the evaluation and ranking of CSFs for International joint ventures between local and other foreign firms as this study was limited to IJVs with Chinse firms.

As criteria with most weightage is JV performance, followed by conflict control, pre partnering need and interdependence, should be focused on by clients and consultants in IJVs for monitoring of IJV.

To increase the effectiveness of this study, in future it is a theoretical recommendations that other multi criteria decision making techniques may be used in prioritization and ranking the CSFs for IJVs in Pakistan's Construction industry and compare their results to this research results.

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APPENDIX 1

Critical Success Factors for Joint Venture Between Chinese and Local Firms in Pakistan's Construction Industry

Respected Sir/Madam,

This questionnaire survey is a part of my MS thesis research titled "Critical success factors for Joint Venture - between Local and Chinese firms - in Pakistan's Construction Industry". The main objective of this survey study is to **Prioritize different criteria and critical success factors within those criteria among each other** for a successful joint venture between local and Chinese firms in Pakistan.

Regard,

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Personal Information

This section of survey deals with personal information of the respondents. Please be assured that your personal data and information will only be used for study purpose and no personal information will be disclosed and shared at any forum.

➤ **Name and Email address**

➤ **Name of Organization and Position Title**

➤ **Please indicate your organization type**

Client

Design/ Supervision Consultant

Contractor

Other: _____

➤ **Please indicate your field of work**

- Contracts Management
- Building design
- Infrastructure management
- Construction management
- Quantity surveying
- Engineering
- Site execution
- Project management
- Construction Consultancy
- Other: _____

➤ **Construction industry experience**

- 0 to 1 years
- 1 to 5 years
- 5 to 10 years
- 10 to 15 years
- 15 years and more

➤ **Highest academic qualification**

- Diploma / B-Tech
- Bachelors
- Masters
- Doctorate

➤ **Have you been involved in the Joint Venture of a local and Chinese firm in Pakistan's Construction Industry?**

- Yes (As Client)
- Yes (As Consultant)
- Yes (As Contractor)
- No
- Yes (As any other Stake Holder: _____)

Prioritization of Criteria & Factors for Successful Joint Venture between Local and Chinese Firms in Pakistan’s Construction Industry

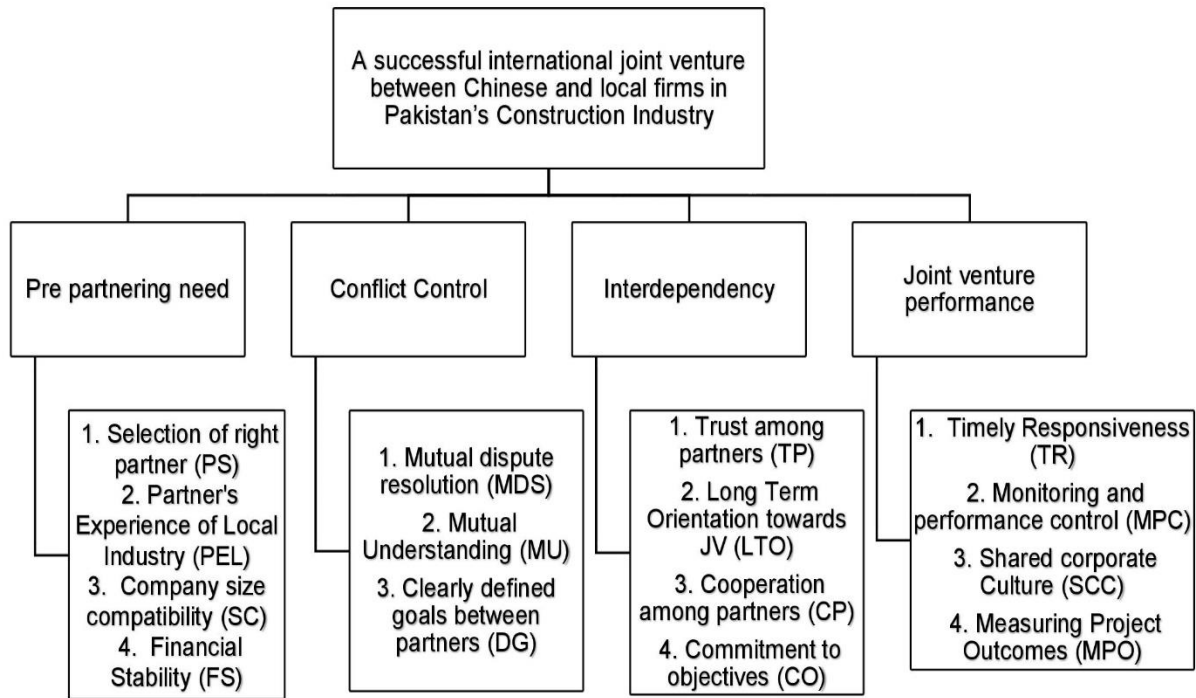
In this section respondents based on their professional experiences and knowledge are required to rate importance of **Critical Success factors for a Joint Venture between Local and Chinese firms in Pakistan’s Construction Industry.**

The scales of comparison have been shown in following table:

Table: Scales of Comparison

Explanation	Numeric Values
If Option A and Option B are equally important:	1
If Option A is moderately more important than option B	3
If Option A is strongly more important than option B	5
If Option A is very strongly more important than option B	7
If Option A is extremely more important than option B	9
Use even numbers for intermediate judgements	2, 4, 6, 8

Using the scale from 1 to 9 (where 9 is extremely important and 1 is equally important), please indicate the relative importance of options A (left column) to options B (right column).



Criteria Comparison

Option A	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Option B
Pre-Partnering Need																		Conflict Control
Pre-Partnering Need																		Interdependence
Pre-Partnering Need																		Joint Venture Performance
Conflict Control																		Interdependence
Conflict Control																		Joint Venture Performance
Interdependence																		Joint Venture Performance

1. Pre-Partnering Need (Factors)

Option A	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Option B
Selection of Right Partner																		Partner's Experience of Local Industry
Selection of Right Partner																		Company Size Compatibility
Selection of Right Partner																		Financial Stability of firms
Partner's Experience of Local Industry																		Company Size Compatibility
Partner's Experience of Local Industry																		Financial Stability of firms
Company Size Compatibility																		Financial Stability of firms

2. Conflict Control

Option A	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Option B
Mutual Dispute Resolution																		Mutual Understanding
Mutual Dispute Resolution																		Clearly Defined Goals Between Partners
Mutual Understanding																		Clearly Defined Goals Between Partners

3. Interdependence

Option A	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Option B
Trust Among Partners																		Long term Orientation Towards JV
Trust Among Partners																		Cooperation Among Partners
Trust Among Partners																		Commitment to Objectives
Long term Orientation Towards JV																		Cooperation Among Partners
Long term Orientation Towards JV																		Commitment to Objectives
Cooperation Among Partners																		Commitment to Objectives

4. Joint Venture Performance

Option A	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Option B
Timely Responsiveness																		Monitoring and Performance Control
Timely Responsiveness																		Shared Corporate Culture
Timely Responsiveness																		Measuring Project Outcome
Monitoring and Performance Control																		Shared Corporate Culture
Monitoring and Performance Control																		Measuring Project Outcome
Shared Corporate Culture																		Measuring Project Outcome