PERFORMANCE ASSESSMENT OF CONSTRUCTION ENGINEERING & MANAGEMENT (CEM) DEGREE PROGRAM IN DEVELOPING COUNTRIES: CASE OF PAKISTAN

A thesis of

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by

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This is to certify that the

Thesis titled

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Has been accepted towards the partial fulfillment

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“ This thesis is dedicated to those who never believed in me but made me

who I am today *.”*

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ABSTRACT

Construction is one of the most essential industries in Pakistan and a critical asset in helping the country succeed in a globally competitive market. Construction industry performance to a large extent is backed by the competence and skills generated by Construction Engineering and Management (CEM) programs offered by Pakistani universities.

Construction management education programs and the industry are both connected to the lifeline of industry's survival and development. The industry requires the construction management programs to not only provide an adequate number of graduates, but also properly train its future leaders in the skillset required in order to quickly become productive workers. Therefore it is inevitable that the construction management programs must be constantly revamped and enhanced to address the education needs of the industry. The value of well-defined and structured courses as well as industry experiences and feedback must be inclusive to the programs. These programs need the industry to provide support and input to improve the future construction manager's education and experience level before entry into the workforce.

This research focused on finding ways for the improvement of the construction industry based on the evaluation of existing practices, curricula and teaching/delivery methodology. It identifies the critical skillset needed for construction managers as perceived by the industry and further examines the relative differences in importance of the skills as perceived by the industry in contrast to academia. The findings are based on the data from two major universities offering postgraduate level CEM education: NEDUET, Karachi and NUST, Islamabad. Most of the respondents (61%), who entered into these programs to improve their technical skills and enhance their project

management competencies, agreed that the program is well designed with good number of compulsory and optional courses. While evaluating the teaching methodology, approximately 81% respondents agreed that more than 60% major course content was satisfactorily delivered by well versed and competent course instructors.

This study would be instrumental in providing recommendations to update/overhaul CEM curricula and mode of deliverance in order to bridge the gap between academia and industry as well as to enhance the existing program's effectiveness with respect to construction industry advancements.

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INTRODUCTION

1.1 GENERAL

Construction projects are unlike other corporate projects; they are Architectural, Engineering & Construction (AEC)-based and need creative solutions that are unique to each project, in contrast to business projects where generalized solutions and steps are devised in all sorts (Stukhart, 1993). There may be organizational standards in an Architectural/Engineering (A/E) firm with broad set of rules, procedures or best practices already worked for them; but blindly following these standards not only restricts opportunities for generating unique solutions but also customizes creative thinking needed for construction project (Lowe, 1991).

Many of the modern industrial projects are complex and multidisciplinary in nature like Panama canal extension, Palm island Dubai, Grand Coulee Dam USA ,Shanghai Metro China projects etc. Consequently the construction part of such projects also becomes complex, both technically managerially. Besides, improved techniques and materials are often used in the projects in order to bring down costs, enhance quality and ensure timely completion. These however demand skilled knowledge and more attention to the construction process (Howell and Ballard, 1998).

Construction managers plays a very key role in modelling the industry effectiveness and efficacy. They serve as interact with all stake holders involved in construction business (like consultants, contractors etc.). The success of a project and construction

business is highly influenced by the skills applied by construction managers (Ahmed et al., 2014). The present-day construction demands from the construction mangers practical approach in solving problems, foresight and innovative skill in mobilization and maximizing efficient utilization of resources, proper coordination of all activities and a result-oriented plan of implementation and control (Clyde, 1983).

Construction industry performance, to a large extent, is backed by the competence and skills generated by Construction Engineering and Management (CEM) programs offered by graduate universities all over the world. Construction industry and construction management programs taught at universities are significantly important for each other's backing therefore industry always demands from institutes to not only produce competent graduates in quantity but also adequately trained (Tache, 2010).

Tache (2010) described that effective project managers are always in demand to further handle complex projects accordingly. Some of the skills that make construction managers effective are time management, project management tools, technical knowledge, leadership and interpersonal skills, communication skills and organizational.

Suzanne and Rosemary (2002) insisted that construction industry should support and back the CEM programs so as competent future construction managers could be trained with sufficient knowledge and skills.

Questions like have CEM graduates met their professional objectives up till now? Are these graduates performing in the field as they envisaged? Does the content of pertinent university degree programs have all components to meet the continuously changing

construction industry trends? Literature review demonstrated that there is an inherent limitation on the studies gauging performance of such course curriculums with respect to generating the requisite skills for imparting the right level of industry performance and there is an immense need to investigate and strategically update curricula of CEM graduate programs in Pakistan and so that it reflects, at all times, the key skillset required by the industry. It is now imperative for an institutes offering CEM programs to have a prudent plan to effectively train potential construction managers and meet industry needs (Farooqui et al., 2008).

1.2 PROBLEM STATEMENT

The construction industry in Pakistan does not have any organization or professional body which can access the prevalent needs and trends of the industry. No private or public sector is engaged in research to assert the current and upcoming needs of the industry. Lack of interest in research and constructive feedback has made vulnerable conditions for the industry to rise of its full potential.

1.3 RESEARCH OBJECTIVES

The objectives of this research are:

1. To ascertain current effectiveness of CEM masters programs offered in Pakistan universities against the local construction industry needs.
2. To examine the relative differences in importance of the technical skills as perceived by the industry in contrast to the academia.
3. To suggest improvements in the existing curricula or mode of deliverance for meeting industry demands.

1.4 SCOPE OF STUDY

The scope of this study was limited to the CEM programs being offered in universities of Pakistan since 5 or more years like NEDUET (2004) and NUST (2009). An effort was made to include as much feedback of these universities' graduates as well as their potential employers working at different positions and areas of Pakistan, namely, but not exclusively to, Lahore, Rawalpindi, Islamabad and Karachi.

1.5 SIGNIFICANCE OF STUDY

This study would be instrumental in providing recommendations to update/ overhaul CEM curriculums in order to bridge the gap between academia and industry as well as to enhance the existing programs' effectiveness with respect to generating the performance and leading to opportunities for innovation in the construction industry.

1.6 ORGANIZATION OF THESIS

This thesis has been organized into six chapters.

Chapter 1 is 'Introduction'. It explains in general, the concept of critical skillset required by the construction managers in the context of academia and industrial practices, why the need was felt for this study, the importance of the study for construction industry of Pakistan and the objectives behind the study.

Chapter 2 is 'Literature Review'. It explains the previous studies done concerning ideal skills set to be acquired by construction managers through academic and industrial trainings. It also explains to readers, the history of construction management programs offered in universities, especially emphasizing the role of construction management and

managers in the industry, how construction managers need to perform in industry and what types/kinds of skills are required to establish their character.

