

CAPITAL UNIVERSITY OF SCIENCE AND
TECHNOLOGY, ISLAMABAD



**Assessment of Potential Effects of
China Pakistan Economic
Corridor on Development of
Pakistan's Construction Industry**

by

Aamir Shehzad

A thesis submitted in partial fulfillment for the
degree of Master of Science

in the

Faculty of Engineering

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Dedicated to my beloved family (Wife and Children) for supporting me throughout the preparation of thesis. They have suffered a lot during my study as I was unable to give them quality of family time. They have stood by me in most challenging phase of my life.



CERTIFICATE OF APPROVAL

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Abstract

Role of construction sector in development of infrastructure is inevitable. The construction industry remains the key player in achievement of basic infrastructure and ultimately in social prosperity as well as economic stability. It is one of the pillars of economy which directly related to GDP and industrial growth of Pakistan. However, current status of Pakistan construction industry is not performing to its true potential. Among many factors, the lack of foreign direct investment (FDI) is one of the key factors in such performance. The recent developments of China Pakistan economic corridor (CPEC) is one of the major sources of FDI which will provide opportunities for all sectors of the economy including infrastructure, railway, energy production, agriculture, aviation, construction industry, etc. However, the true potential remains to be explored. The current research explores the impacts of CPEC on uplift and development of construction industry of Pakistan. The objective of the study was to evaluate the impact of identified factors on local construction industry. After a comprehensive literature review, different impacts factors were identified. These factors were then categorized into different impact areas. Based upon these areas, a questionnaire was developed and authenticated by using Delphi technique. The developed questionnaires was distributed among industry professionals of different organizations to assess impact of CPEC on the factors affecting the development of Pakistan. The study received a response rate of 72%. The response of industry experts was analyzed using statistical analysis package SPSS. The application of ranking factor analysis highlighted that the development of human skill the most important factor to be affected by CPEC .Similarly, the frequency analysis observed that human skill development achieved the highest score (3.77) followed by project management practices (3.71). The overall results of this study helped to prioritize factors to support uplift the construction industry of Pakistan. These prioritized list of factors referred to the construction industry of Pakistan that has not still been established.

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Abbreviations

AFM	Access to foreign market
AIM	Adopting of innovative method
AT	Advancement in technology
CA	Contract Agreement
CB	Confidence Building
CBFL	Capacity Building of local Firms
CBLF	Capacity building of local firms
CCMP	Complexity in construction management practices
CEMRSC	Changes in execution methodology with respect to safety concerns
CMC	Construction market competitions
CMS	Construction management skills
COMM	Communication
CPEC	China Pakistan Economic Corridor
CRS	Conflict resolution skills
CS	Communication skills
CSS	Compliance to safety standard
DA	Diversity awareness
DB	Ranking Doing Business Ranking
DGP	Gross Domestic Product
DI	Design improvement
DMCP	Data management for complex projects
DSWO	Development in current project management strategies of working organizations

EG	Employability growth
EMCSP	Effective monitoring & control system and practices
EP	Enhance procurement
EPCE	Exchange of professional cultural experiences
ERM	Efficient Resource Management
ETRGP	Enhancement in technology related government policies
EWE	Efficient working environments
FID	Foreign Direct Investment
GII	Generation of innovative ideas
GLTCM	Growth of local technology construction market
GNP	Gross National Product
GOVT	Government
GWFE	Global work force experience
HSD	Human Skill Development
IA	Innovative Aptitude
IASMP	Increase Awareness about stake holder management practices
ICE	Invest/cost/expenditure
ICOLL	Industrial collaborations
IIBV	Improvement in international business ventures
ILSF	Increase in labor skill force
IM	Innovative materials
IMPCOM	Improved competitiveness
INC	Investment corporation
INCCR	Increased creativity
INVCOR	Investment corporation
IO	Investment opportunity
IPDM	Innovation in project delivery methods
IPP	Improve procurement practices
IPRP	Improve project performance
IS	Investigative skills

ISBA	Improvement in Safety budget allocation
ISC	Improvement in safety concerns
ISSET	Improvement in safety evaluation techniques
ISO	International Standards Organization
ISPEA	Improvement in safety policies of executing agency
ISS	Improvements in soft skills
IWE	Improve working environment
IWEDC	Improved working environment due to diverse culture
JD	Job development
KE	Knowledge Enhancement
KT	Knowledge transfer
MC	Market Competition
Mgmt	Management
MICCI	Monetary incentive in construction contracts improvement
MNC	Multinational Corporations
MOU	Memorandum of Understanding
MP	Mutual production
MS	Management Skill
MT	Multi-Tasking
MW	Mega Watt
NS	Negotiate Skill
OBOR	One Belt One Road
OCHTS	Output concerns due to high tech system
ODPEP	Optimization in design procurement and execution practices
OECC	Overall effects on construction costs
OGI	Opportunity for global intervention
OS	Organizational support
OSP	Organization safety plan
PA	Professional Awareness
PAPPE	Proper availability of PPE (Personal Portative Equipments)

PC	Professional Commitment
PE	Performance Enhancement
PFHD	Promotion of fair human dealing
PG	Productivity and growth
PSA	Promotion of safety awareness
PSDMS	Problem Solving and Decision making Skills
PSE	Provision of Safety equipment
PTW	Promotion of team work
QCP	Quality control practices
QI	Quality improvement
QW	Quality awareness
RAS	Reduce Accident at Site
RCG	Removal of communication Gap
RD	Research & Development
RFUNT	Risk factor due to uncertainty of new technology
RIS	Risk identification and investigation Skills
SCM	Scope management
SDM	Skill development method
SE	Safety environment
SEZs	Special Economic Zones
SM	Stress Management
SP	Sustainable Performance
SPCS	Safety Provision at construction site
SPSS	Statistical Package for the Social Sciences
SSSRE	Self-sufficiency and self-reliance enhancement
SSWF	Size of Skilled Working Force
ST	Safety trainings
SUS	Sustainability
TC	Technology credibility
TCMS	Time & Cost management skills
TCOMM	Technology commercialization

TIO	Technology investments vs output
TSD	Technical skills developments
TSE	Technical skill enhancement
TW	Team Work
UIU	Uplift in intercultural understanding
WEI	Work efficiency improvements
Yrs	Years

Chapter 1

Introduction

The vital geo-strategic position of Pakistan has great potential for economic prosperity. The current uncertain economic conditions in this region have severely affected the country's economy due to lack of basic infrastructure facilities. In order to rescue the current deteriorating situations, extra ordinary vision and measures are required. The CPEC is one of the hopes in such hour of need.

One Belt One Road (OBOR), the Chinese vision of shared prosperity and common destiny seeks to restore and capitalize on the central role that the ancient Silk Road played in economic wellbeing of people across the continents. It is dynamic and all-inclusive-initiative that will prove to be forerunner in prosperity of Asia, Africa and Europe resulting in a truly globalized economy. China Pakistan Economic Corridor (CPEC), the concept of One Belt One Road will not only serve as a gateway to energy transaction and trade for both countries but also for region like Afghanistan, Central Asian states and beyond will get easy access to international markets, refer figure 1.1.

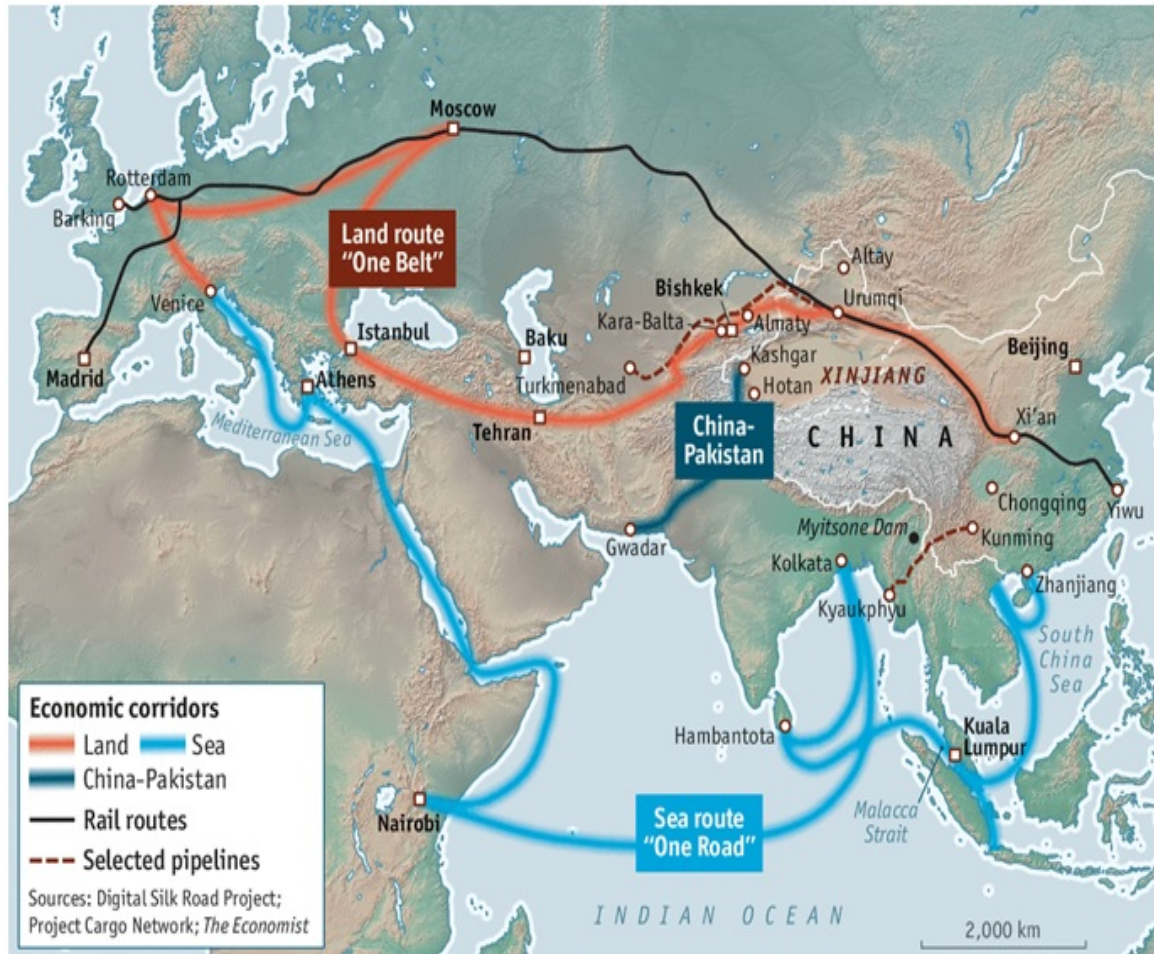


FIGURE 1.1: Futuristic map of One Belt One Road (OBOR) concept [1].

From the very outset, it has been Pakistan's endeavor to trickle down the benefits of CPEC to all regions of Pakistan refer table 1.1. The land route connecting Kashgar to Gwadar comprises of three alignments – western, central and eastern to cover all federating units of the country. CPEC will open unlimited opportunities for all sectors of the economy including infrastructure, energy production, railways up-gradation, establishment of Special Economic Zones (SEZs), ports development, aviation, agricultural, mining, tourism and cultural exchanges to name but few.

TABLE 1.1: Benefits of CPEC [2]

Benefits to Pakistan	Benefits to China
<ul style="list-style-type: none"> ● Business friendly trade routes across the whole country ● Infrastructure development throughout the country ● Interconnection between provinces ● Development of backward area of Pakistan i.e. Gilgit, Fata, Baluchistan. ● Employment prospects ● Stability of economy by investment in different sectors 	<ul style="list-style-type: none"> ● Chinese enterprises are confronting issues to contend in worldwide market because of high transportation cost and conveyance time. China is expected to save approx \$ 2 billion of supply of oil through shortest CPEC route ● China is utilizing a longest path because of which transportation cost and time increases, which gives an aggressive edge to competitors ● Economic development in Xianjing province ● Strong regional province

The unique geo-strategic location of Pakistan can be fully exploited by turning it in to hub of transit trade. This would lead to unprecedented boom in business and trade requiring a robust logistics system and supply chain managed on scientific lines. Thus strengthening the existing logistics system, which, is still ill organized and lacks capacity to meet CPEC challenge [3].

In order to bear fruits of this important vision, the availability of basic infrastructure is vital. The role of construction industries in development of infrastructure cannot be denied. The industry would be the key player in achievement of basic infrastructure and ultimately in social prosperity as well as economic stability of the country. However, there still remains a lot to explore the impacts on trade and

business for the region in general and Pakistan in particular as a result of CPEC endeavor.

1.1 Research Motivation

Geographically, Pakistan is located on cross-roads of Asia with China on its north, India in east and Afghanistan in west respectively. The geo strategic location of Pakistan makes it an important country in terms of its location and has great potential from economic prosperity. Such a strategic location can offer promising business ventures if exploited properly. Unfortunately, there had been a continuous decline in the economy during last few decades. In order to mitigate the declining trend in economy, both China and Pakistan joined hands to stabilize the current economic crisis thus initialing CPEC and other infrastructure projects which present mutual interest of both countries. However, the situation where there is a great lack of basic infrastructure, the role of construction industry remains vital and vice versa. The exchange of cross industrial experiences can help to improve the construction industry practices, pertinent to employability, health & safety practices and socio economic growth. Better infrastructure will not only help in economic growth but also help to uplift construction industry status.

1.2 Problem Statement

The economy of Pakistan has observed an average growth of 3.7 in GDP during the last decade[4].The construction sector is one of the main pillars of Pakistan economy along with other industrial ventures with a vital contributions in country's GDP. However, according to the World Bank data, figure 1.2, the value addition in GDP from the sector has observed a downward trend during this period.

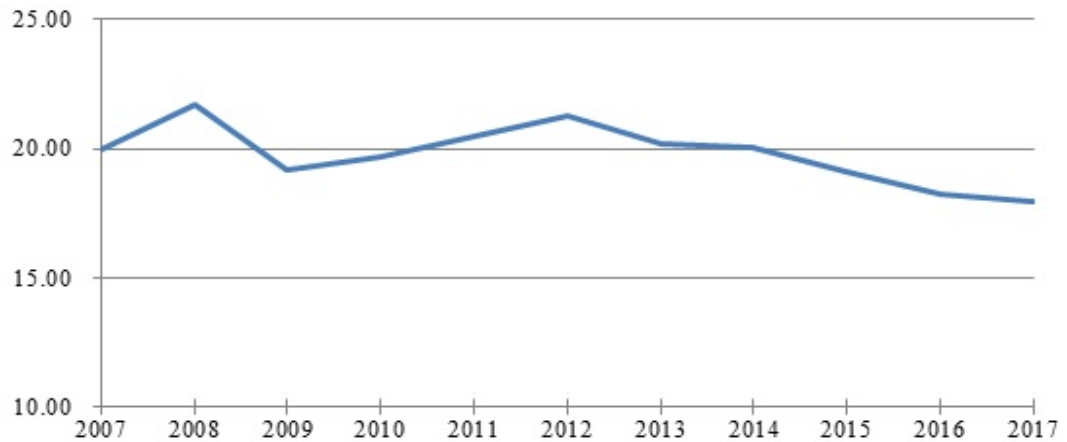


FIGURE 1.2: Industry (including construction), value added (% of GDP),[5]

The construction industry has remained one of key players in development of basic infrastructure in addition to the development of its allied industries. Unfortunately, the current status of Pakistan construction industry is not performing to its true potential. One of key concerns remains an un-symmetrical annual percentage growth of industry during this period, Figure 1.3.



FIGURE 1.3: Industry (including construction), value added (annual % growth) [6]

The non-availability of basic infrastructures has been one of the main concerns in industrial growths. Apart from many other factors, lack of foreign direct investment (FDI) is one of major concern which has also weakened the supporting role of construction to economy.