Chapter 3 is 'Methodology' of research. It explains how the research is conducted to obtain our primary data, questionnaire is developed keeping our objectives in view, how the questionnaire is circulated among general contractors, architects/engineers, construction managers and academicians wherein they are asked to give importance ratings to the skills deemed significant in a construction manager, how the sample size is determined, and are be our target respondents and the rationale for their selection. Finally, it explains how the collected data is analyzed to produce results.

Chapter 4 is 'Data Analysis and Results'. It discusses in detail how our objectives are achieved from using our analyzed data. It provides graphical representation as well as tables concerning compilation of our data. It also explains how our collected and analyzed data is interpreted to produce the results which interpret achievement of our objectives.

Finally, Chapter 5 is 'Conclusions and Recommendations'. It is expected that the study would be instrumental in providing recommendations to update/ overhaul CEM curriculums or mode of deliverance in order to bridge the gap between academia and industry as well as to enhance the existing programs' effectiveness with respect to generating the opportunities for innovation in the construction industry.

Chapter 2

LITERATURE REVIEW

2.1 BACKGROUND

The face of construct industry and business has now changed its dynamics as new dimensions have been incorporated in for construction practices which required new skills set by managers to handle such diversity (Choudhury, 2000; Kay, 2001). Since the face of construction industry experiences gradual changes as per changing trends of technologies therefore to remain competitive in market, the managers substantially rely on the skills and knowledge acquired through experience and training (Fotwe and Mcaffer, 2000).

The shift in global economy and business trends, the construction industry also faces shifts in their overall process which ultimately leads to modification of prevailing skills and techniques. The managers are now no more taken as sole entity rather a team leader to meet requirement of modern days (Galloway, 2007; Beder, 1999; 2009; Gillear, 2002; Meier et al., 2000; Kirschenman, 2011; Chan and Fishbein, Lang et al., 1999).

Construction projects are specialized one which requires specific technical knowledge to handle them. That's why one project managers could have knowledge of infrastructure projects but may lack expertise of building works. Therefore, project managers when acquire specialized knowledge in any area of construction, they develop certain types of skills. Such core skills enable a platform to foothold firm project management skills (Semple and John, 2011).

During 20th century many psychologist have studied over the attributes of efficient learning required for good education (Bloom, 1999). Anderson and Karthwohl (2001) defined six mental learning styles (skills): creating remembering, applying, understanding, evaluating and analyzing. Typically, students rely on: Understanding (intuitive perception), remembering (auditory input), and applying (reflective processing). Pennypacker (2009) explained that competent project managers are those who apply skills according to the need of an hour and utilizes all technical tools (risk evaluation, scheduling, change management etc,) as and when needed.

Baldizan and McMullin (2008) observed that traditional teaching methods do not impart cognitive attributes within students (creating analyzing and evaluating). Such traditional teachings might be useful in certain contents but in construction industry where highly skilled technical understanding and decisions are required, this style becomes less effective. Pertinent core field knowledge can be developed through observation, experimentation and communications (Felder and Silverman, 2006).

2.2 DEFINITION OF SKILL

"An ability and capacity acquired through careful, logical, and continual effort to smoothly and adaptively carryout complex activities or job functions involving cognitive skills, technical skills and/or interpersonal skills"(2015).

Falender and Carol (2007) stated that a skill is a capability to do an activity in a proficient manner.

2.2.1 Different Types Of Skills

Job skills (hard skills) are those technical skills which are acquired through training or

education. On the other hand, interpersonal interactions or dynamics which are quantifiable usually known as soft skills also have major impact on performances (Jones, 2012). Three main types of skills are shown in Table 2.1:

Table 2.1: Skill types (Jones, 2012)

Skill Type	Description
Transferable / Functional	• Actions taken to perform a task, transferable to different work functions and industries. • Based on ability and aptitude • Examples: Organize, Promote, Analyse & Write (OPAW)
Personal Traits/Attitudes	• Traits or personality characteristics that contribute to performing work • Developed in childhood and through life experience • Examples: Patient, Diplomatic, Results-oriented, Independent
Knowledge-based	• Knowledge of specific subjects, procedures and information necessary to perform particular tasks • Acquired through education, training and on-the-job experience • Examples: Project Administration, Contract Management, Accounting

Thamhain (2010) researched the training of project managers wherein based upon findings, the qualities of a project manager are characterized as follows;

- **Interpersonal skills:** These skills include communication and interaction with people to help them out without having any authority or liability.
- **Technical expertise:** Technical knowledge of specific domain acquired by project managers enables them to elucidate and manage projects competently
- **Administrative skills:** Initiating, planning, organizing and monitoring skills are part of these skills.

2.3 KNOWLEDGE, SKILLS AND ABILITIES (KSA)

The reason sometimes these terms are used interchangeably is because they are all "must-haves" (Prediger, 2007).

- **KNOWLEDGE** is the theoretical or practical understanding of a subject (Clandinin, 1995).
- **SKILLS** are the proficiencies developed through training or experience. Skills are learned (El-Sabaa and Salah, 2001).
- **ABILITIES** are the qualities of being able to do something. There is a fine line between skills and abilities (Prediger, 2007).

2.4 ESSENTIAL CONSTRUCTION MANAGER (CM) SKILLS

Typically, training of project managers is based upon the development of technical skills like planning, estimating, controlling and scheduling etc. But specific skills application are very much dependent upon the complexity of the project (Norback, 2009).

Katz (1974) proposed that human skill, conceptual skill and technical skills are three major classes in which all skills lies.. He argued that competency of project manager in these three domains are very important to be effective.

Since Katz's proposition of the three-skill concept have been further described by various authors and most relevantly these are applicable in commerce and industrial project management.

Katz and Thamhain (1983) listed ten important skills for project managers as conflict resolution, planning, team building, entrepreneurial, allocation skill, administrative, managerial support building, organization, technical and leadership .

Goodwin (1993) identified four important skills for an effective project manager: (1) technical (2) human (3) conceptual and (4) negotiating skills. According to Goodwin, negotiating skill will assist the project manager in appreciating the various activities and the resources and facilities required in performing and completing the activities. It will also assist him to see how, for example, changes in the design or scope of the project will affect the budget, schedule, and overall performance. Gushgari (1997) listed twenty important skills to something called long-term profitability and communication topped the list while listening and project management were second and third respectively. Project managers perceived risk taking skills as least important

Odusami (2002), basing his study on Gushgari (1997), analysed 13 most important skills importance as perceived by consultants and its found that motivating others and leadership were highly rated followed by decision. Contractors rated communication skills the most important while clients favoured the decision making attribute making most important . In general, decision making was rated top most and negotiating skills was at last.

2.4.1 Construction Manager Responsibilities

Construction management include organizing, planning, implementing, scheduling, monitoring, and managing, projects. Construction managers must learn essentials of project management knowledge (Baharudin, 2006). Egbu (1999) based on his study, listed 75 types of skills wherein leadership, communication, motivation, health and safety, decision making, and forecasting and planning were amongst the top six. Wateridge (1997) concluded list of critical skills after thorough research as shown in Table 2.2.