The China Pakistan Economic Corridor (CPEC) has provided a major foreign funded mega portfolio comprising projects worth \$46 billion in the country[7]. Besides its proven opportunities for other economic sector of country, the construction sector will also be affected, both directly and indirectly, by this investment. However, currently, most of the studies on CPEC have been focused to economic and monetary analysis and have provided a grey area for the researchers to investigate its impacts on other aspects of industrial growth other than monetary benefits. The construction sector would play a pivotal role in this venture between two countries with developments projects in basic infrastructure including railways, roads, energy, agriculture, aviation, etc. Therefore, besides the monetary aspects, it is very much necessary to explore that how CPEC projects will be affecting the local construction industry of Pakistan. This will not only help to identify the affects but also guide us to focus on the major highlighted concerns for uplift of this vital economic pillar.

1.3 Objectives

The objectives of this research study are to:

1. Identify potential factors that can impart an impact of CPEC on construction sector of Pakistan.
2. The effects of identified factors on development of Pakistan's construction industry.

1.4 Scope of Study

Scope of study is limited to the assessment of impacts of CPEC, figure 1.4, on uplift and development of construction industry of Pakistan.

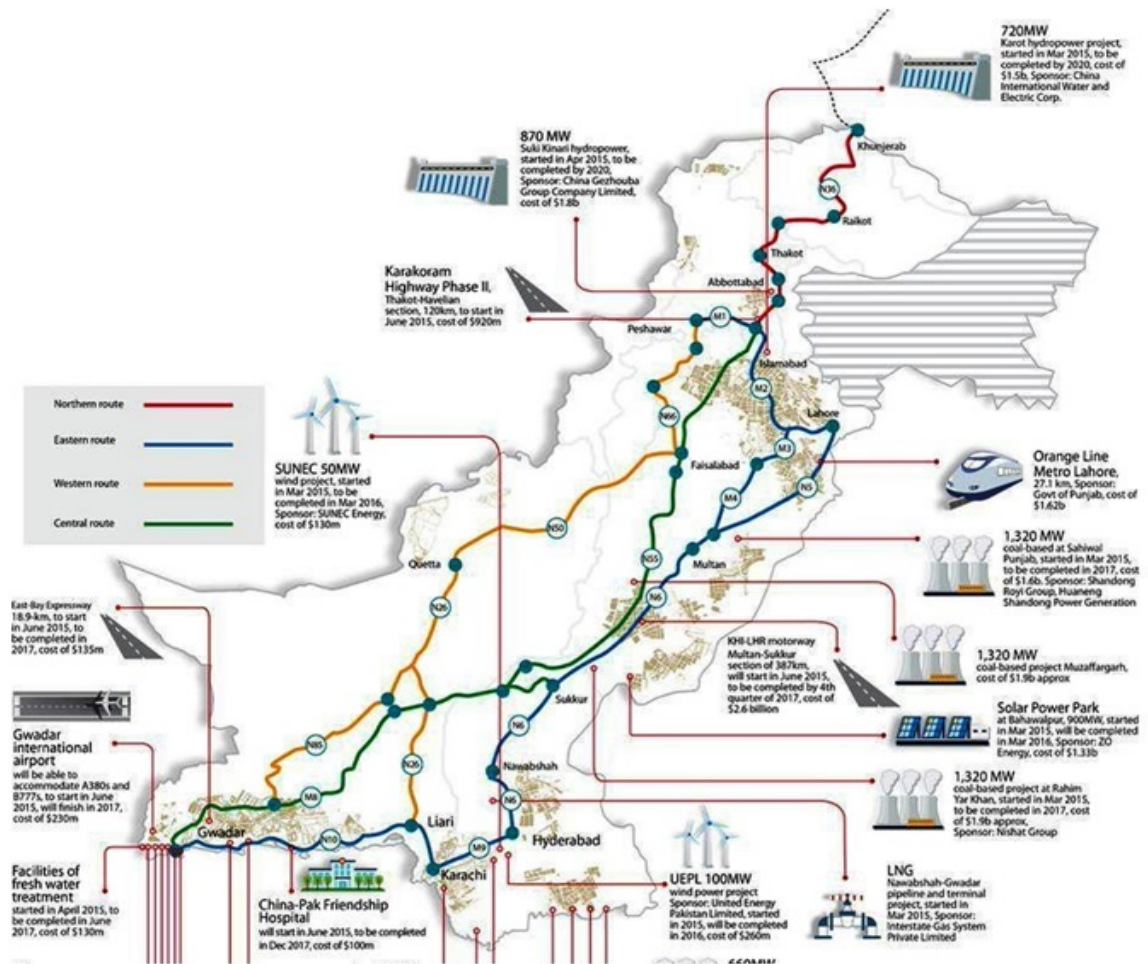


FIGURE 1.4: Detail of CPEC and its related projects [7].

1.5 Methodology

The research methodology adopted for this study have been discussed in detail in chapter three.

However, a brief of methodology is elaborated in graphical format in fig. 1.5

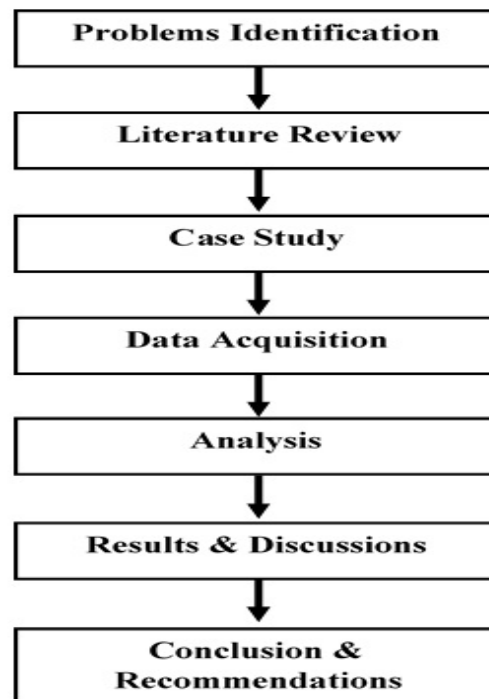


FIGURE 1.5: Main steps of methodology

1.6 Dissertation Outline

This research consists of five chapters. In first chapter background, objectives and scope of study .have been discussed. It discusses the GDP and its effects on economy. An introduction to CPEC has been provided. Problem statement has been discussed. In view of the problem statement, objectives and research scope has been briefed.

Literature review is the second chapter which has been discussed by considering previous studies, adopted methodology and their conclusion. This part evaluated past research contributions, key factors influencing the output, limitations of past research works and the concerned factors, related to the construction industry at international level.

Detail methodology and different phases of methodology have been discussed in chapter three. Variables involved selection criteria, data, methods and techniques to analyze the data of each phase have been identified and elaborated.

Results and discussion have been covered in chapter four. Results of each factor have been graphically defined and finding of the study have been evaluated through detail analysis of the results. Detail description of findings and outcome of the research studied have also been discussed in this section.

Chapter five pertains to conclusion and recommendations. Furthermore, the guidance for the future research work for enhancing the advantage from this study area has been recommended.

Chapter 2

Literature Review

This chapter deals with comprehensive review of previous concluded researchers. Chapter divided into three parts. The first part deals with the construction industry of Pakistan and its role in Pakistan economy. The second part deals with the impact of foreign direct investment and the last section of the chapter presents the literature on factors that affects the performance of construction industry.

2.1 Construction Industry

Construction is a process of building infrastructure for utility of humans and lives on earth [8]. Construction industry includes all the processes, equipment, material and people involved in construction of infrastructure. Construction industry can further be distributed as shown in figure 2.1.

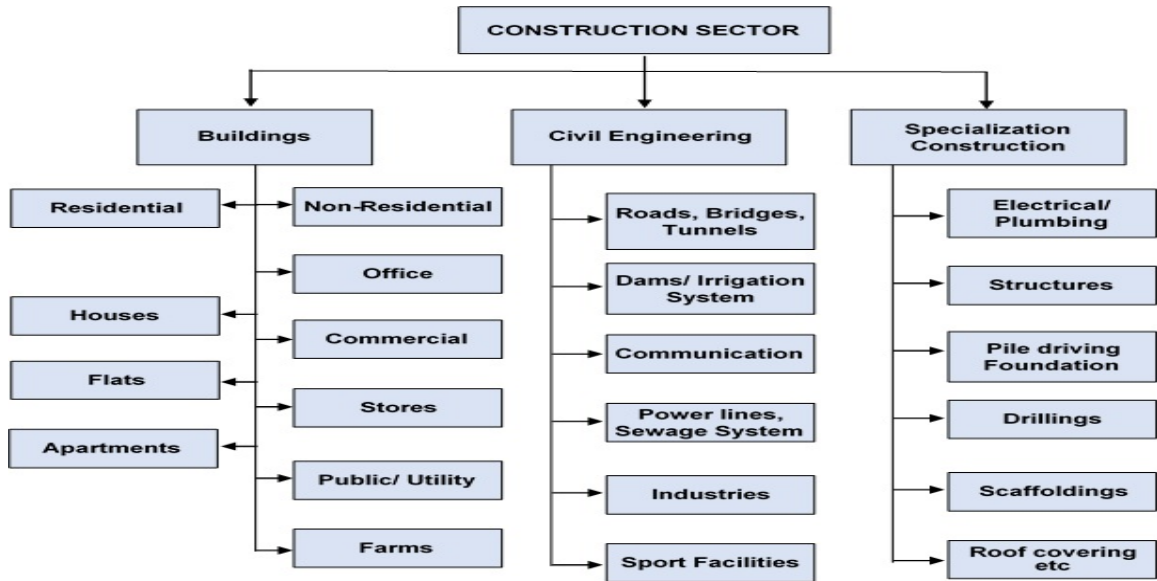


FIGURE 2.1: Distribution of construction sector (Malaysian National Standard of Classification 2000)

2.2 Role of Construction industry in Pakistan Economy

Development is an imperative industry all through the world speaking to a sizeable degree of most countries' Gross Domestic Product (GDP) and Gross National Product (GNP). The criticalness of the improvement isn't simply related to its size yet not withstanding its part as a driving force in economical development. The development of construction industry is playing an essential part in the socio-economic development of Pakistan. The role of infrastructure development, building, and construction assumes a basic part in lifting economic improvement of Pakistan [9]. Construction activities provide opportunities to all skilled and unskilled people like affirmed civil, electrical and mechanical engineers and allied professionals [10]. The sector wise GDP growth of Pakistan in past decade is shown in figure 2.2.

Construction industry development in Pakistan was proactive in 2013 – 15 regardless of various challenges and threats. Country has declared numerous socio economic development situated approaches and acquainted exhaustive basic changes

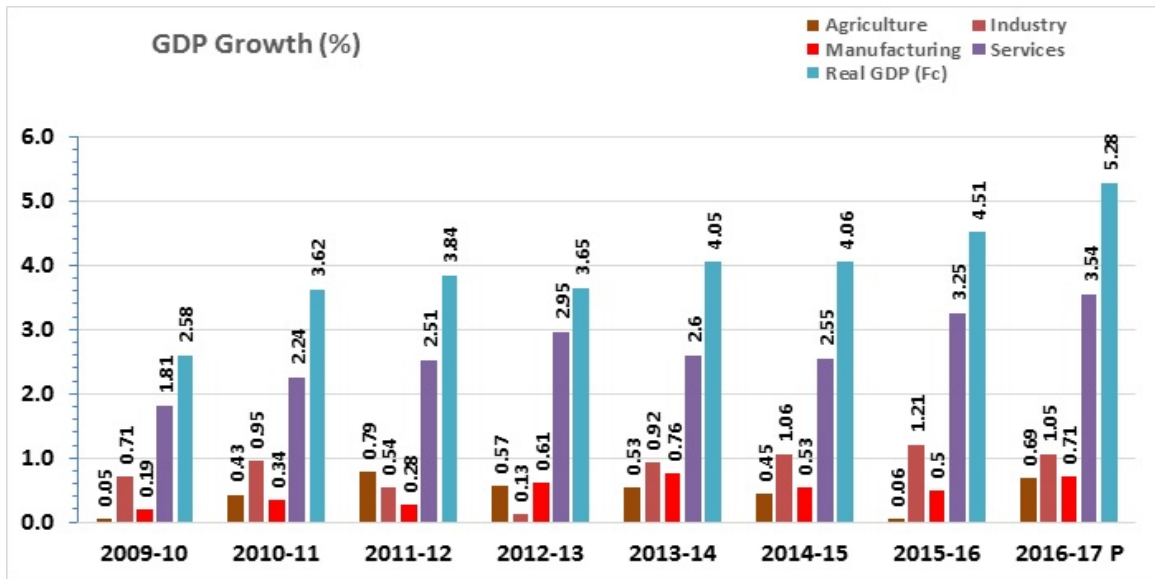


FIGURE 2.2: Sectorial Contribution to the GDP growth (% Points)[11].

to accomplish economic goals. Because of consistent endeavors, the circumstance began enhancing as key economical indicators demonstrating positive signs for Socio – Economic growth. During 2014-17, Pakistan has faced many problems for example, war against extremism, vitality deficiencies, settlement of IDPs and reinforcing of state establishments. Keeping in veiw its vital contributions, the construction sector of Pakistan has been a keen area for many researchers.

Farooqi and Ahmed [12] explored the present condition of Pakistan construction industry and proposed guidelines to enhance the performance of construction industry on a sustainable basis. The study developed a link of Pakistan’s construction industry with national GDP growth. This study was executed into two major steps, at first extensive literature review of construction industry was performed and in second step using this literature review number of interviews was conducted with industry professionals and questionnaire survey was performed to develop concrete platform. Upon finalization of results and their compilation at the end of study following salient results:

- Project management weaknesses were highlighted in stakeholders’ management that result in lower productivity.
- Lack of risk management practices among participants.

- Causes of delay in construction activity were also highlighted with responsibility of these were also mentioned.
- Analysis of safety culture of national construction industry.
- Issues related to total quality management and quality control were reported.
- Constructability practices and Contract Management practices thoroughly analyzed using cause and effect relationship technique.
- Bid procurement practices were described with critical analysis on lowest bidder winning approach. Best value procurement being identified as way forward for Pakistan's construction industry
- Client satisfaction index developed for various categories of factors

The study recommended that professionals involved in construction industry should get familiarize with construction project management knowledge, skill and techniques. Client commitments toward risk management is necessary for smooth construction practices as awareness regarding risk assessment is a way out from debacles in construction industry. Organization and management bodies concerning construction requires overhauling on modern lines to standardize construction industry practices. Low bid procurement system needs to be replaced with best value procurement system to achieve quality of workmanship in construction activity.

2.3 Factors Affecting the Construction Industry of Pakistan

Construction activities in Pakistan have slowed down due to precarious economic conditions prevailing for last few years. Government is trying its level best to revive economic activities but due to absence of sufficient regulatory legislation

related to construction industry revival of construction industry hangs in balance. Construction activities also remain in limbo due to lack of communication between stakeholders. Therefore, to address the issues related to construction industry concrete efforts are required at policy making level [13]. There is also dire need for defining new funding mechanism for public sector projects as infrastructural projects suffer delays due to hindrances in cash flows and meddling by other governmental organizations [14].

Haseeb et al.[15]stated that delays are constantly estimated as costly to all stakeholders ultimately resulting in conflicts, claims and add up to renunciation for better achievement in the development of construction sector. Study defined the factors of delay in terms of client's related delay, consultant's related delay, contractor's related delay and some other external factors like change in government, regulation and location, effect of subsurface condition, natural disasters,(earth quake, floods etc). The study concluded that client's related factors as major cause for delay and to overcome these delays, client must ensure strong economical ability and timely arrangements for financing to ensure for efficient work growth. Consultant delays included non-understanding of the client requirement and missing of important detail in construction drawings and incomplete project information. The study recommended that requirements and project information may be properly studied before commencement and reduce changing in drawings during construction for decreasing in delay of the project. Contractor's delays were due to the lack of sufficient resources and sub standard material quality. The contractor must have knowledge about his resources strength and having up to date machinery. The contractors also manage the capital resources throughout the project and use it properly so that contractors may not affect the cash flow problems throughout the projects.

Rashid et al. [16] investigated the causes for delay in construction industry located in Punjab province. Seven major factors have been considered in this study. These factors are related to client, consultant, contractor, natural factors, procurement, labor and general condition factors have been considered. The consequence of the study is that the aspects relating with client, consultant, contractors, material

and equipment have considerable effect on project delays. While worker and environmental conditions have negligible effects on delays. Financial problems were main reason of delays. Firm should design proper plan of payment from client to contractors and contractors to supplier and staff to overcome the delays. Construction firms should have sufficient available stock of material for smooth working of projects and material must be as per specification and good quality. Construction firms must have their own equipment, tools and techniques for smooth functioning of projects instead of acquiring them on rent. From the above, it has been concluded that the lack of financial management and project management practices have been common concerns that effect the construction sector performance and need to be addressed, for enhanced output.

2.4 Role of Foreign Direct Investment in Economy

Foreign direct investment (FDI) has turned into source of capital accumulation especially in developing countries where there is a dearth of resources [17]. FDI can trigger economic activities which would result in increase in employment opportunities, technology transfer, skill development and healthy competition in market [18]. Detail of FDI in Pakistan is shown in table 2.1.

TABLE 2.1: Foreign direct investments in Pakistan (\$Million)

Year	Total FDI
2006-2007	5139.6
2007-2008	5409.8
2008-2009	3719.9
2009-2010	2150.8
2010-2011	1634.8
2011-2012	812.6
2012-2013	621.9
2014-2015	709.3
Total	27,475.70

FDI can bear fruits only if FDI is accompanied with sound economic policies and liberal view towards trading activities. Role of foreign direct investment help in improving the economic growth rate as: [19]

- FDI improves the technology, management and marketing skills of the developing state by bringing assets which is either missing in such countries and without which development cannot take place.
- Employability rate will be increased through FDI. Without FDI business openings are not accessible in developing states. Further, these business openings are probably going to be in generally higher ability regions. FDI provide both direct and indirect employability opportunities of developing countries.
- Foreign direct investment provides competitive environment and promotes higher wages.
- Foreign direct investment provides a competitive environment in domestic market. Competitive environment provides higher efficiency and better productivity and services.

It has been observed that FDI improves the infrastructure condition of the development with up lift in FDI, technology and developments. It also help in improving the living condition of countries [20].

Kukaj and Ahmeti [21] stated that role of investment particularly FDI plays an important role in development of economy growth. FDI is important element for development of strategy for economic growth. Monetary advancement contributes through FDI in two fundamental ways. Efficiency of domestic capitals can be enhanced through the exchange of technologies, Human skills development, innovations and best practices. Besides, FDI has the two advantages and expenses, and its effect is controlled by the country's particular conditions by and large and specifically environmental policy. The range of chances for linkage between FDI and domestic up lift depends upon the diversification and the level of absorption capacity of the country in which the foreign investors intends to invest. One of the most important steps that must be taken by government to attract the investors is the ability to plan policies that improve the domestic capacity of population. Researchers are of the view that government policies should focus on particular sections of FDI rather than a general policies to enhance FDI. It is concluded that result of FDI are only effective if efforts are done from inside the country and internal efforts have enhanced the human development index and increase in infrastructure spending results in attraction of foreign investor. As every country is unique in terms of historical, cultural and geopolitical parameters therefore country specific studies to target segments of FDI results in overall increase in foreign investment.

Aurangzeb and Stengos [22] explored the genuine connection amongst FDI and monetary development. The analysis demonstrate that the countries with greatest FDI inflows extreme profitability in the export sector than a country which has a low level FDI inflows. It was concluded that FDI inflows make a vital part growth in economy by improving efficiency factor in the export sector through developing the linkages between the Multinational Corporations (MNC) and their economy associates.

Bjvortan et al. [23] studied two major components of FDI and causes & effects of FDI on economic growth of a country. After analysis of five different countries, the study articulated that a stable social / political and economic environment, openness in trade policies, geographical location next to a strong and growing economy are the key factors which could develop role of FDI into a success story. Local existing firms of host country also react differently by operating in a healthy competition, environment in depending upon ground conditions of market and public policies of host countries.

Zeb et al.[24] explored the consequences of FDI on economic growth of Pakistan since 1972 – 2012 and stated that FDI plays an important role in economic development. Three important factors of trade directness, political instability and terrorist attacks were considered in this study. The study suggested that government must take a keen interest in development of infrastructures, developing in trade and employment policies, environmental stabilization, increase employability rate and more attractive planning for foreign investment to enhance the economic development.

2.5 CPEC and its Economical Benefits

CPEC, from its inception has been a grey area for research. However, most of the time, the economic aspect has been analysed. Meena [25] stated that to gain maximum benefits from CPEC and to ensure it leads to 2 % annual GDP growth, government should engage all stakeholders to resolve any conflicts/ issues. The study recommended to minimize conflicts by prioritizing route of CPEC based on key factors like population density, loss of productive land and percentage of population displaced. Transparency in the contracting and execution of the projects would ensure true economic gains for country.

Zhang et al. [26] investigated social impacts assessment for CPEC investment activities. The study recognized the social effects and risks during the development of CPEC. The field research was limited to Kashi district and Pakistan's Gwadar

area, information gathering and relative dissecting, different risks were identified, fundamentally including large scale and small scale risks. The studies observed safety as a major measure for reducing the negative impacts and risks while keeping and developing positive effects for the development of CPEC region.

Shapiee and Idrees [27] studied the present coordination's course of action amongst China and Pakistan with reference to exchange administrative responsibilities and their impacts on such plans. The study considered China Pakistan individual trade relations and consequences for Pakistan economy, alongwith CPEC transport mechanism for physical framework in Pakistan. Researcher highlighted the need for revision of socio-legal framework in Pakistan to accommodate complete benefits from CPEC. In addition to this, a comprehensive transport infrastructure and supporting logistics supply chain network was recommended to reap the benefits of CPEC. Moreover CPEC invitation to other regional partners to join and participate in this mutual benefit program, was also considered.

Husain et al. [28] studied the economy and logistics industries of Pakistan in the light of China Pakistan economic corridor as pragmatic realities. The study intended to provide a clear picture regarding the impact of china Pakistan economic corridor on logistic and economics industries of Pakistan. It concluded that, in future, the logistic and economical industries of Pakistan would create jobs, private sector participation enhancement, GDP improvement and infrastructure developments. In parallel, it also mentioned that some barriers may also extract benefits between the two countries like cultural differences, attitude toward the corruption and transparency and labor market competition, which needs to be managed on priority basis.

2.6 CPEC and Development Projects

The evaluated speculation of US\$ 59 billion under the umbrella of CPEC ventures is expected to give a way to a maintainable financial development of Pakistan[29]. CPEC will bring prosperity and development across the country. This would

enhance the lives of basic man in Pakistan while making exceptional business openings in the segments of power, transportation and infrastructure works as shown in figure 2.3. The enhancements in development industry have likewise urged the financial specialists to put resources into real sector development and there has been incredible increment in commercial and housing division projects.

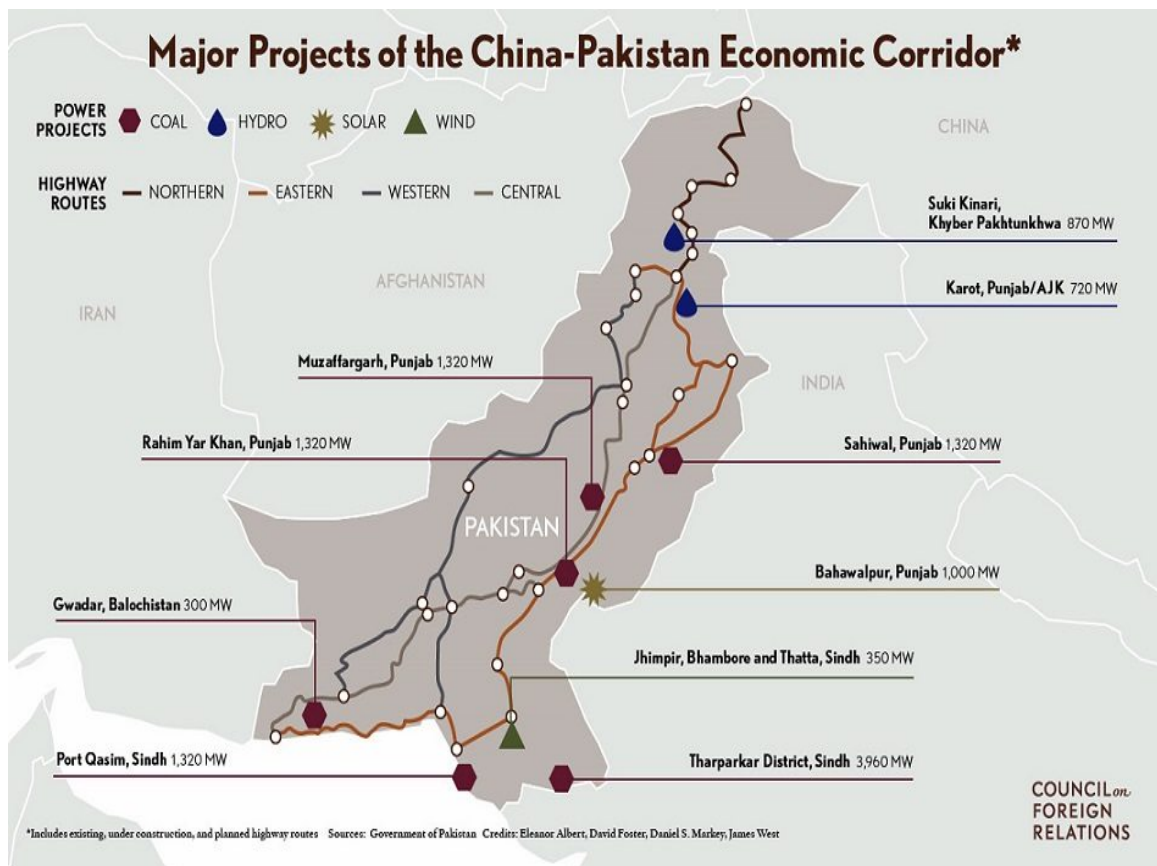


FIGURE 2.3: Detail of CPEC and its related projects [7].

The scope of CPEC not only includes roads and highways network but it's consist of different packages of energy sector and other related projects which is basic requirement of enhancing the Pakistan's economy. Table 2.2 details the CPEC portfolio of investment.

TABLE 2.2: CPEC portfolio of investment [7]

PROJECTS	US\$ (M)
Energy	33,793
Transport and Infrastructure	
Roads	6,100
Rail network	3,690
Mass transit in Lahore	1,600
Gwadar Port	786
Others	44
TOTAL	46,013

2.7 Factors Involved in Development of Construction Industry

Fox and Skitmore [30] identified the factors involved in development of construction industry productivity and efficiency. A detailed study was carried out and 8 variables were identified, which helped out the construction industry for enhancing productivity and efficiency. These eight variables were: (1) industry led better practice and culture (2) Financial resource and investor confidence (3) Human Skills developments (4) Government policies relevant to the construction industry (5) Researches and development for construction (6) Self reliant Construction Culture (7) Institutional support (8) Supporting attitude from Client. The study recommended that these eight variables are important for both developed and under developed countries.

Enshassi et al. [31] reported on factors affecting sustainable development of a construction project. The study based on 53 sustainable factors which were identified through literature reviews. All factors were classified in project cycle phases like design phase, inception phases, construction, demolition and operation phases. It was concluded that five factors in construction phases, three factors in inception phases, one factor in operation phases and one factor demolition phases effect the project sustainability in construction project. Moreover, it was recommended that

how to integrate the whole project sustainability into the construction process to achieve sustainable project construction.

Mishra and Mishra. [32] reviewed the risk factor in construction projects by comparing national and international construction projects. For the said purpose, 50 articles published from past 15 year were reviewed. It was found that a simple analytical tool would like to develop for each project to evaluate the risk analysis quickly and effectively.

Fox and Skitmore [33] identified the key factors in the future development of the construction industry. The key factors were short listed on the basis of their importance and strength. These important factors were long term policies of the organization, human resource, technological advancement and inter-cultural working harmony etc.

Ofori [34] reviewed on the nature of the construction industry, its needs and its development. Main key factors were identified as technology development, corporate development, human resource development and institution building etc. The study recommended that performance could be enhanced by better planning and by providing better opportunities to the employer. Besides above studies, key factors identified by different researchers have been detailed in the table 2.3 which affect the performance of construction sector.

TABLE 2.3: Identified Key factors

S.No.	Researcher / Author	Country	Identified factors
1	Paul Fox and Martin Skitmore [30]	Hong Kong	(1) Industry led better practice and culture (2) Financial resource and investor confidence (3) Human Skills developments (4) Government policies relevant to the construction industry (5) Researches and development for construction (6) Self-reliant Construction Culture (7) Institutional support (8) Supporting attitude from Client

S.No.	Researcher / Author	Country	Identified factors
2	Paul Fox and Martin Skitmore [33]	Hong Kong	<ul style="list-style-type: none"> (1) Long term vision & policy for the industry (2) Basic resource and infrastructure (3) Financial and human resource (4) Best practice culture (5) Techniques supporting high production performance (6) A learning culture
3	Adnan Enshassi, Bernd Kochendoerfer Hadeel Al Ghoul [31]	Germany	<ul style="list-style-type: none"> (1) Economic sustainable factor (2) Social sustainable factors (3) Environmental sustainable factors
4	Surabhi Mishra, Brajesh Mishra [32]	India	<ul style="list-style-type: none"> (1) Country risks (2) Political risks (3) Technology Implementation (4) Inflation, Country economic condition and rules and regulations (5) Inadequate Managerial skills (6) Improper Coordination between Teams (7) Poor safety procedures (8) Construction Delays
5	George Ofor [34]	Singapore	<ul style="list-style-type: none"> (1) Human resource development (2) Leadership (3) Technology development (4) Corporate development (5) Institution building (6) Materials development
6	Martyn J. Hills, Paul W. Fox, Patrick S.W. Fong, Carol K.H. Hon [35]	Hong Kong	<ul style="list-style-type: none"> (1) Basic resources and institutional infrastructure (2) Financial and human resources (3) Techniques and technologies supporting high production (4) Long-term vision and policy for the industry (5) Thinking the best and behaving the best

S.No.	Researcher / Author	Country	Identified factors
			(6) A learning culture
7	Jack Katende, Henry Alinaitwe, Dan Tindiwensi [36]	Uganda	(1) Financial Capacity (2) Lack of adequate research and development (3) Economics and costs (4) Corruption (5) Political interference (6) General level of technology (7) Poor Financial Planning (8) Market Forces (inflation) (9) Inadequate participation from foreign firms (10) Lack of coordination between parties in the construction industry (11) Environmental factors
8	Murat Gunduz, Ahmad Mohammed Ali Yahya[37]	UAE	(1) Effective communication between stakeholders (2) Companys technical and financial strength (3) Adequate risk analysis (4) Adequacy of plans and Specifications (5) Effective procurement and tendering method (6) Team motivation (rewards and incentives) (7) Personnel selection and training (8) Political conflicts and corruption
9	Xiaer Xiahou, Jingfeng Yuan, Yan Liu, Yuchun Tang, Qiming Li [38]	China	(1) Demands for more production (2) Lack of labor (3) Serious environment problems (4) Shortage of resources (5) Technologies progress (6) Integration of advanced technologies (7) Management improvement (8) Productivity improvement (9) Quality improvement (10) Cost reduction (11) Construction-time reduction

S.No.	Researcher / Author	Country	Identified factors
			(12) Integration of the supply chain (13) Health and safety improvement (14) Supporting policies
10	Zakari Tsigas, Michael Emes, Alan Smith [39]	UK	(1) External Challenges (2) Client knowledge and experience (3) Project characteristics (4) Contractual aspects (5) Project team competence (6) Project Risk Management (7) Communication and culture

Chapter 3

Research Methodology

This chapter discusses the mechanism to achieve the desired results of study. The current chapter details the source of data, tools and techniques to analyze the acquired data and results.

The chapter has been divided into following four phases.

- Phase 1 Goals definition and scope
- Phase 2 Data acquisition
- Phase 3 Impact Assessment and data analysis
- Phase 4 Interpretations

The research methodology adopted for this study is elaborated in graphical representation as shown in Figure 3.1.