Table 2.2: Skills for an Effective Construction Manager (Wateridge,1997)

Skill	Number	Adair	Posner	Thamhain	Einsiedel	Godsave
Leadership	5	√	√	√	√	√
Planning	4	√	√	√	—	√
Team building	3	√	√	√	—	—
Controlling	3	√	—	√	√	—
Organization	3	—	√	√	—	√
Communication	3	—	√	√	√	—
Delegation	2	—	√	√	—	—
Decision making	2	—	—	—	√	√
Business	2	—	—	√	—	√
Technical	2	—	—	√	√	—
Technological	2	—	√	—	—	√
Stress management	2	—	√	—	√	—
Problem solving	2	—	—	√	√	—
Staffing	1	—	—	√	—	—
Directing	1	√	—	—	—	—
Total	-	5	8	11	7	6

Dainty (2004) also conducted a thorough study over the required skills by construction managers as shown in Table 2.3.

The success of a project is highly dependent upon the timely completion of project. Project manager need to apply all technical and managerial skills to meet those tasks effectively and to ensure this, project manager need to have specialised skills comprised of technical and soft skills (Thomas et al, 2009).

According to Baharudin (2006), understanding of technical drawings, communication, decision making and leadership skills are far significant for an efficient manager's success.

Table 2.3: Skill type required by CM (Dainty, 2004)

Technical skill	Managerial skill	Financial skills	IT skill
Basic technical knowledge	Leadership	Reporting systems	Operating systems
Forecasting techniques	Time management	Project finance arrangement	Programming languages
Site layout and mobilization	Decision making	Investment appraisal	Special applications
Material procurement	Negotiation	E.V and Taxation	Spreadsheet
Operation research	Delegation	Stock control and evaluation	Database
Technical writing	Strategic planning	Establishing cash flows	Network systems
Design activities and background	Human behavior	Establishing budgets	CAD/ETAB
Reading and understanding drawings	Motivation and promotion	**Legal skills**	Project management software
Construction management activities	Recruitment	General legal background	Information systems and IT tools
Planning and scheduling	Team working	Drafting contracts	**General skills**
Estimating and tendering	Top management relations	Industrial relations	Marketing and sales
Productivity and cost control	**Communication skills**	Health and safety issues	Public relations
Work study	Presentation	Preparation of claims and litigation	Understanding of organization

2.4.2 Importance of Soft Skills

Several studies (Domal and Trevelyan, 2009; Goh, 2007; Katz, 1993; Martin et al., 2005; Meier et al., 2000; Scott and Yates, 2002; Valenti, 1996) have suggested major overhauls in engineering education sector based upon the findings from the industry, professors and students. Gaps among industry and academia is found significantly increasing as technology is being introduced more frequently.

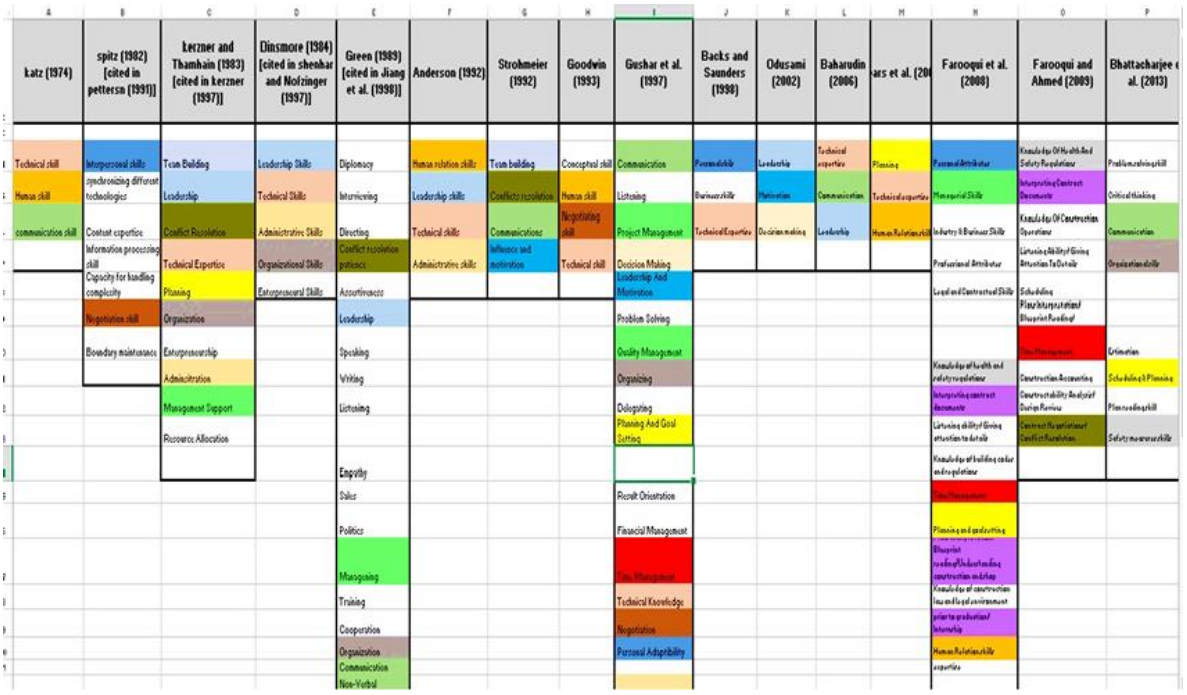
To remain effective in job environment, employability skills are very necessarily to be acquired. (Robinson, 2000). Zaharim et al (2010) concluded that along with technical skills. Non-technical skills are also of high importance for employability in industry like teamwork, learning, decision-making, professionalism, communication and lifelong .

Students gave higher impact to soft skills for skilled engineers than entry level technical engineers (Lang, 1999). The engineer is no longer simply a technical person but a professional team player with high technical expertise (Redish and Smith, 2008).

In the 21st century, good communication skills dictate cross cultural experience and foreign language proficiency (Gilleard and Gilleard, 2002). Good communication skills are a requirement for efficacious leadership (Kirschenman, 2011). Communication skills include oral communication with managers and peers, presentation skills, business writing skills and cross-cultural communication abilities (Norback, 2009).