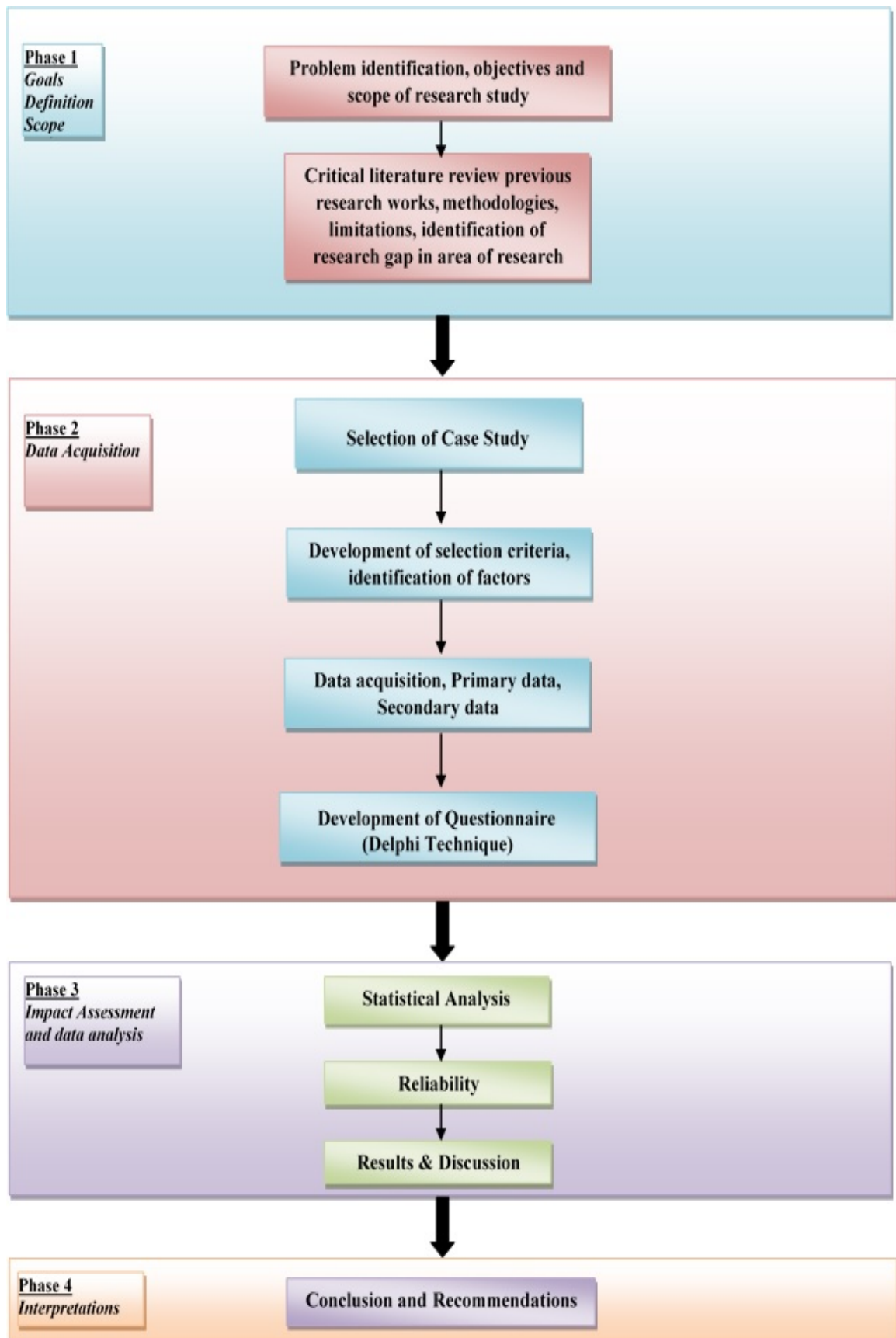


FIGURE 3.1: Research Methodology Flow Chart

3.1 Data Collection

The data types included primary and secondary data. The primary data was achieved through development of survey questionnaire whereas the secondary data was collected through published reports, previous survey, data from organizations and other indirect available resources.

3.1.1 Primary Data

With the aim to assess the current situation of construction industry performance and create suggestion for development, the following aspects for the performance of construction industry have been investigated.

1. Role of construction industry in Pakistan Economy
2. Factors affecting the construction industry of Pakistan
3. Role of foreign direct investment in economy
4. Effects of FDI in development projects
5. CPEC and its economic benefits
6. Factors involved in development of construction industry

A critical literature was performed for the previous published data resources including reports, papers etc. After detailed literature review, pool of factors were selected. Main organization were short listed on the basis of their involvement in construction industry as well as in CPEC. Key personal of these organization were visited and views on main factors were discussed. Background of the interviewees is shown in the table 3.1.

TABLE 3.1: Background of the Interviewees

Interviewee	Position of the Interviewee	Exp (Yrs)	Group	Sector
A	Professor Construction Management	More than 10 Yrs	Academia	Private
B	Director Planning & Contracts	More than 20 Yrs	Client	Govt
C	Executive Director Planning	“	“	“
D	General Manager Business Development	“	Consultant	Semi Govt
E	Manager Planning & Design	More than 15 Yrs	“	“
F	Project Director CPEC	More than 20 Yrs	Contractor	Govt
G	Dy Project Director CPEC	“	“	“
H	Deputy Director PPP Cell	15 Yrs	“	“
I	Director Construction & Health Safety	More than 15 Yrs	“	Private
J	Manager Plans & Acquisition	15 Yrs	“	“
K	Manager Technical & Coord	“	“	“

After comprehensive discussion with experts, table 3.2 details the scrutiny of factor list for the current study.

TABLE 3.2: Scrutiny of Factor list

Potential factors highlighted by the interviewees	Inclusion status											
	A	B	C	D	E	F	G	H	I	J	K	Total
Financial resources and investors' confidence	✓	✓		✓		✓	✓		✓		✓	7
Human skills Development	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	11
Research and Development for construction	✓		✓	✓	✓		✓	✓		✓		7
Self-reliant construction culture	✓	✓	✓				✓	✓	✓			6
Integration of advanced technologies	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	10
Long term vision and policy for the industry	✓		✓	✓	✓		✓	✓		✓		7
Improvement in Health safety and environment practices	✓		✓	✓	✓	✓	✓		✓	✓	✓	9
Basic resource and infrastructure	✓			✓	✓		✓	✓		✓		6
A learning culture and Inter cultural working environment	✓	✓	✓	✓		✓	✓	✓	✓		✓	9
Economic sustainable factor	✓		✓	✓	✓	✓					✓	6
Social sustainable factors		✓	✓			✓	✓		✓	✓		6
Environmental sustainable factors	✓	✓	✓			✓	✓	✓	✓			7

Potential factors highlighted by the interviewees	Inclusion status											
	A	B	C	D	E	F	G	H	I	J	K	Total
Inflation, Country economic condition and rules and regulations		✓	✓	✓	✓			✓		✓	✓	7
Advancement in management practices	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	11
Lack of adequate research and development	✓		✓		✓		✓	✓	✓		✓	7
Inadequate participation from foreign firms		✓		✓		✓	✓		✓	✓	✓	7
Lack of coordination between parties in the construction industry	✓	✓				✓				✓	✓	5
Two way Industrial linkage	✓	✓		✓	✓	✓		✓	✓	✓	✓	9
Effective communication between stakeholders	✓	✓	✓				✓	✓	✓			6
Company's technical and financial strength			✓	✓	✓	✓	✓			✓	✓	7
Adequate risk analysis	✓	✓	✓				✓			✓	✓	6
Adequacy of plans and Specifications	✓	✓	✓	✓	✓				✓			6
Political conflicts and corruption	✓		✓		✓	✓	✓			✓	✓	7
Client knowledge and experience	✓		✓		✓			✓		✓		5
Adaptation of Hi-Tech System	✓	✓		✓	✓	✓	✓	✓	✓		✓	9

Afterwards these detail factors were discussed with industry professionals to finalize list of main factors. Identified Factors were:

1. Human skill development
2. Inter cultural working environment harmony
3. Improvement in health safety & environment practices
4. Introduction to adaptation of Hi-Tech system
5. Technology transfer
6. Advancement in management Practices
7. Two way industrial linkage

3.1.2 Delphi Technique

Based upon these finalized factors, survey questionnaire was developed by using Delphi technique. The Delphi strategy is a gauging technique in view of the outcome of assessments sent to a board of professionals [40]. In this procedure a few rounds of questionnaires are convened, and the feedbacks are collected and communicated to the professionals subsequent to each visit. After presentation of summary, discussions starts in another round and hence further iterations till convergence on agreed view point.

The Delphi technique proceeds by the following steps, refer figure 3.2. Two rounds of Delphi technique were adopted in the current study.

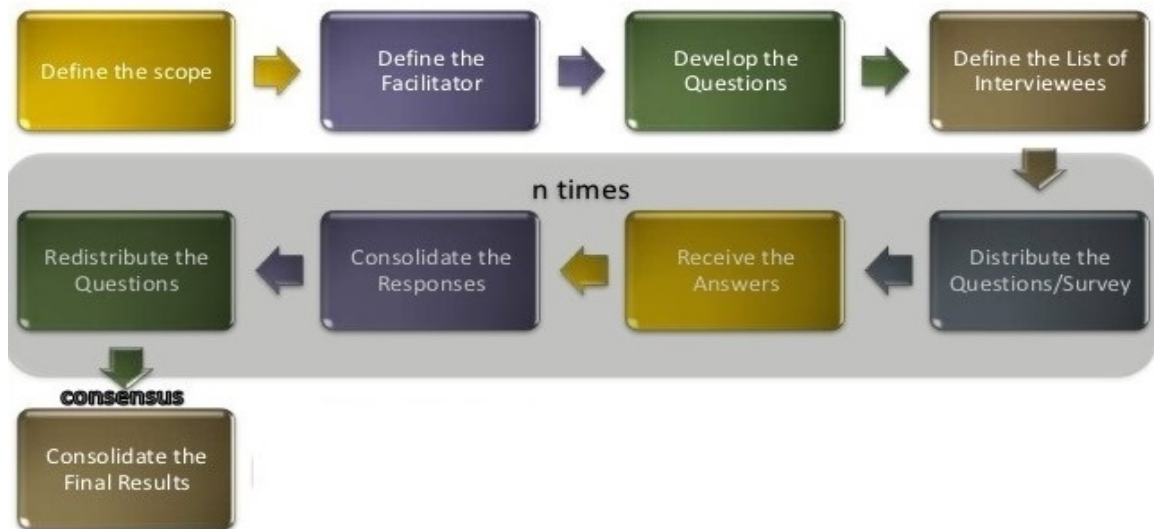


FIGURE 3.2: Delphi Technique process [41]

3.2 Questionnaire Development

After a critical literature review, certain factors with potential of construction industry were identified. These identified factors were further divided into sub categories to find out the potential effects of CPEC on construction industry of Pakistan. Based upon identified factors detailed questionnaire was then developed by using Delphi technique to receive the feedback.

The questionnaire tool adopted to collect the data is provided in Appendix A.

3.2.1 Likert Scale

In order to gauge the feedback, likert scale was used. The following corresponding attributes were adopted, shown in table 3.3.

TABLE 3.3: Attributes of Feedback Scale

S.No	Item Description	Score Range
1	Very Strong	5
2	Strong	4
3	Medium	3
4	Weak	2
5	Very Weak	1

3.3 Data Acquisition

The developed questionnaire was sent to key personal of the construction industry for their feedback involved in development of CPEC as well as working in key positions of Pakistan construction industry. The response rate was also measured.

3.4 Data Analysis

After obtaining feedback from industrial professional, data was statistically analyzed through SPSS software. The data analysis cycle adopted in this study is graphically presented in figure 3.3.

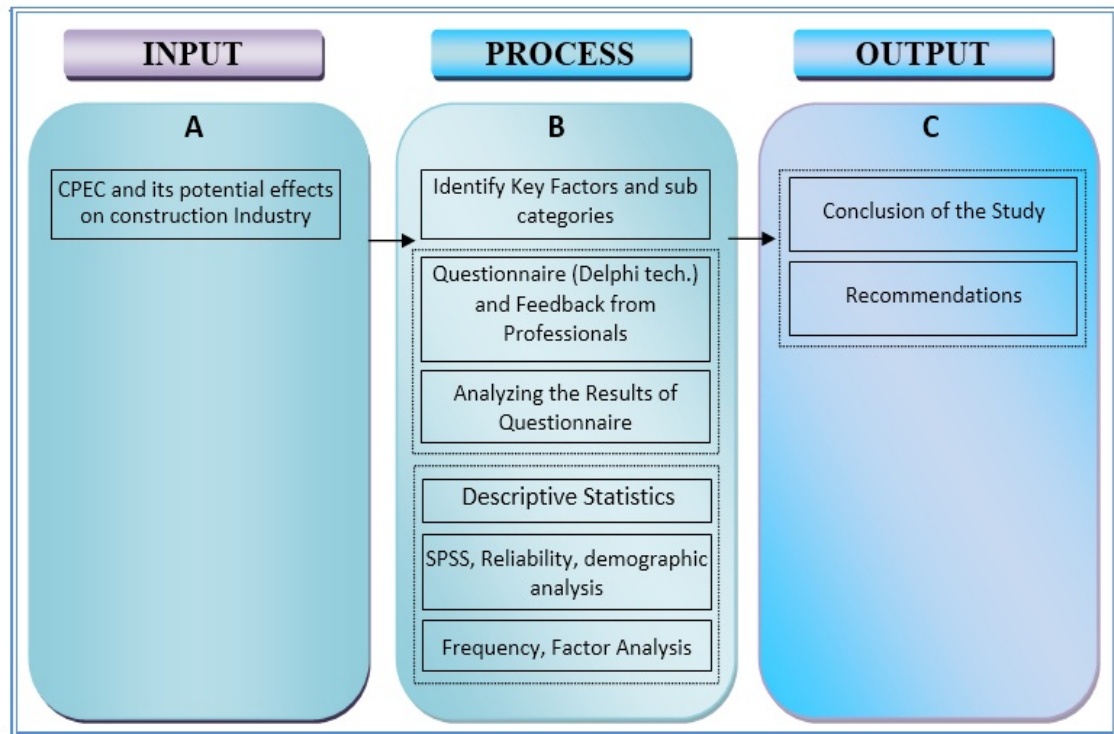


FIGURE 3.3: Data Analysis cycle

3.4.1 SPSS

Statistical analysis has been carried out through SPSS (Statistical Package for the Social Sciences). SPSS can collect information from a record and then utilize it to create organized reports, diagrams, and plots of allocation and developments, descriptive statistics, and complex statistical analysis [42]. SPSS is one of the vibrant amongst well known statistical package. It can perform highly complex data analysis by using only simple input instructions by either through interactive and non-interactive (batch) uses.

3.4.2 Data Reliability

One of the major concern about the data authenticity lies in its reliability. The reliability test is one of the basic test performed to validate the data reliability.

Cronbach alpha is a beneficial analysis used to gauge the reliability or internal consistency of any given data set. Cronbach alpha is strictly for reliability analysis only and gives a holistic overview about reliability of given data [43]. Table 3.4 details the Cronbach's Alpha consistency levels for data sets usually adopted in statistical studies.

TABLE 3.4: Cronbachs alpha ranges [44]

Cronbachs alpha	Internal consistency
$\alpha \geq 0.9$	Excellent
$0.9 > \alpha \geq 0.8$	Good
$0.8 > \alpha \geq 0.7$	Acceptable
$0.7 > \alpha \geq 0.6$	Questionable
$0.6 > \alpha \geq 0.5$	Poor
$0.5 > \alpha$	Unacceptable

3.4.3 Demographic Analysis

Demographics basically belong to the human population individuality. Individuality for example age, sex, profession, qualification, relevant experience etc. are all example of demographics that are commonly used in analysis. When manipulating a review, the investigation needs to assess who to analyze and how to breakdown general research response data into major gatherings of respondents. In this study demographic data included organization type, profession, gender, work experience, qualification and their interaction with CPEC.