2.5 SKILLS IDENTIFIED BY VARIOUS AUTHORS

Various authors over period of time has strived hard to identify key critical skill set required by practising construction managers to perform effectively in industry. Ideal skill set identification have always remained difficult due to continuous changing trends of construction industry. Different skills sets identified by different researchers are shown in Table 2.4 for further consideration and analysis as industry needed;



Katz (1974)	spitz (1982) [cited in pettersn (1991)]	Kerzner and Thamhain (1983) [cited in kerzner (1997)]	Dinsmore (1984) [cited in shenhar and Nofzinger (1997)]	Green (1989) [cited in Jiang et al. (1998)]	Anderson (1992)	Strohmeier (1992)	Goodwin (1993)	Gushar et al. (1997)	Backs and Saunders (1998)	Odusami (2002)	Baharudin (2006)	ars et al. (20	Farooqui et al. (2008)	Farooqui and Ahmed (2009)	Bhattacharjee et al. (2013)
Technical skill	Interpersonal skills	Team Building	Leadership Skills	Diplomacy	Human relation skills	Team building	Conceptual skill	Communication	Personal skills	Leadership	Technical expertise	Planning	Personal Attributes	Knowledge Of Health And Safety Regulations	Problem solving skill
Human skill	synchronizing different technologies	Leadership	Technical Skills	Interviewing	Leadership skills	Conflicts resolution	Human skill	Listening	Business skills	Motivation	Communication	Technical expertise	Managerial Skills	Interpreting Contract Documents	Critical thinking
communication skill	Content expertise	Conflict Resolution	Administrative Skills	Directing	Technical skills	Communications	Negotiating skill	Project Management	Technical Expertise	Decision making	Leadership	Human Relations skill	Industry & Business Skills	Knowledge Of Construction Operations	Communication
	Information processing skill	Technical Expertise	Organizational Skills	Conflict resolution process	Administrative skills	Influence and motivation	Technical skill	Decision Making					Professional Attributes	Listening Ability Of Giving Attention To Details	Organization skills
	Capacity for handling complexity	Planning	Entrepreneurial Skills	Assertiveness				Leadership And Motivation					Legal and Contractual Skills	Scheduling	
	Negotiation skill	Organization		Leadership				Problem Solving						Plan/Interpretation/ Blueprint Reading	
	Boundary maintenance	Entrepreneurship		Speaking				Quality Management						Site Management	Estimation
		Administration		Writing				Organizing					Knowledge of health and safety regulations	Construction Accounting	Scheduling & Planning
		Management Support		Listening				Delegating					Interpreting contract documents	Constructability Analysis/ Design Review	Plan reading skill
		Resource Allocation						Planning And Goal Setting					Listening ability/ Giving attention to details	Contract Negotiation/ Conflict Resolution	Safety management skills
				Empathy									Knowledge of building code and regulations		
				Skills				Result Orientation					Site Management		
				Politics				Financial Management					Planning and prioritizing		
				Managening				Site Management					Blueprint reading/Understanding construction drawings		
				Training				Technical Knowledge					Knowledge of construction law and legal environment		
				Cooperation				Negotiation					prior to graduation/ Internship		
				Organization				Personal Adaptibility					Human Relation skills		
				Communication									expertise		
				Non-Verbal											

Table 2.4 : List of skills identified by various authors (1974 ~ 2013)

katz (1974)	spitz (1982) [cited in pettersn (1991)]	kerzner and Thamhain (1983) [cited in kerzner (1997)]	Dinsmore (1984) [cited in shenhar and Nofzinger (1997)]	Green (1989) [cited in Jiang et al. (1998)]	Anderson (1992)	Strohmeier (1992)	Goodwin (1993)	Gushar et al. (1997)	Backs and Saunders (1998)	Odusami (2002)	Baharudin (2006)	ars et al. (20	Farooqui et al. (2008)	Farooqui and Ahmed (2009)	Bhattacharjee e al. (2013)
Technical skill	Interpersonal skills	Team Building	Leadership Skills	Diplomacy	Human relation skills	Team building	Conceptual skill	Communication	Personal skills	Leadership	Technical expertise	Planning	Personal Attributes	Knowledge Of Health And Safety Regulations	Problem solving skill
Human skill	synchronizing different technologies	Leadership	Technical Skills	Interviewing	Leadership skills	Conflicts resolution	Human skill	Listening	Business skills	Motivation	Communication	Technical expertise	Managerial Skills	Interpreting Contract Documents	Critical thinking
communication skill	Content expertise	Conflict Resolution	Administrative Skills	Directing	Technical skills	Communications	Negotiating skill	Project Management	Technical Expertise	Decision making	Leadership	Human Relations skill	Industry & Business Skills	Knowledge Of Construction Operations	Communication
	Information processing skill	Technical Expertise	Organizational Skills	Conflict resolution patience	Administrative skills	Influence and motivation	Technical skill	Decision Making					Professional Attributes	Listening Ability/ Giving Attention To Details	Organizational skills
	Capacity for handling complexity	Planning	Enterpreneural Skills	Assertiveness				Leadership And Motivation					Legal and Contractual Skills	Scheduling	
	Negotiation skill	Organization		Leadership				Problem Solving						Plans Interpretation/ Blueprint Reading/	
	Boundary maintenance	Enterpreneurship		Speaking				Quality Management						Time Management	Estimation
		Administration		Writing				Organizing					Knowledge of health and safety regulations	Construction Accounting	Scheduling & Planning
		Management Support		Listening				Delegating					Interpreting contract documents	Constructability Analysis/ Design Review	Plan reading skill
		Resource Allocation						Planning And Goal Setting					Listening ability/ Giving attention to details	Contract Negotiations/ Conflict Resolution	Safety measures skills
				Empathy									Knowledge of building codes and regulations		
				Sales				Result Orientation					Time Management		
				Politics				Financial Management					Planning and goal setting		
				Managening				Time Management					Blueprint reading/Understanding construction and shop		
				Training				Technical Knowledge					Knowledge of construction law and legal environment		
				Cooperation				Negotiation					prior to graduation/ Internship		
				Organization				Personal Adaptibility					Human Relations skills		
				Communication									expertise		
				Non-Verbal											

2.6 HISTORICAL BACKGROUND OF CM

Goff (2002) explains that during World War II there was virtually no construction taking place in America except for construction related to the war effort. In the years immediately after the war, most construction in America was local schools or hospitals, new private houses, repair and expansion of the civil infrastructure, repair and expansion of all sorts of other facilities and a good many relatively small to modest sized commercial, industrial and governmental projects.

Heerkens (2006) explained that in the mid 1950 after world war-II, America faced huge boom of infrastructure developments which included hospitals, schools, industries etc. There were many huge scale projects being built throughout the country but there was no other profession dedicated to manage such influx of projects (Zielinski, 2005). During this period, it was normal trend of geeting projects immensely delayed as well as cost element was also at high rates. Contractors used to bid very high for the projects by exploiting the need of which clients had (Herkens, 2006).

Baharudin (2006) stressed that all professionals related to construction industry pointed and criticized the attitudes of contractor's towards high biding policy for public projects. Further, Egbu (2007) explained that in order to break the monopoly of contractors, a new form of management should be introduced who solely manages the project and their fees be compensated by the clients over contractors behalf.

2.7 ROLE OF CEM EDUCATION PROGRAMS

The development of the requisite knowledge and skills needed to perform construction manager role have traditionally relied on engineering degree programmes that are pursued in academic institutions. Construction and engineering degree programmes for educating project managers conventionally reflect a technical content. To ensure their continued relevance in an industry, construction project managers often rely on various learning activities that help them to fulfil for the project, both the construction specific and the non-construction functions demanded of them (Bentil et al, 1996).