3.4.4 Frequency Analysis

Frequency analysis is a descriptive statistical method by which the number of occurrences of each response as chosen by respondent can be presented and results could be analyzed in a way that would draw final conclusion. The cumulative percentages against different variables helps in determining the percentage value for data plus the percentage for all values that precede it.

Frequency analysis on individual and combined level against each factor was performed and number of occurrences of each response as chosen by respondent was measured. On the basis of responses, results and discussions were performed.

3.4.5 Ranking Factor Analysis

Ranking factor analysis is used to rank the factors under consideration after evaluation and analysis of data accordingly to their values from largest to smallest and vice versa. It is static method in which the variables are grouped in accordance with their relevance among them. Based upon the results, the factors were then ranked from lowest to highest based on the results in SPSS [45].

Ranking factor analysis was adopted to find out the relative importance of relative importance index of the various factors [46].

They adopted same method within various groups (client, consultants or contractors etc.). Equation 3.1 defines the current work.

$$RII = \frac{\sum W}{A \times N} \dots \dots \dots (3.1)$$

W = The point / ranking (ranges 1 to 5) feedback taken from the professionals

A = The maximum scoring i.e. 5

N = The total number of respondents

3.5 Conclusion and Recommendations

According to performed analysis, conclusions were drawn. Based on these conclusion and keeping view the objectives of this study, future recommendations were proposed.

Chapter 4

Results and Discussions

The present study was carried out for assessment of CPEC impacts on development of construction industry of Pakistan. The data was collected from the participants of construction industry who were directly or indirectly involved in CPEC. The data was analyzed and results of demographic analysis, ranking analysis, frequency analysis and reliability analysis have been presented in this chapter.

4.1 Demographic Analysis

The developed questionnaire was distributed among 100 professionals of different organizations to assess impact of CPEC on the factors affecting the development of Pakistan. The organizations were shortlisted on the basis of their involvement in CPEC. Out of 100, a response rate of 72 % was received back. Among these organizations, the data observed, that 13.9 % response was related to the clients, 25 % from consulting firms, 59.72 % contracting firms with a remaining 1.39 % as others, figure 4.1. The demographic data showed that majority of professional who participated in the study were related to the profession of Civil engineering with a percentage of almost 83 %.

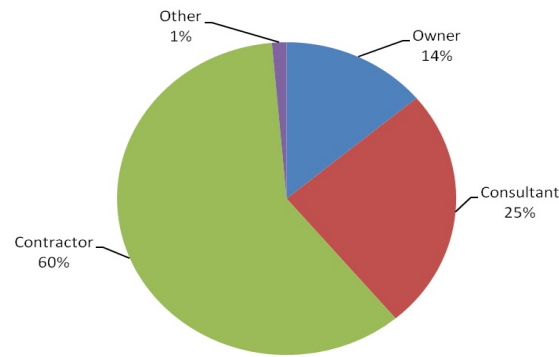


FIGURE 4.1: Type of Organization

The second major contribution was received from Quantity surveying professional with a response rate of 11% followed by Designers (4.17%), and others (1.39%) respectively, figure 4.2.

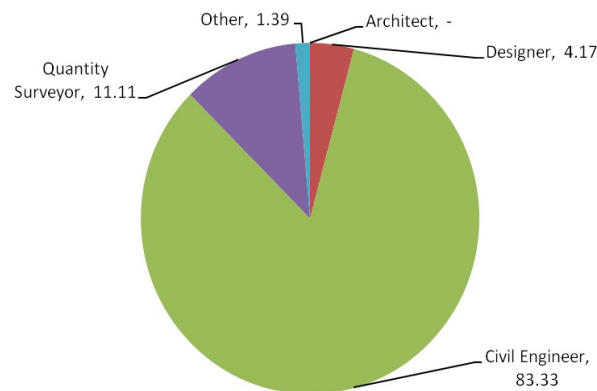


FIGURE 4.2: Feedback from industrial professionals

The level of experience and education both play a pivotal role in enabling the professionals to give a real time assessment of an impact study. Keeping this in view, the experience and education level of professional was also assessed. There were 3 participants with experience less than 5 years, 26 with 5-10 years experience, 29 with 10-15 years experience, 10 with 15-20 years experience and remaining 4 were with experience more than 20 years, figure 4.3.

The qualification demographics depicted that the participants reported different educational qualifications i.e. 56.94% had bachelors degree, 29.17% had Masters

degree, 11.11% had PHDs and 2.78% were including other qualifications, refer figure 4.4.

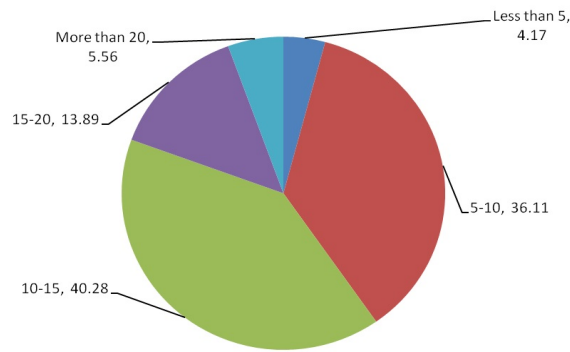


FIGURE 4.3: Participant with Work Experiences

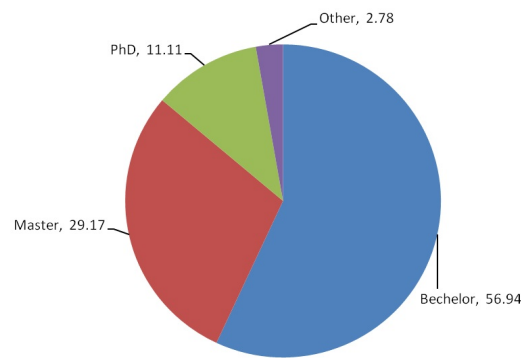


FIGURE 4.4: Participants with different educational qualification

The human development is an important factor in the development of countries and therefore the individuals were short listed on the basis of their involvement in construction industry as well as in CPEC.

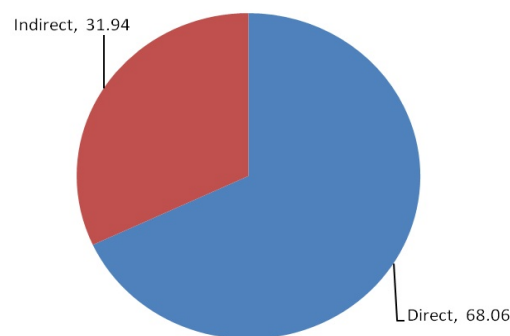


FIGURE 4.5: Interection status of industry professionals

Feedback taken from the key persons in which more than 65 % of the participants are directly involved in CPEC whereas remaining professionals have an indirect involvements, figure 4.5.

4.2 Reliability Analysis

The reliability analysis of the different factors was conducted to determine the reliability of data. All factors were observed with reliabilities greater than 0.765, table 4.1. The results justified that the data was reliable and further analysis could be proceeded.

TABLE 4.1: Reliability statics for the studied key factors

S.No.	Key Factors	Reliability
1	Human Skill Development	0.855
2	Project Management Practices	0.766
3	Awareness of Occupational Health & Safety Practices	0.932
4	Technology Transfer	0.906
5	Adoption of Technological Advancements	0.891
6	Inter Cultural Working Harmony	0.919
7	Industrial Linkage	0.922

In order to further strengthen the findings, the analysis has been performed on two levels. Individual level and combined level.

4.2.1 Individual Level

4.2.1.1 Ranking Factor Analysis

The total number of respondents for subject case study were 72. For current study, the factors like human development skills, adaptation to technological advancement, awareness of occupational health and safety, project management practices, technological transfer, inter cultural working harmony and industrial linkage have been considered to evaluate the impact of CPEC on uplift of local construction industry. Graphical representation of ranking factor analysis against each factor is discussed in detail as follows:

(i) Human Skill Development

Human skill development being pivotal factor in growth of any country was chosen as first factor for research due to its significance. It is the foremost important factor for the growth of any development sector. The achievement of FDI in the form of CPEC is expected to impact the human skill development and vice versa. Twelve sub factors were identified to evaluate the impact on Human skill development, figure 4.6.

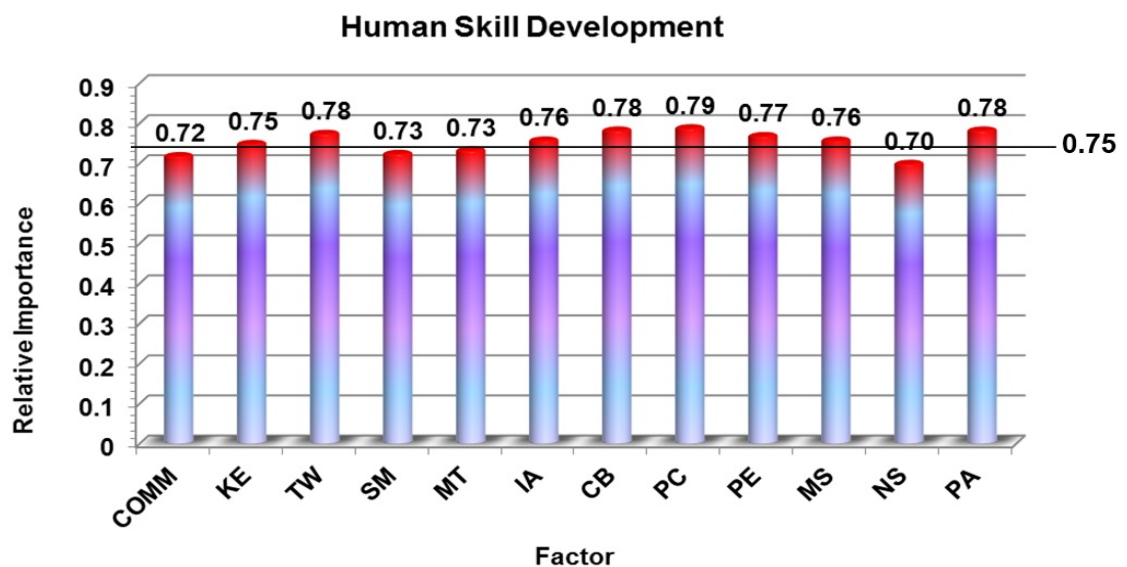


FIGURE 4.6: Ranking factor analysis of Human Skill development

The adoption of ranking factor analysis observed a strong relationship of CPEC project with human skill development i.e. almost 80% of the professional supported that CPEC will help to improve the local skill of available human resource. Out of sub factors, the enhancement of professional commitment was considered the top ranked factor (0.79) for the human skill development followed by team work (TW), confidence building (CB), and professional awareness (PA). According to analysis, the sub factor of negotiations skills (NS) has been considered least contributing in the human skill development as a result of FDI in the form of CPEC.

Discussion

Industrial professionals consensus on enhancement of confidence building and professional awareness by CPEC Projects is testimony of already scarcity of both values in current construction market. Pakistans construction industry is lagging behind in human development of its professionals when compared to International construction industry standards. CPEC would bring international professionals who would help to enhance its capacity and diversity. They would also have positive effects on human development of local professionals.

(ii) Project Management Practices

Project management practices are one of the key factors involved in the success or failure of any construction project. Currently, the lack of such practices severely affects (hampers) the construction projects in Pakistan. However, the implementation of international Project Management Practices will help to adopt new and advanced project management practices as agreed by the professional, refer figure 4.7.

Figure 4.7. Ranking factor analysis of Project Management Practices On average, this main factor achieved a ranking of 0.74. However among the ten identified project management factors, the quality awareness achieved the highest impact with the value of 0.79. Whereas risk identification and investigation skills (RIS) and problem solving and decision making skills (PSDMS) remained the least with 0.71.

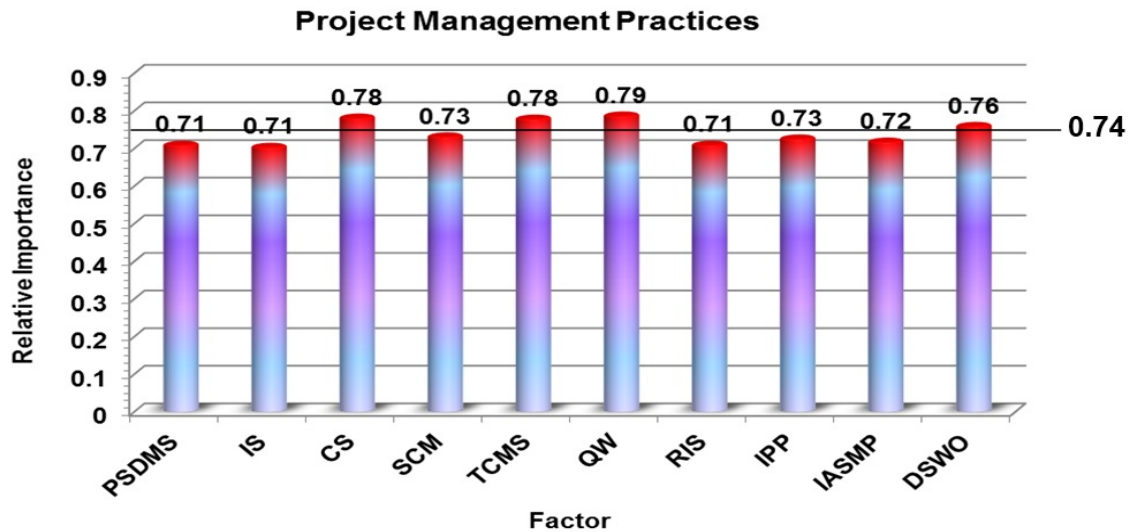


FIGURE 4.7: Ranking factor analysis of Project Management Practices

Discussion

Quality Assurance (Q/A) and Quality Control (Q/C) always remain major issue in Pakistans construction industry. It is evident from daily practices and outcomes of projects that quality is always compromised. Therefore, professionals firmly believe in revival of quality assurance and quality control as major aftereffect of CPEC projects.

(iii) Awareness of Occupational Health and Safety Practices

The implementation of occupational and safety practices is one of the important factor to decide a safe and healthy working environment. In industrialized and developed countries, a safe working environment is the most crucial factor at the stage of planning and design. The local construction industry of Pakistan is also expected to gain the very useful experiences of international project like CPEC.

Out of fourteen factors emphasizing the awareness of occupational health and safety, on average, all the responders agreed to uplift in awareness due to CPEC project, figure 4.8. Reduce accident at site (RAS) achieved a highest concern with a score of 0.74, whereas all other factors remained above 0.6 in this case.



FIGURE 4.8: Ranking factor analysis of Awareness of Occupational Health & Safety Practices

Discussion

Occupational health and safety remains core field of interest in developed countries for last few decades. Insurance companies, legislative rulings defining safety standards and increased public awareness were major factors that triggers increase in safety standards worldwide. Unfortunately Pakistans construction industry couldnt meet up with international safety standards. Therefore, people linked with construction industry envisioned that inclusion of CPEC projects would bring along International safety standards. Thus creating a healthy and safe work environment which will ultimately enhance the output of this vital sector.

(iv) Technology Transfer

The transfer of technology is considered to be one of the key aspects which the local industry is expected to benefit the most. On average, figure 4.9, each of factors included related to technology transfer received on average score of 0.73. All the respondents agreed to the fact that the transfer of technology would have positive effects on the output of local construction sector.

Discussion

Pakistans construction industry remains dependent upon technologically from past few decades. Conventional approaches are mostly used for execution of tasks, which are generally observed to be slow, labor intensive and unsafe. Therefore,

there exist unison among professionals that CPEC would result in technology transfer of construction techniques thereby enhancing productivity, safety and quality in construction industry.

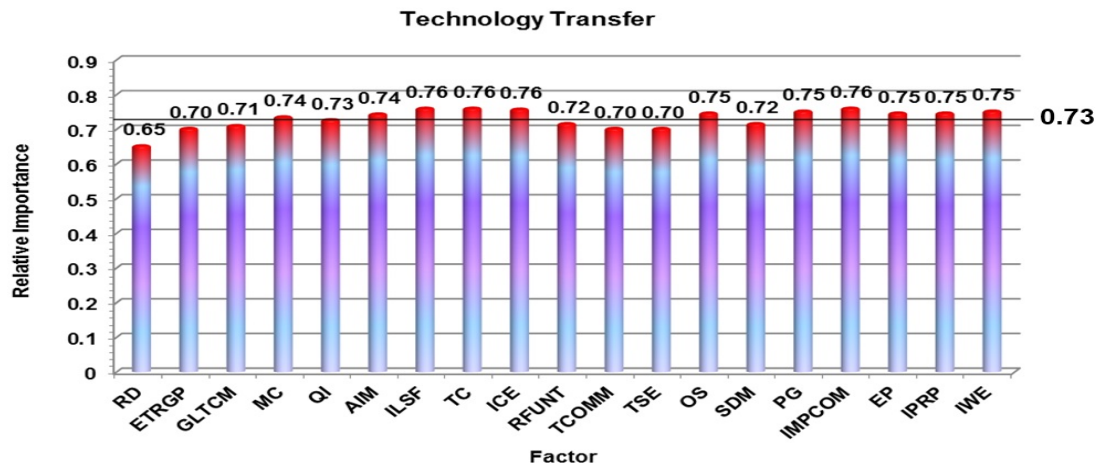


FIGURE 4.9: Ranking factor analysis of Technology Transfer

(v) Adoption of Technology Advancement

The technology transfer due to CPEC would also result in technological advancement at local environment. Such adoption will ultimately bring a positive effect in the output of industry which is currently lacking behind. Among 18 (eighteen) sub factors, the factor SSWF (size of skilled working force) achieved the highest consideration with a score of 0.79. However the average score remained 0.74, figure 4.10.

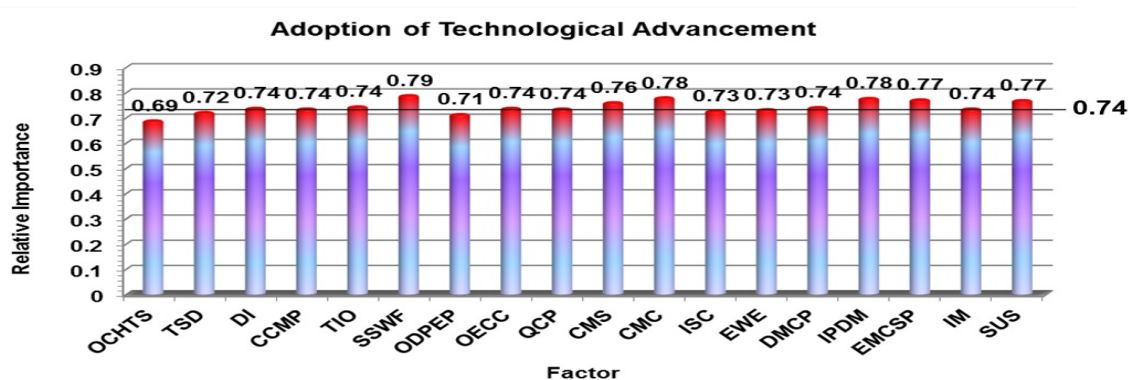


FIGURE 4.10: Ranking factor analysis of Adoption of Technology Advancement

Discussion

Low literacy level in Pakistan along with lack of sufficient vocational training institutes results in dearth of skilled manpower for construction industry. China on the other hand has focused in this particular field since decades and therefore, produces one of the best lot of skilled working force to support its industrial growth. CPEC would resultantly enhance size of skilled working force as visualized by industrial professional in this research. Skill development institutes under supervision of Chinese instructor would help in technology transfer and increase in size of skilled labor.

(vi) Inter – Cultural working Harmony

Working with other nation will also improve the inter cultural harmony and cultural relations. The people working in such environment will benefit from each other cultures which will further strengthen the relationship between the two countries. Among 15 (fifteen) sub factors supporting this factor, WEI (work efficiency improvements) achieved the highest consideration with a score of 0.79. However the average score remained 0.73, refer figure 4.11.

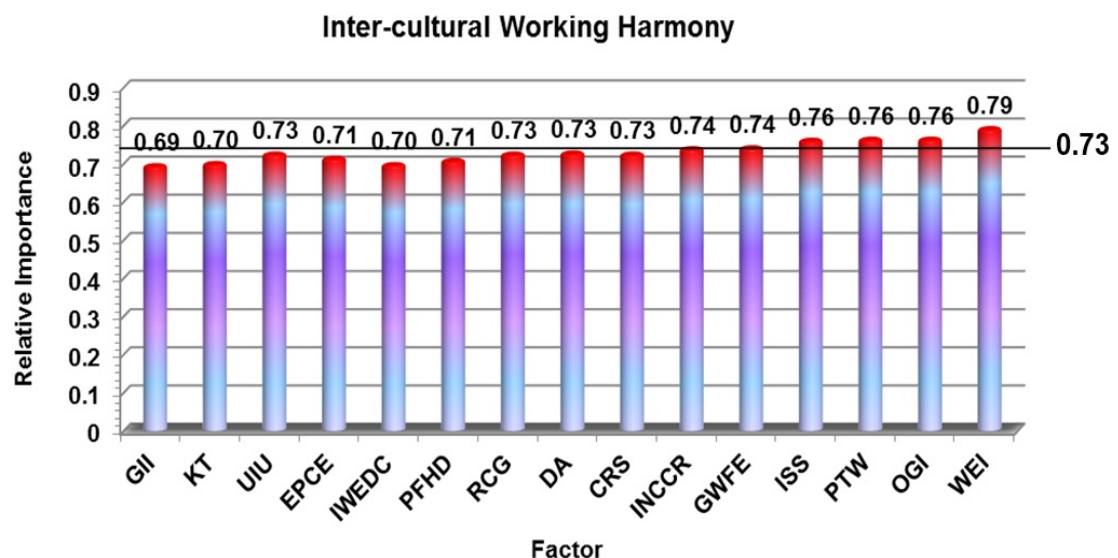


FIGURE 4.11: Ranking factor analysis of Inter – Cultural working Harmony

Discussion

Pakistan's construction industry remains void of inter cultural concept due to a

very few number to international ventures. People generally migrate less in this industry, hence, local people of that particular vicinity are found in overwhelming majority among industry workers executing any project. Nevertheless, industry has not witnessed any massive induction of foreign professionals in any of past project, However, CPEC would definitely provide a greater exposure to inter-cultural harmony concept as it would form amalgamation of work force that belong to entirely different cultural background.

(vii) Industrial Linkage

Apart from all other factors substantiated earlier, the linkage of construction development between the two countries during CPEC would benefit in a long term. The other factors like human skilled development, project management practices, technology transfer etc are all dependent upon a strong industrial relationship. The industries professionals also agreed to the fact that a strong industrial relation would result in strong CBFL (capacity building of local firms) (0.76) and IC (investment corporation) & AT (advancement in technology) (0.76), figure 4.12.

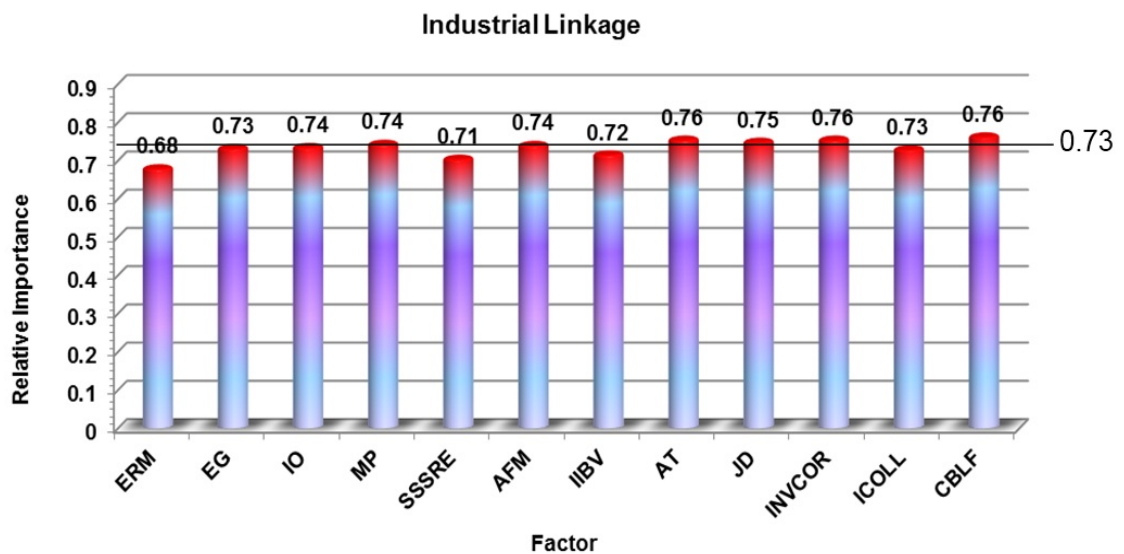


FIGURE 4.12: Ranking factor analysis of Industrial Linkage

And last factor which has the lowest rank in industrial linkage is ERM (0.68) (efficient resource management).

Discussion

Construction industry is conjugated with many industries, ranging from small industries of hardware tool manufacturers to gigantic firms like Paint manufacturers, Reinforce Earth technology, and Sewerage technology etc. The updation of construction industry would ultimately guarantee growth for allied industries along with increase industrial growth and employment opportunities. CPEC driven industrial growth would definitely leave positive marks on local supporting manufacturing industries.

4.2.1.2 Frequency Analysis

The frequency analysis has been carried out for the data obtained through SPSS and graphical representation of detailed analysis is described below.

(i) Human Skill development(HSD)

HSD helps employees to develop their personal, organization skills, knowledge and abilities. The results of frequency analysis showed that the top ranked skill was confidence building with percentage of 76.4%, followed by performance enhancement i.e. 75%, professional commitment i.e. 73.6 % and at the last was negotiation skills i.e. 51.3%, refer figure 4.13.

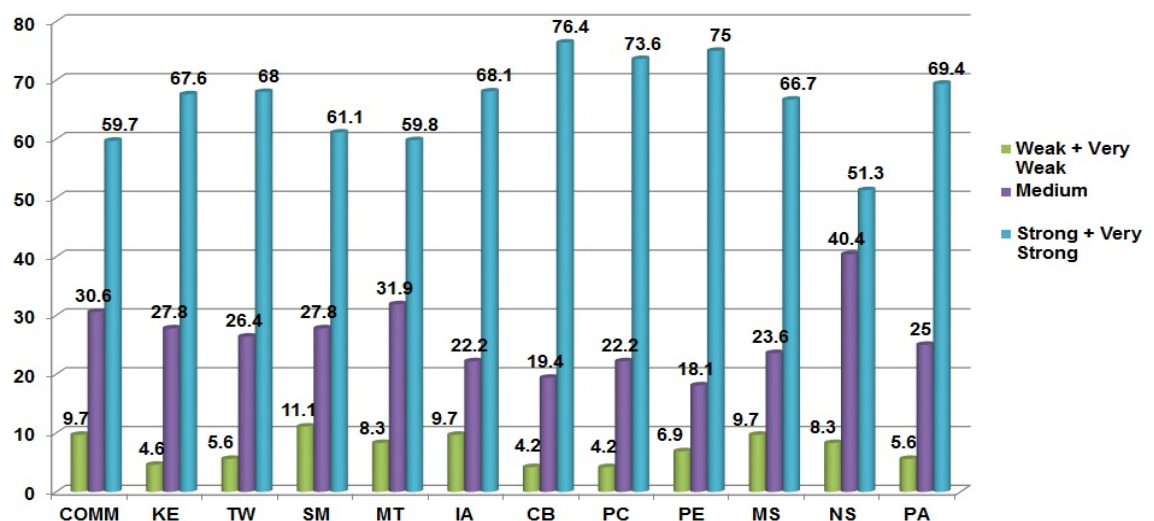


FIGURE 4.13: Frequency analysis against factor Human skill development

Discussion

Consensus among industry professional is observed regarding the improvement of Human Skill Development. Among these supporting factor, the confidence building achieved the highest agreement. Confidence building is defined as ability to stand in front of ones fear and respond to the challenges very bravely. Construction industry is a challenging field, where professionals had to encounter a variety of challenges. Therefore, confidence building is key factor in improving over all human skill development of individuals.

(ii) Project Management Practices

Good project management like problem solving and project management skills, communication skills, risk identification, scope management etc play an important role in project completion as it enables us to balance the triple constraints i.e. time, scope and cost in an efficient way. Out of all these sub factors, communication skills got highest positive percentage of 76.4 % followed by quality awareness (73.6%), figure 4.14, whereas investigative skills stood at last with 55.6 % only.

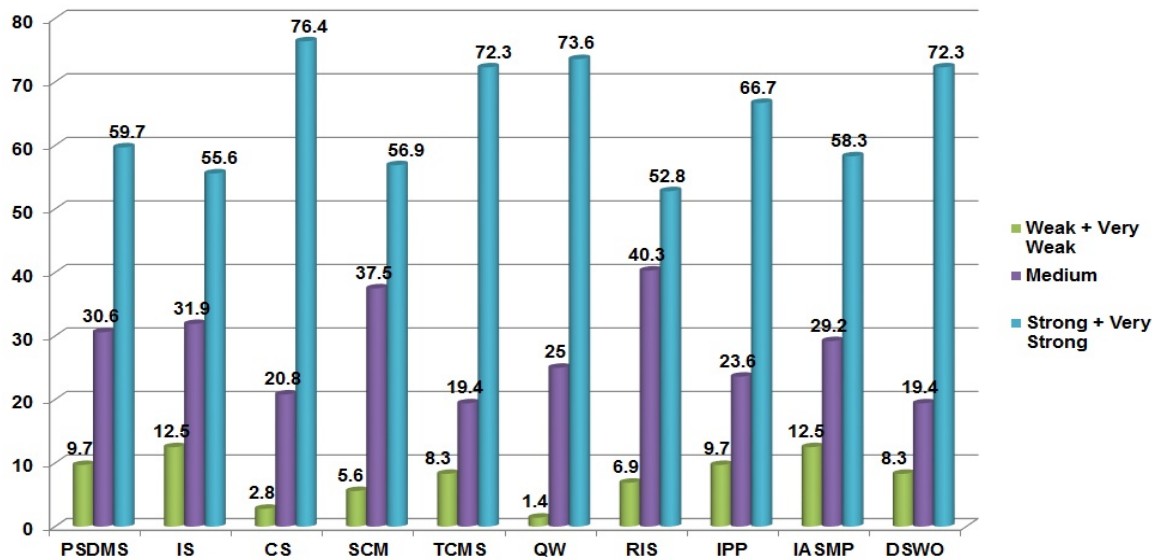


FIGURE 4.14: Frequency analysis against factor Project Mgmt Practices

Discussion

Construction industry requires active involvement from different stakeholders for smooth functioning. During execution of any construction project communication

between these stakeholders become key factor to achieve the targets set in construction schedule. Lack of communication or barriers to communication always result in unfavorable situations and ultimately causing delay to the project. Communication skill is therefore, most vital area to be focused for smooth functioning of project. Hence, highest frequency score for communication skill is equivalent to this skill being grey area in industry.

(iii) Awareness of Occupational Health and Safety Practices

Awareness among employer and employees with regard to occupy health and safety is an crucial factor in construction as it mitigates the risks of injuries and helps in creating pleasant environment in the workplace. Frequency analysis was carried from given data and the results depicted highest positive percentage of improvement in safety policies of executing agencies and reduction in accident at sites, as 62.5% and 61.2 respectively. Improvement in safety evaluation technique obtained third rank with 59.7 % while promotion of safety awareness remained at last with 43.1 %, figure 4.15.