Construction management graduate degree programme is usually opted by individual interested to explore construction part specifically therefore degree of background, skills, knowledge and experience vary among students of different schools. Many non-construction based disciplines professionals are attracted to the realm of construction. The prospective students to construction management programs always look for the missions, goals, objectives and the course curriculum of the programs and decide on the school they wish to join. But occasionally they do get confuse about their career aspirations in between industry needs and taught at universities (Farooqui et al, 2009).

Farooqui and Ahmed (2008) concluded from their study that CEM graduate students gave higher significance to construction accounting, value engineering/ constructability analysis/ design review while contract negotiations/ conflict resolution were given lesser significance by the educators. It was urged for strategic curriculum improvement through a collective effort to strategically assess and improve construction management curriculums offered at different universities of Pakistan.

2.7.1 Problem-Based Learning and Engineering Education

Traditionally, courses taught in engineering are primarily based upon more theoretical portion rather than practical exposure (Sallfors et al. 2000). The courses taught in civil engineering programs usually are based upon idealized problems which are solved with pre-defined methodologies but in industry the dynamics changes drastically. Such programs are not fit for preparing future professionals (Kumar, 2004).

Problem-based learning (PBL) has been used successfully by other educators, particularly medical educators, to train medical care providers. PBL is a training method that challenges students to *"think and learn"* by solving real-world problems while working in groups and learning from each other as shown in comparison chart below;

Table 2.4: Comparison of TM and PBL, (Busch, 2008)

Lecture Based	**Problem - Based**
Curriculum as Perception	Curriculum as Experience
From the perception of teacher/expert	From the perception of student/learner
Linear and rational	Coherent and relevant
Part to whole organization	Whole to part organization
Teaching as transmitting	Teaching as facilitating
Learning as receiving	Learning as constructing
Structured environment	Flexible environment

2.8 CEM EDUCATION IN PAKISTAN

Farooqui et al. (2008) explained that Pakistani construction industry has grown immensely during the last few years, there is an immediate need of an hour to train and educate our construction professionals about modern construction trends in order to meet international standards without foreign aid. Construction management program is an ominous need of Pakistan construction industry. It was further elucidated that many world class universities and institutions are offering various degree programs to train their professionals for the local and international demand. By keeping this rationale in mind the ME/MS in Construction Engineering and Management (CEM) programs are designed to meet the growing demand for local technical managers with strong engineering, and technical backgrounds.

2.8.1 Universities offering CEM education

- NED University of Science and Technology (NEDUET), Karachi (2004) [1]
- MEHRAN University of Science and Technology (MUET), Hyderabad (2007)[2]
- National University of Sciences and Technology (NUST), Islamabad (2009)[3]
- Superior University (SU), Lahore (2012)[4]

[1] http://www.neduet.edu.pk/Civil/programmes.html

[2] http://www.muet.edu.pk/directorates/directorate-postgraduate-studies/course-outline#construction

3http://www.nust.edu.pk/INSTITUTIONS/Schools/SCEE/Institutes/NIT/AP/PG/MS-CEM/Pages/Course-Curriculum.aspx

[4] http://www.superior.edu.pk/presentation/user/ProgramDetail.aspx?fId=1&pId=14

2.9 SUMMARY

This chapter elucidates the previous studies done concerning ideal skills set to be acquired by construction managers through academic and industrial trainings. It explains to readers the types, classifications and different attributes of skill set, the history of construction management practices in industry and education programs offered in universities, especially emphasizing the role of construction management and managers in construction industry, how construction manager need to perform in industry and what types/kinds of skills are required to establish his character. It further highlights the lack of modern studies and research concerning assessment of construction management education programs to enrich skills for project and construction managers as being one of the factors contributing to the decline in the effectiveness of the industry.

Chapter 3

METHODOLOGY

3.1 INTRODUCTION

The findings of literature review provided an overview of construction managers' role and responsibilities in the industry. Literature review demonstrated that there is an inherent limitation on the studies gauging performance of such course curricula and its mode of deliverance with respect to generating the requisite skills for imparting the right level of industry performance and there is an immense need to investigate performances of CEM graduates in industry and offerings of university CEM program in Pakistan.

3.2 RESEARCH DESIGN

In order to gather the requisite data, the suitable way to get information about preeminent assessment of prevailing trends and practices of construction management in Pakistan was through questionnaire survey.

3.2.1 Strategy for Sample Selection

Before reaching out for questionnaire survey and data collection, the sample was divided into three (3) categories; CEM graduates (Student), their employers and CEM faculty, respectively.

3.2.2 Phases of Questionnaire survey circulation

Pertinent sample categorization helped in carrying out the survey in following three (3) phases;

1. Phase – I : CEM Graduates
2. Phase – II : Employers of CEM graduates
3. Phase – III : CEM Faculty

1. Phase-I targeted those construction engineering and management students who have successfully graduated from National University of Sciences & Technology (NUST) and N.E.D University of Engineering & Technology (NEDUET) .

2. Phase-II focused the potential employers from construction industry which were identified from the graduate's survey feedback. These employers included general/prime contractors, sub-contractors, architectural/engineering consultants and construction management consultants.

3. Phase-III was subjected to CEM faculty members of the universities from where our prime respondents (students) graduated. Respondents were professors, associates professors, assistant professor and lecturers.

3.2.3 Region Selection

Since the research has to represent the context of Pakistan and be representative, the sample size covered a larger area stretching from north (Islamabad) to south (Karachi) regions.

3.3 DEVELOPMENT OF QUESTIONNAIRE SURVEY

The survey was developed through critical review of previous studies by Farooqui et al., (2008), El-Sabaa. (2001), and Bhattacharjee et al., (2013). It was developed for each category and had two types of questions;

1. Close-ended questions with ordered choices
2. Five (5) point Likert-type scale

The survey questionnaire was divided into three sub-sections. The first two sections dealt with the background of individual graduated students and profile of their current employers/firms, respectively. The third section contained 16 questions to determine the expected and perceived knowledge about skills required to work in contrast to industry and graduates perspectives. The last technical skill evaluation question which contained 26 items was asked to ascertain key technical attributes reckoned necessary to perform effectually in the construction industry.

The student's questionnaire was designed to access their perspectives and reasons for enrolling in pertinent program, their expectations, their views regarding the content and design of compulsory and optional courses, their views about standards of academic offerings and gaps in between industrial - academics understandings, their understandings of technical and managerial skills importance, increase in salary, recommendations, etc.

Similarly, questionnaire for employers was also drafted to ascertain their overall views regarding potential industrial needs and performances of their employee (CEM graduate). Questions like employers observations about change in their employee

attitude after and before CEM program completion, views regarding technical and managerial skills acquisition necessary for construction industry, their recommendations for bridging of industry – academic gaps, etc. were also made part of the survey.

Academic survey formulation followed same direction as of employers survey but few more questions like their views regarding necessity of CEM graduates evaluation, their suggestions about additional courses to be taught, their observations about employed and unemployed students performances during academics, etc. were also asked.

To validate the questions, experts from the construction management programs at NUST and NEDUET were included for the cognitive interviews. Information obtained from the cognitive interview sessions were incorporated into final version of the survey questionnaires. Several language errors were corrected and technical terminologies were revised to increase clarity of the questionnaires.

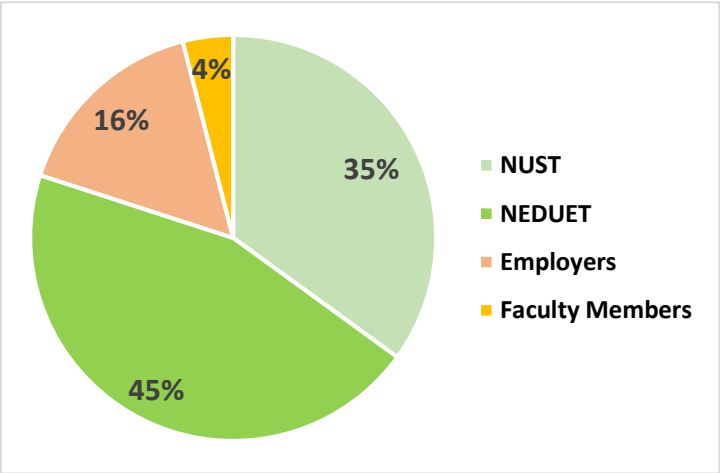
3.4 QUESTIONNAIRE SURVEY DISTRIBUTION

The finalized survey was made into printed copies and a web survey tool was used to facilitate the distribution and collection of the survey questionnaires via internet. After successfully developing the online questionnaire, a three pronged approach was adopted to circulate the questionnaire to get maximum response. After three weeks of the first invitation to participate in the survey an additional email was sent to motivate the study population for participating in the survey. Graduates were contacted several times via telephone and reminder emails to send feedback. Hence, besides emails and postal survey, physical visits to the graduates and their employers were too carried out.

3.5 DATA COLLECTION

The questionnaire survey was circulated among sample size of 255 respondents as shown in Figure 3.1;

Figure 3.1 Sample Distribution



Around 205 (80%) students who graduated in CEM masters program from NUST (89,35%) and NEDUET (116,45%) , 40 (16%) of their employers and 10 (4%) faculty members engaged in construction management studies at both pertinent universities were contacted for survey and data analysis.

3.6 DATA ANALYSIS STRATEGY

Data collected from survey was analysed using Spearman Rank Correlation Coefficient (SRCC), Simple Relative Importance Index (RII) and Percentage Frequency Distribution (PFD) techniques to identify the level of importance and degree of association between the responses of the CEM graduates, their employers and faculty members. Several studies conducted by Assaf and Al-Hejji (2006), Wong et al. (2000) and Holt (1998) indicated that RII ranking technique is used widely in construction

research for measuring apparent importance level. Total 26 items were measured on an ordinal scale as each respondent was asked to assign a level of importance from 1 to 5, where 1 = least important and 5 = most important. From this, the value of RII for each item was calculated. The standard deviation and mean of the values were considered inappropriate to evaluate the overall rank orders as they failed to validate any relationship between the items. Thus, all the numerical scores of each item on the questionnaire were transformed to relative importance indices to decide the rank orders. The RII was calculated using the following formula:

$$\sum \mathbf{A} / (\mathbf{B} \times \mathbf{N}); \quad (0 \leq \mathbf{RII} \leq 1)$$

Where, **A**= weightage given to each item by the respondents ranging from minimum of 1 (least important) to a maximum of 5 (most important), **B** = the maximum weightage (which was 5 in the study); **N** = total number of respondents.

Using pertinent formula, each items were ranked according to their RII value, where the highest RII = highest rank and vice versa. Items having equal RII were ranked in accordance with the percentage of respondents assigning 5 to the item. Remaining questions feedback was analyzed using PDF technique and items were ranked accordingly where highest percentage (%) = highest rank. Upon receipt of responses from the industry and graduates, SRCC test was performed on the ranks of the survey items to identify the degree of association between the industry's expectation and the students' perception. Faculty members perspective was incorporated at later stages using same techniques, to further elucidate the difference of perceptions between industry and academia.

Chapter 4

DATA ANALYSIS AND RESULTS

4.1 INTRODUCTION

This chapter discusses in detail the results of collected data and its further analyzation to interpret the results in order to achieve the objectives of pertinent research.

4.2 SUMMARY OF RESPONSES

Out of 255 survey respondents, 190 complete responses were received which provided a response rate of 75% as (see Table 4.1). There were 50 (19%) respondents who did not give any feedback. Around 15 (6%) incomplete responses were also received which were not taken into consideration while data analysis.

Table 4.1: Summary of Responses

Respondents Category	Respondents Contacted	Complete Response	Incomplete Response	Didn't Respond	Feedback Received
NUST – Graduates	89	71	3	15	80%
NEDUET - Graduates	116	86	7	23	74%
Employer	40	26	5	9	65%
Academic	10	7	0	3	70%
Total	255	190	15	50	75%

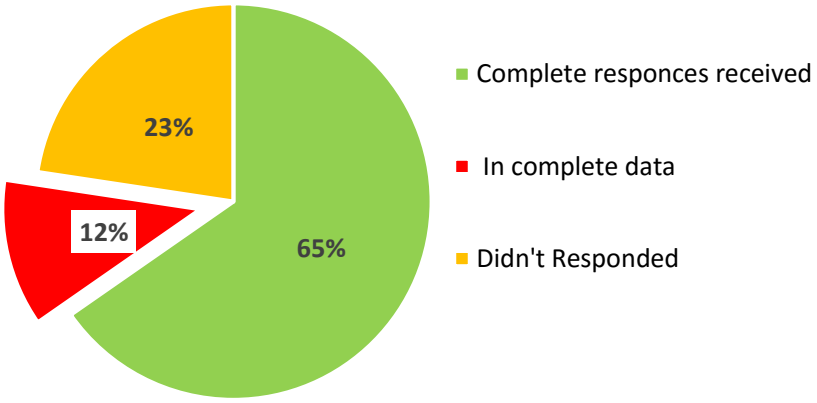
4.2.1 CEM Graduates Responses

Out of 190 complete responses, 157 (81.5%) were from those CEM graduates who completed their masters program from aforementioned two universities in Pakistan. Of these responses, 71 (45%) were received from NUST with the response rate of 80% while remaining 86 (55%) responses were from NEDUET graduates with the response rate of 74% as shown in Figure 4.1 above.