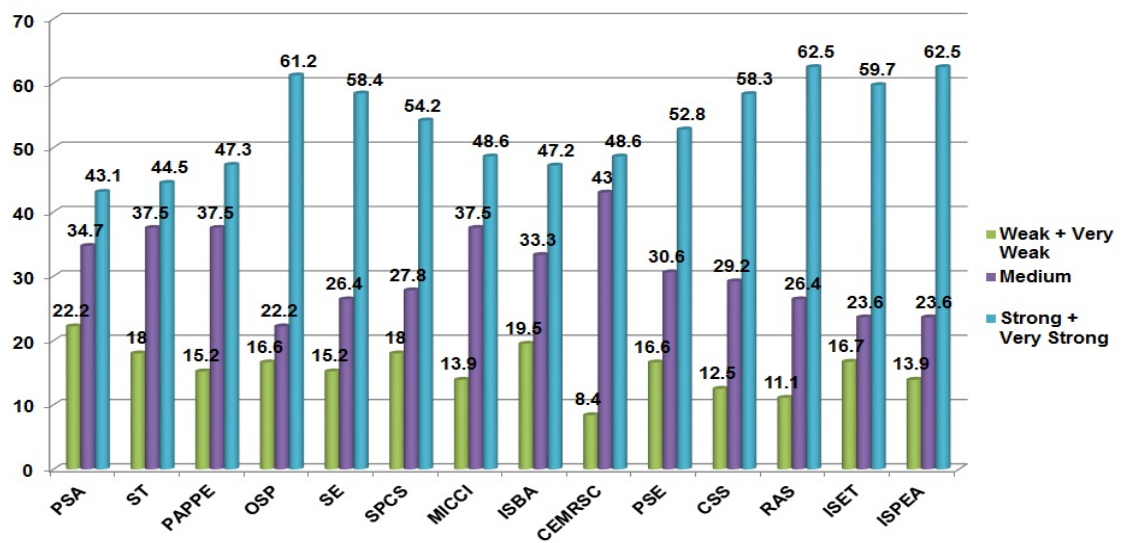


FIGURE 4.15: Frequency analysis against factor Awareness of Occupational Health and Safety Practices

Discussion

Construction industry in Pakistan is prone to accidents at site causing casualties and injuries to the workforce. Casual behavior and lack of knowledge on Occupational health and safety practices of the work force have been reported the key issues in this regard. However the current world demands a strict regulations enforcements by government agencies along with awareness to general public. CPEC projects would help to promote an environment with safety standards to be followed by international firms. International firms with dedicated teams for maintaining occupational health and safety standards would lead the way. Therefore, FDI from CPEC would help and guide to raise the awareness level of safety standard in Pakistans construction industry.

(iv) Technology Transfer

The technology transfer from industrialized countries is viewed as a key to addressing the low level of technological development of developing countries. The results of frequency revealed that both invest / cost/ expenditure and organization support with 69.5% were at top, improved working environment with 68% was second , third was improved competencies i.e. 66.6%, where as research and development with 41.6% remained at last, refer figure 4.16. CPEC will provide opportunities to construction companies of Pakistan to get benefited from modern day technology as a result of technology transfer.

Discussion

As already discussed earlier, technology transfer is much anticipated in our traditional and conventionally operating construction industry with the advent of CPEC projects. This would ensure foreign international construction companies operation in Pakistan, which are already well versed with latest technologies. Therefore, local firms working as JV partners or as subcontractors would be direct beneficiaries of this technology transfer.

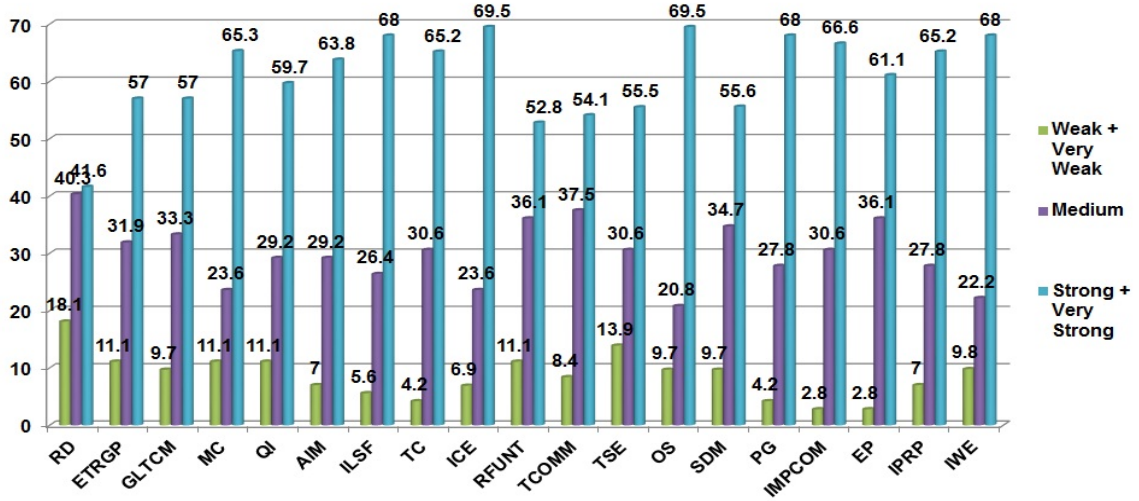


FIGURE 4.16: Frequency analysis against factor Technology transfer

(v) Adoption of Technological Advancement

In order to meet the modern day challenges the construction companies have to equip and utilize themselves with new technologies to increase their efficiency and productivity resulting in timely completion of projects. The frequency analysis results showed that size of skilled force achieved highest scoring 73.6% in frequency analysis subsequently followed by innovation in project delivery method with 72.2% and construction market compress with 70.8 %, figure 4.17. Output concern due to high technically system got lowest 50% in frequency analysis.

Discussion

Dearth of skilled labor is most critical problem at this point in time for construction industry throughout the world. After the anticipated boom in construction activities with advent of CPEC projects, this particular issue would be further magnified if not addressed properly, as skilled workforce is directly linked with use of modern and innovative practices for better output toward achieving the milestones. Therefore, there remains strong consensus among industry professionals regarding these two factors as also supported by results of frequency analysis.

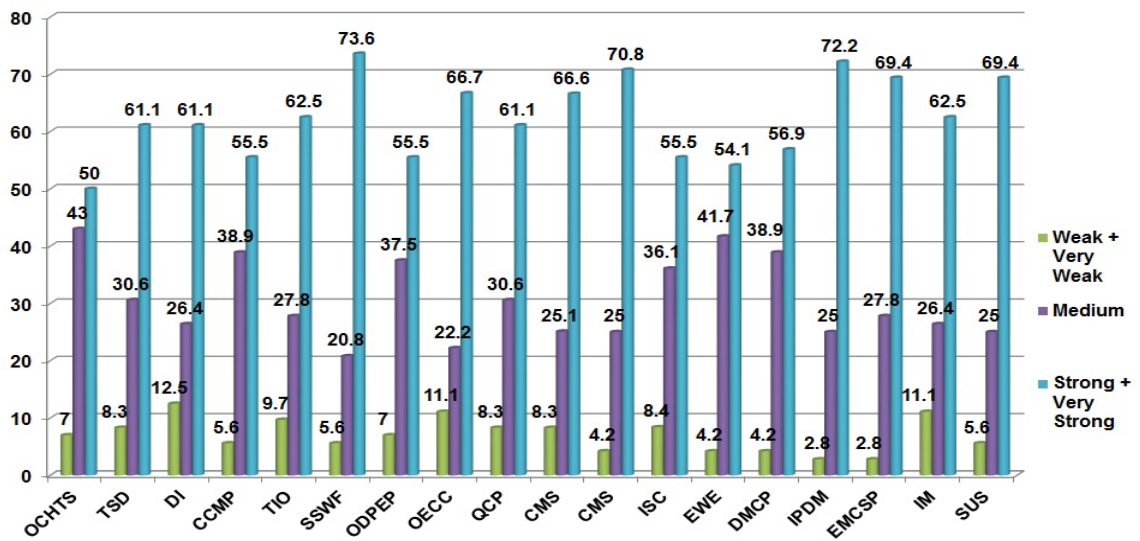


FIGURE 4.17: Frequency analysis against factor Adoption of Technological Advancements

(vi) **Inter-cultural Working Harmony**

As result of CPEC many international construction companies would be involved in the project under execution and thereby creating employment opportunities for Pakistani nationals too. This will help in understanding of not only socio cultural differences but also we will get benefited from expertise of international workforce. The inter culture working harmony will strengthen the relations and bring fruitful results for both the countries. Analysis showed that among 15 sub factors work efficiencies improvement had the highest percentage i.e. 73.6%, followed by promotion of team work i.e. 69.5% and opportunity for global intervention with 65.2%, whereas generation of innovation idea was at bottom of the list with 50%, figure 4.18.

Discussion

Latest studies have reported that when people from different cultural and social backgrounds interacts and team up during given task they generally tend to perform better with respect to group of people having uniform background. The same has been observed in this study. Having different background causes difference in approach to solve a given set of challenges, therefore, having a variety of inputs arising from heterogeneous professionals during brainstorming session resultantly

produces far better results if compared to the people sharing same cultural and social values.

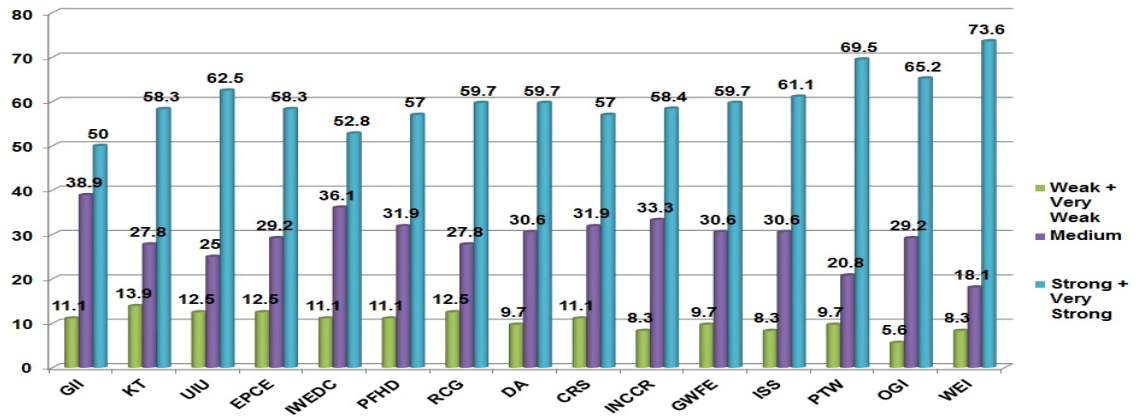


FIGURE 4.18: Frequency analysis against factor Inter-cultural Working Harmony

(vii) Industrial Linkage

Investment in construction sector under CPEC will have an effect on other sectors of which the industrial sector is very important. The strength and nature of industrial linkage between both the countries will have a great impact on our economy. Frequency analysis result depicted in descending order from top shows capacity building of local firms, access to foreign market and investment corporation with 70.8%, 68.1% and 68% respectively, refer figure 4.19. Efficient resource management end up at last in list with 43.1 %.

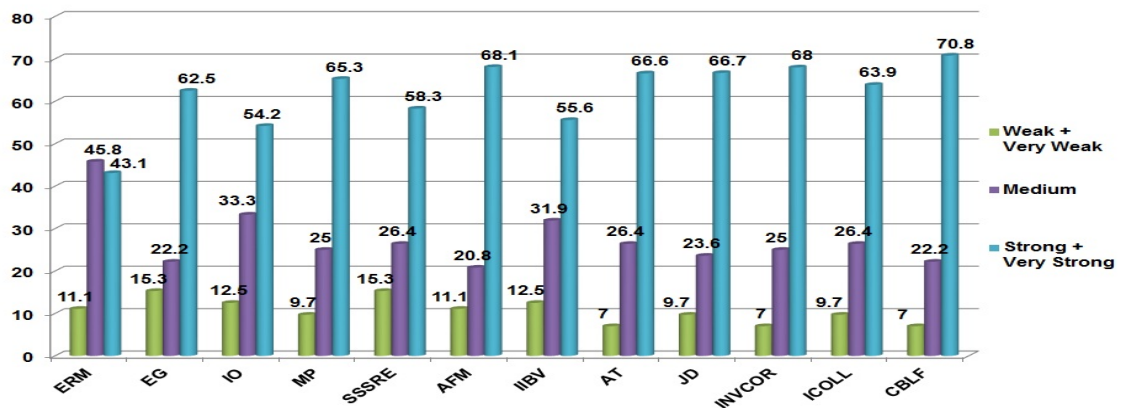


FIGURE 4.19: Frequency analysis against factor industrial linkage

Discussion

Coherence of construction industry with other allied industry is most obviously observed phenomenon by policy makers. Therefore, infrastructure spending always set motion to the economy of a country due to its interlinking nature. Boom in construction industry cause two way effect to the related industry thereby creating further employment and economic activities across the board.

4.2.2 Combined Level

4.2.2.1 Ranking Factor Analysis

On continuation of individual ranking factor analysis, combined factor analysis was also performed using equations:

$$RII = \sum W / A \times N \dots\dots\dots (4.2)$$

$$= \sum RII / N_{sf} \dots\dots\dots (4.3)$$

N_{sf} is the total number of sub factor.

The output of analysis is being presented in figure 4.20 in a graphical format. Among the seven factor, the human skill development achieved the highest ranking with a score of (0.75) followed by Project management practices (0.74), Awareness of occupational health (0.7), Technology transfer (0.73), Adoption of technological advancement (0.74), intercultural working harmony (0.73) and Industrial linkage (0.73) respectively. This suggests that the industries professionals considered the development of human skill the most important to be affected by CPEC project.

Among the eight factor, the human skill development achieved the highest ranking with a score of (0.75) followed by Project management practices (0.74), Awareness of occupational health (0.7), Technology transfer (0.73), Adoption of technological advancement (0.74), intercultural working harmony (0.73) and Industrial

linkage(0.73) respectively. This suggests that the industries professionals considered the development of human skill the most important to be affected by CPEC project.

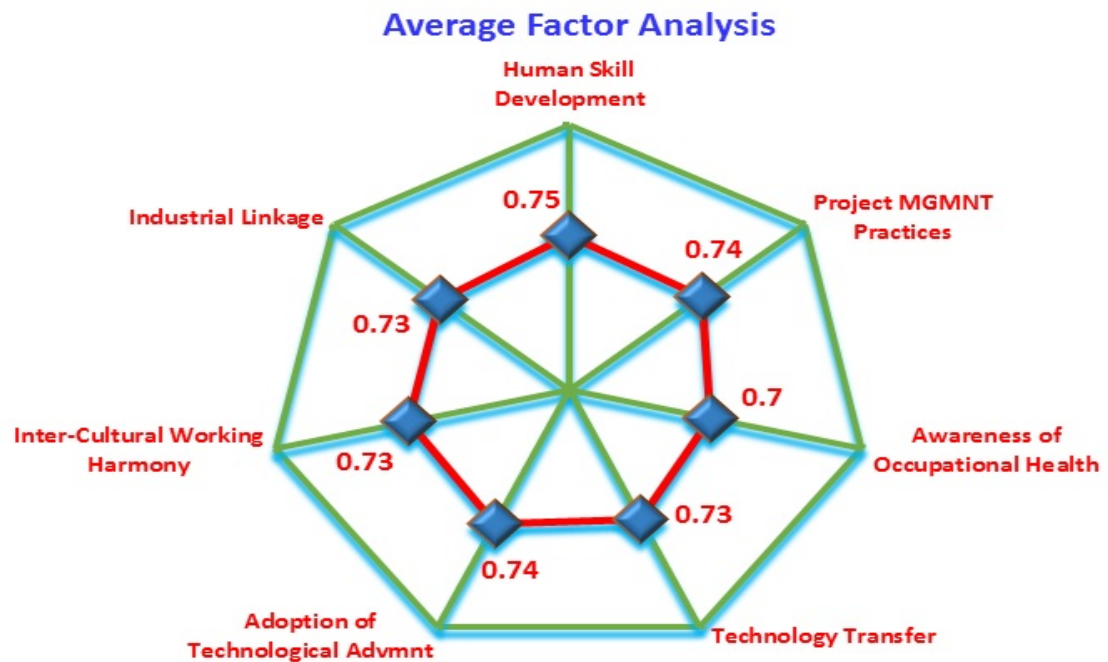


FIGURE 4.20: Average of Ranking Factor Analysis

Discussion

Skilled work force forms the backbone of any industry, hence availability of sufficient amount of skilled labor is imminent to growth of construction industry. Conventional vocational training institutes in Pakistan couldnt cope up with this growing demand of technical manpower and continuously changing Construction technology. Therefore, with the advent of FDI funded projects like CPEC, project management practices within construction industry would be improved substantially due to induction of foreign professionals. Construction industry in industrialized countries have evolved to near perfection as these countries have undertaken massive infrastructural projects in near past. China being perfect example of such metamorphosis from agricultural economy to Global Industrial leader could easily revive Pakistans construction industry with help of CPEC funded projects. Technology transfer from ultra-modern Chinese companies via JV pattern with local

firms for execution of mega infrastructural projects would have lasting effects on local construction industry. Hence, human skill development would be centerpiece of all the benefits being attained to local industry with CPEC.