4.2.2 Employer Responses

A total of 40 (16% of total sample) employers of CEM graduates were identified from the information received from them. Out of 40 employers, 26 responses were collected with the rate of 65%. Around 5 (12%) responses received, were incomplete and 9 (23%) did not give feedback as graphically shown in Figure 4.1.

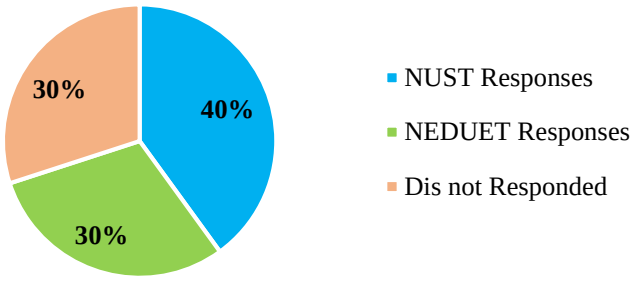
Figure 4.1: Employers Responses Summary



4.2.3 Academia (Faculty Member) Responses

Total of 10 (4% of total sample) current and former faculty members from both NUST (5) and NEDUET (5) were identified from their respective institute's construction engineering and management departments for survey distribution. 4 complete responses were received from NUST and 3 from NEDUET at the response rate of 80% and 60%, respectively as shown in Figure 4.2. Since, sample size was limited to 10 therefore to obtain maximum feedbacks, cognitive interviews techniques were applied which helped to understand academic perspectives regarding quality of CEM education in Pakistan as well as their expectations from industrial practices.

Figure 4.2; Faculty Members Responses



4.3 PART – I : CEM GRADUATES EDUCATIONAL BACKGROUND

4.3.1 Bachelors Graduation year

Graduates who participated in survey (157), most of them (27,17%) completed their bachelors degree in year 2012. Further, 23 (15%) students graduated in 2010 and 2011, respectively while 22 (14%) had completed their degree in 2013. About 5 % of students were those who had their bachelors degree completion in between years 199–2000 as shown in Table 4.2.

Figure 4.3: Bachelors Graduation year

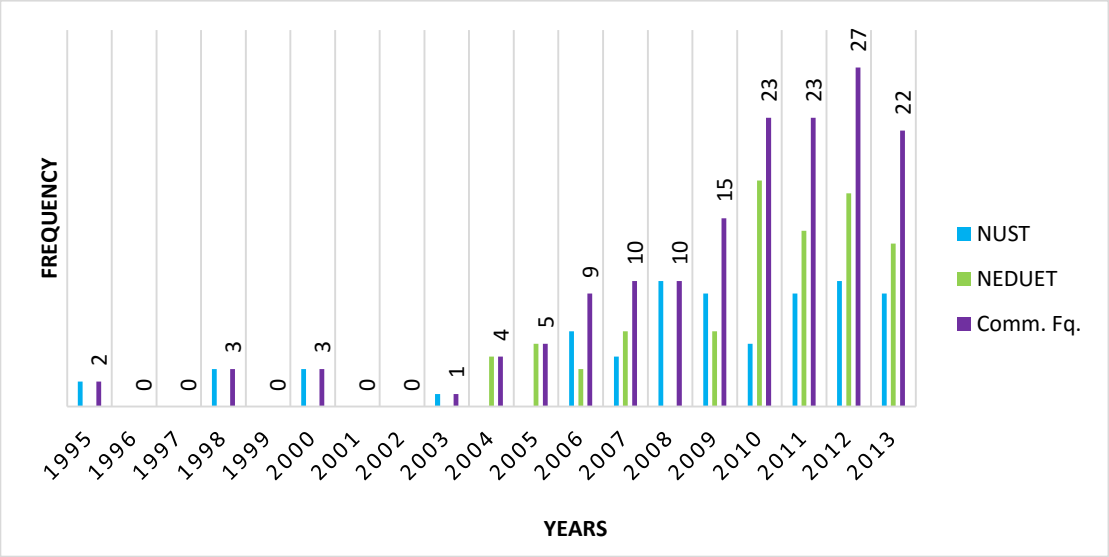


Table 4.2: Bachelors Graduation year

Year	NUST	NEDUET	Cumulative. (Fq.)	PFD (%)
1995	2	0	2	1
1996	0	0	0	0
1997	0	0	0	0
1998	3	0	3	2
1999	0	0	0	0
2000	3	0	3	2
2001	0	0	0	0
2002	0	0	0	0
2003	1	0	1	1
2004	0	4	4	3
2005	0	5	5	3
2006	6	3	9	6
2007	4	6	10	6
2008	10	0	10	6
2009	9	6	15	10
2010	5	18	23	15
2011	9	14	23	15
2012	10	17	27	17
2013	9	13	22	14
Total	**71**	**86**	**157**	**100**

4.3.2 Bachelors Graduation University

List of universities from where NUST respondents completed their bachelors degree are shown in Table 4.3 below;

Table 4.3: Summary of Bachelors Universities - NUST respondents

University	Fq.	PFD (%)
UET LHR	31	44%
NUST	15	21%
UET TAXILA	8	11%
MCE	6	8%
UET Peshawar	3	4%
NEDUET	3	4%
SSUET	2	3%
B.U.E.T	1	1%
DUET	1	1%
B.Z.U Multan	1	1%
Total	71	100%

It can be seem from above table that out of 71, 31 (44%) students completed their bachelors degree from University of Engineering & Technology, Lahore (UET LHR) before graduating from NUST masters program while 15 (21%) of students already belonged to NUST. Around 6 (8%) students completed their bachelors degree from south region universities (Karachi) and 01 student also belonged to Balochistan (west region). Such diversity in masters students background is due to the location of NUST. Almost from every region of country, students came to NUST for CEM masters program which indicates the spread of construction management knowledge throughout the country .

In contrast to NUST graduates sample, the bachelors background of NEDUET graduates was found very much limited to south and west region. Out of 86 respondents, 76 (88%) students graduated from NEDUET at bachelors level and preferred to continue with masters in CEM from same university as shown in Table 4.4 .

It is mainly due the reason that no other institute in Karachi offers specialised program in construction management therefore students always preferred to opt it for higher studies.

Table 4.4: Summary of Bachelors Universities - NEDUET respondents

University	Fq.	PFD (%)
BUET khuzdar	1	1%
NEDUET	75	88%
QUEST Nawabshah	1	1%
SSUET	9	10%

Other than NEDUET as shown in , 9 (10%) students belonged to Sir Sayed University of Engineering and Technology (SSUET) while BUET khuzdar and QUEST had only 01 student graduated from NEDUET .