4.2.2.2 Frequency analysis

Similarly, the average of frequency analysis was also performed to rank the factors on the basis of frequency by using the equation as given below.

$$= \sum W / N \dots\dots\dots (4.4)$$

Then

$$= \sum R_f / N_{sf} \dots\dots\dots (4.5)$$

In this case, the human skill development achieved the highest score 3.77 followed by project management practices (3.71), awareness of occupational health(3.49), technology transfer (3.66), adoption of technological advancement (3.72), intercultural working harmony (3.66) and Industrial linkage(3.67), refer figure 4.21.

However, it is important to observe that each of the factor was able to achieve a range of 3.65 to 3.8 which was almost equal to “agree (4)” in our scale.

Discussion

Frequency analysis and ranking factor analysis both asserted the importance of human skill development for a successful construction industry. Above mentioned techniques for data analysis highlighted that most influential factor among seven selected is human skill development. Human skill development remain pivotal factor because individuals are most desired asset to any organization. They help the organization to achieve the planned targets within stipulated time. Adaption of modern technology, awareness to occupational health and safety, Intercultural harmony among industry professionals and other important factors impact the human skill development, directly or indirectly. Therefore, human skill development should be given due importance at policy making level for betterment of

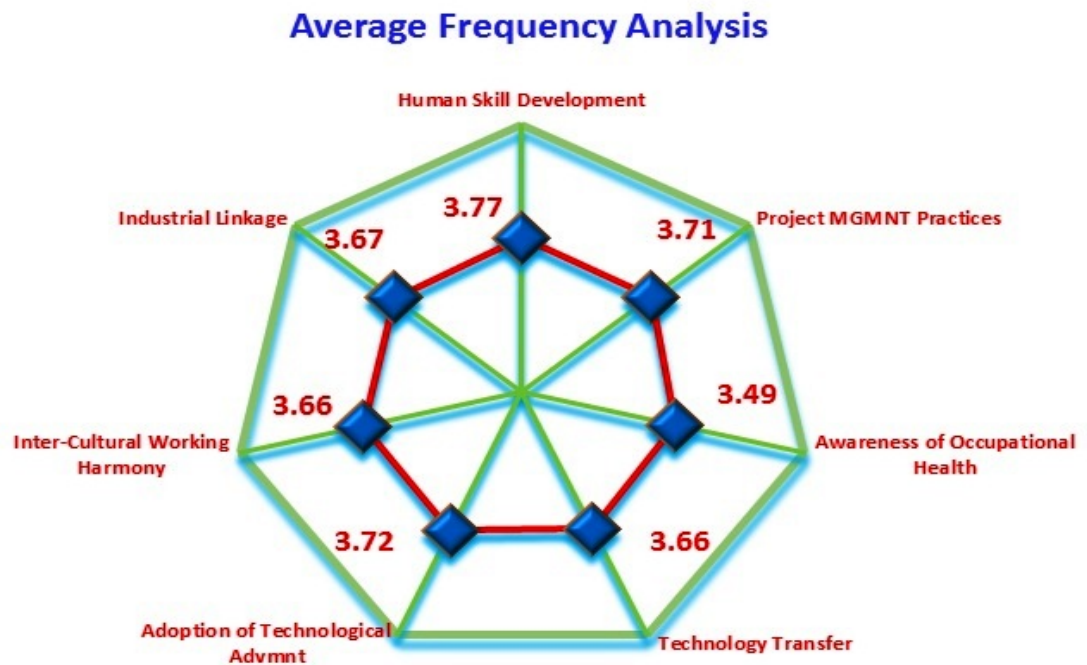


FIGURE 4.21: Average of frequency Analysis

construction industry and enhancement of quality image of infrastructure projects at international level.

Chapter 5

Conclusions and Recommendations

This chapter briefs the summary of analysis, their findings and conclusions. Some future recommendations have also been presented in this chapter. Two sections have been formulated. Section 1 details the conclusion based upon data analysis, whereas the later section presents recommendations.

5.1 Conclusions

Scope of study in this research was limited to the assessment of impacts of CPEC on uplift and development of construction industry of Pakistan. The objective of the study was to evaluate the impact of identified factors on local construction industry of the country.

Based upon critical literature review seven (07) factors with potential impact of construction industry were identified. Factors under consideration are:

- Human skill development
- Inter cultural working environment harmony

- Improvement in health safety & environment practices
- Introduction to adaptation of Hi – Tech system
- Technology transfer
- Advancement in management Practices

These identified seven (07) factors were further divided into sub categories to find out the potential effects of CPEC on construction industry of Pakistan. A detailed questionnaire was developed using Delphi technique. A response rate of 72 % was received back. Conclusions are summarized as below.

- The data was analyzed using statistical analysis and it has been observed:
 - ◊ The reliability analysis of the different factors resulted a value greater than 0.7 in each case. This result justified that the data was reliable.
 - ◊ The results of the individual level ranking factor analysis against each factor was analyzed and most important sub factors against each factor are listed down as shown in table 5.1.

As per ranking factor analysis, professional commitment, quality awareness, size of skilled working force and work efficiency improvements achieved the highest concern (0.79). These important sub factors play an important role to improve the efficiency of main factors and also help in enhancing the efficiency as well as productivity of construction industry performance.

- The results of individual level frequency analysis against each factor were also analyzed and most occurring responses against each sub factor were analyzed, table 5.2.

Among these supporting factors, the confidence building and communication skills achieved the highest agreement (76.4%). Construction industry is a challenging field, where professionals had to encounter a variety of challenges. Therefore, confidence building is key factor in improving overall

TABLE 5.1: Ranking Factor Analysis

S. No	Main Factor	Sub Factors	Important Sub Factor
1	Human Skill Development	12	Professional Commitment (0.79%)
2	Project Management Practices	10	Quality Awareness (0.79%)
3	Awareness of Occupational Health & Safety Practices	14	Reduces Accidents at site (0.74%)
4	Technology Transfer	19	Increase in Labor Skill Force, Technology Credibility, Invest/ Cost/ Expenditure Improved Competitiveness (0.76%)
5	Adoption of Technological Advancements	18	Size of Skilled Working Force (0.79%)
6	Inter Cultural Working Harmony	15	Work Efficiency Improvements (0.79%)
7	Industrial Linkage	12	Capacity Building of Local Firms, Investment Corporation and Advancement in Technology (0.76%)

TABLE 5.2: Frequency Analysis

S. No	Main Factor	Sub Factor	Important Sub Factor
1	Human Skill Development	12	Confidence Building (76.4%)
2	Project Management Practices	10	Communication Skills (76.4%)
3	Awareness of Occupational Health & Safety Practices	14	Improvement in Safety Reduction in Accident at Sites (62.5%)
4	Technology Transfer	19	Invest / Cost/ Expenditure Organization Support (69.5%)
5	Adoption of Technological Advancements	18	Size of Skilled Working Force (73.6%)
6	Inter Cultural Working Harmony	15	Work Efficiencies Improvement (73.6%)
7	Industrial Linkage	12	Capacity Building of Local Firms (70.8%)

human skill development of individuals as well as to manage the projects. On the other hand, during execution of any construction project communication between these stakeholders become key factor to achieve the targets

set in construction schedule. Lack of communication or barriers to communication result in unfavorable situations and ultimately impacting negative effects on projects. Communication skill is, therefore, most vital area to be focused for smooth functioning of project. Hence, highest frequency score puts this skill being grey area in industry.

- The results of combined ranking factor analysis observed:
 - ◊ Human skill development achieved the highest ranking 0.75 and suggested that industry professionals considered the development of human skill the most important factor to be affected by CPEC project. Whereas, awareness of occupational health achieved the lowest ranking 0.7 in its support.
 - ◊ The adoption of frequency analysis showed that human skill development achieved the highest score 3.77 followed by project management practices (3.71), whereas, awareness of occupational health achieved the lowest ranking 3.49.

It has also been observed that none of the factor has been totally negated by the respondents and therefore all the factors that have been taken into consideration for enhancing efficiency and productivity of construction industry. However, these factors are expected to reveal better results for a relatively larger sample.

The overall results of this study helped to prioritize factors to support uplift to the local construction industry due to foreign direct investment (FDI) in the shape of CPEC. This prioritized list of factors referred to the construction industry of Pakistan has not still been established till to date.

5.2 Recommendations

Based upon the results, analysis and conclusion of the study, it is recommended that

- Based upon identified factors and their potential effects, a legal framework can be formulized to enhance the productivity of local construction sector.
- A further study can be managed by evaluating the sub- projects involved in CPEC like railways, energy, roads etc.
- A study can also be concluded to explore, observe and rectify deficiencies in construction projects currently undertaken in CPEC investments.

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Appendix A

Questionnaire

QUESTIONNAIRE

ASSESSMENT OF POTENTIAL EFFECTS OF CPEC ON DEVELOPMENT OF PAKISTAN'S CONSTRUCTION INDUSTRY

The vital geo-strategic position of Pakistan has great potential for economic prosperity. The current uncertain economic conditions in this region have severely affected the country's economy due to lack of basic infrastructure facilities. CPEC will provide opportunities for all sectors of the Economy including infrastructure, energy production, railways up-gradation, and establishment of Special Economic Zones, port development, aviation, agriculture, mining, tourism and cultural exchanges. In order to bear fruits of this important vision, the availability of basic infrastructure is vital. However, the role of construction industry in development of infrastructure cannot be denied.

The construction industry would be the key player in achievement of basic infrastructure and ultimately in social prosperity as well as economic stability of the country. This study is being conducted to investigate the potential effects of CPEC on construction industry of Pakistan. Apart from other benefits of CPEC to the country's economy, it is also vital to assess its role in uplift of the construction sector.

The feedback from Industry Professional would be the key to a successful assessment of such impacts of Foreign Direct Investment (FDI) in shape of CPEC in our country. Your kind cooperation is requested.

PART-I: Demographic Data

a. Type of Organization

Owner/ Client Consultant Contractor Other : _____

b. Profession

Architect Designer Civil Engineer Quantity Surveyor Other : _____

c. Gender

Male Female

d. Working Experience (years)

Less than 5 5-10 10-15 15-20 More than 20

e. Educational Qualification

Bachelor Master PhD Other : _____

f. Interaction with CPEC

Direct Indirect

PART-II: Research Data Acquisition

A. Human Skill Development :

In what way do you think that CPEC will impact the following Human Skill Development factors of our local Construction Industry?

S. No	Factors	Very Weak	Weak	Medium	Strong	Very Strong
1	Communication					
2	Knowledge Enhancement					
3	Team Work					
4	Stress Management					
5	Multi Tasking					
6	Innovative Aptitude					
7	Confidence Building					
8	Professional Commitment					
9	Performance Enhancement					
10	Management Skill					
11	Negotiate Skill					
12	Professional Awareness					

B. Project Management Practices :

Project Management Practices are the key to successful completion of any infrastructure project. CPEC being an international venture, how it will impart its contribution in improving Management Practices in our local projects considering the following factors:

S. No	Factors	Very Weak	Weak	Medium	Strong	Very Strong
1	Problem solving and decision making skills					
2	Investigative skills					
3	Communication skills					
4	Scope management					
5	Time & Cost management skills					
6	Quality awareness					
7	Risk identification and investigation skills					
8	Improve procurement practices					
9	Increase Awareness about state holder management practices					
10	Developments in current project management strategies of working organizations					

C. Awareness of Occupational Health and Safety Practices :

Occupational Health and Safety is the prime concern in Construction industry of advanced countries. Up to what extent do you agree that Occupational Health and Safety environment of our local construction sector will be enhanced by following the practices being implemented in development of infrastructure projects in CPEC?

S.No.	Factors	Very Weak	Weak	Medium	Strong	Very Strong
1	Promotion of Safety awareness					
2	Safety trainings					
3	Proper availability of PPE (Personal Protective Equipments)					
4	Organization safety plan					
5	Safety environment					
6	Safety Provision at construction Site					
7	Monetary incentives in construction contracts improvement					
8	Improvement in Safety budget allocation					
9	Changes in execution methodology with respect to safety concerns					
10	Provision of Safety equipments					
11	Compliance to Safety standard					
12	Reduces Accidents at Site					
13	Improvement in safety evaluation techniques					
14	Improvement in safety policies of executing agency.					

D. Technology Transfer :

Technology transfer is one of the key element considered for enhancing the output of construction industry projects. How, in your opinion, CPEC will improve the working of industry professionals?

S.No.	Factors	Very Weak	Weak	Medium	Strong	Very Strong
1	Research & Development					
2	Enhancement in technology related government policies					
3	Growth of local technology construction market					
4	Market Competition					
5	Quality improvement					
6	Adopting of innovative method					
7	Increase in labor skilled force					
8	Technology credibility					
9	Investment/cost/expenditure					
10	Risk factors due to uncertainty of new technology					
11	Technology commercialization					
12	Technical skill enhancement					
13	Organizational support					
14	Skill development method					
15	Productivity and growth					
16	Improved competitiveness					
17	Enhanced procurement					
18	Improve project performance					
19	Improve working environment					

E. Adoption of Technological Advancements :

Do you think that CPEC will help to improve the adoption of advanced technology for increased output of construction organizations?

S.No	Factors	Very Weak	Weak	Medium	Strong	Very Strong
1	Output concerns due to high tech system					
2	Technical skills developments					
3	Design improvement					
4	Complexity in construction management practices					
5	Technology investments vs output					
6	Size of skilled working force					
7	Optimization in design procurement and execution practices					
8	Overall effects on construction costs					
9	Quality control practices					
10	Construction management skills					
11	Construction market competitions					
12	Improvement in safety concern					
13	Efficient working environments					
14	Data Management for complex projects					
15	Innovation in project delivery methods					
16	Effective monitoring & control system and practices					
17	Innovative materials					
18	Sustainability					

F. Inter-Cultural Working Harmony:

FDI provides opportunities to develop Inter-cultural linkage at work environment. How do you foresee that Inter-cultural relations developed by CPEC will affect the working environments in construction projects?

S.No.	Factors	Very Weak	Weak	Medium	Strong	Very Strong
1	Generation of innovative ideas					
2	Knowledge transfer					
3	Uplift in intercultural understanding					
4	Exchange of professional cultural experiences					
5	Improved working environment due to diverse culture					
6	Promotion of fair human dealings					
7	Removal of communication Gap					
8	Diversity awareness					
9	Conflict resolution skills					
10	Increased creativity					
11	Global work force experience					
12	Improvements in soft skills					
13	Promotion of team work					
14	Opportunity for global intervention					
15	Work efficiency improvements					

G.Industrial Linkage :

Construction is one of the major pillars of any economy and industrial linkage is considered as an important factor to uplift the economic conditions in industrialized world. Do you think the industrial linkage developed through CPEC will impart positive features in our local construction industry?

S.No.	Factors	Very Weak	Weak	Medium	Strong	Very Strong
1	Efficient resource management					
2	Employability growth					
3	Investment opportunities					
4	Mutual production					
5	Self sufficiency and self reliance enhancement					
6	Access to foreign market					
7	Improvement in international business ventures					
8	Advancements in technology					
9	Job development					
10	Investment corporation					
11	Industrial collaborations					
12	Capacity building of local firms					