4.3.3 Bachelors degree of Graduates

Out of 157, 151 (96%) students had background of civil engineering while only 3 (2%) had urban engineering at bachelors level. Only 1 respondents belonged to architecture. Diversity in CEM graduates bachelors level education implies that construction management specialization is appreciated by professionals related to civil technology as shown in Table 4.5 below;

Table 4.5: Bachelors degree specialization

Bachelors Degree	NUST (Fq.)	NEDUET (Fq.)	Cumm. (Fq)	PDF (%)
B.E Civil	68	83	151	96%
B.E URBAN	0	3	3	2%
B. Architectural Engineering	2	0	2	1.4%
B. Architecture	1	0	1	0.6%
Total	71	86	157	100

4.3.4 MS / ME CEM Graduation year

CEM graduates who participated in research survey were predominantly those who completed their masters degree program in the year 2015 (63, 40%). Around 33 (21%) students graduated in the year 2014 while 3 (2%) graduated in the year 2008 as shown in Table 4.4 and Figure 4.4.

Table 4.6: Graduates MS/ME completion year summary

Years	NUST (Fq.)	NEDUET (Fq.)	Cumm. Fq	PFD (%)
2008	0	3	3	2%
2009	0	3	3	2%
2010	0	4	4	3%
2011	9	4	13	8%
2012	13	6	19	12%
2013	9	10	19	12%
2014	9	24	33	21%
2015	31	32	63	40%
Total	71	86	157	100

Figure 4.4: Graduates MS/ME completion year

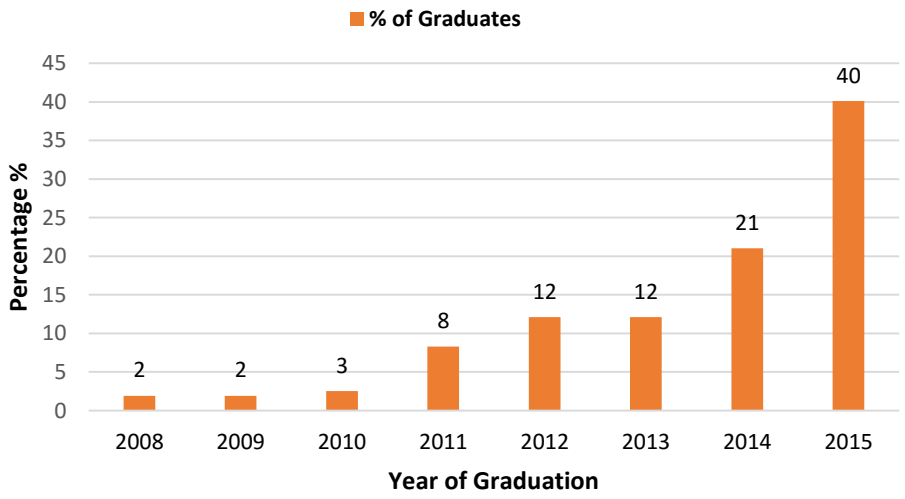
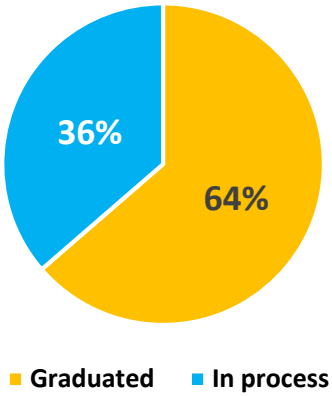


Figure 4.4 shows that more than 90% of students graduated in between 2011 – 2015. It is due to the impact of sample taken from NUST whose first batch of construction engineering and management program graduated in 2011.

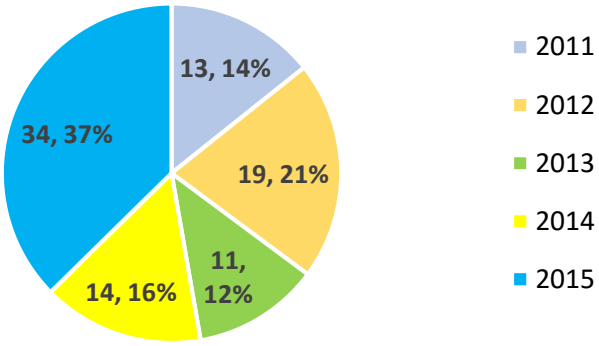
NUST , its first batch of masters in CEM program was graduated in 2011. Up till 2015, 143 students had enrolled in pertinent program and 01 student, who had been disqualified from the program due to termination of masters program tenure, was not included in overall population. Out of 143, 91 (64%) students have graduated and 52 (36%) are in process of their masters program as shown in Figure 4.5.

Figure 4.5: NUST MS CEM Graduates Record - (Over All Population)



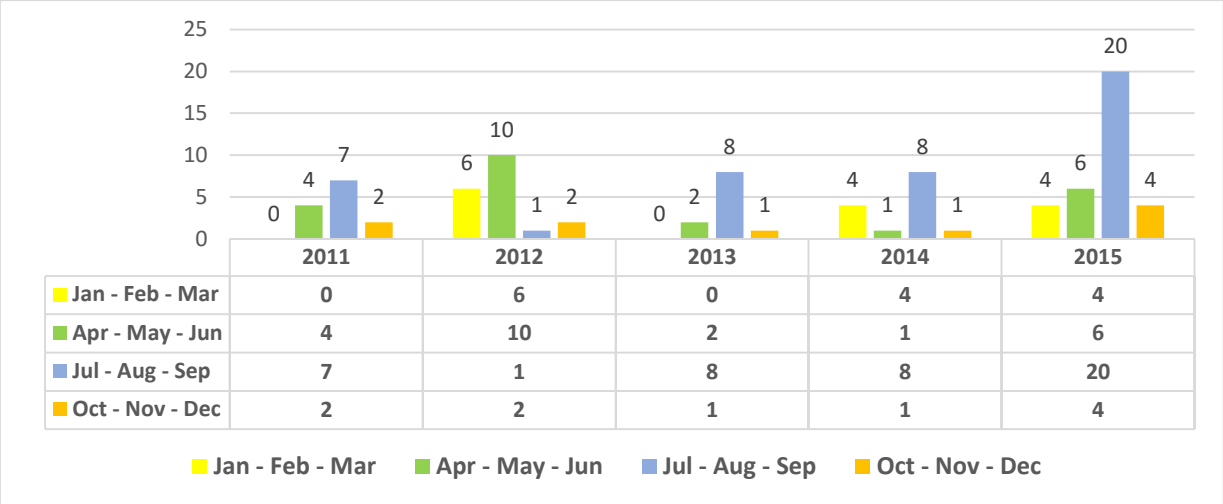
As shown in Figure 4.6, most of the students (34, 37%) graduated in the year 2015 while second highest frequency of graduation year was 2012 (19,21%). Year in which least students graduated was 2013 (11,12%).

Figure 4.6: MS CEM Graduates Record – (Yearly Pass out)



Since, NUST offers MS degree program with research therefore the frequency of graduation year can not be directly related with students enrolment year. In order to understand the trend of students graduation frequency, graduation years were distributed in 4 quarter of months as shown Table 4.7 .

Table 4.7: NUST CEM Graduates Record – (Quarterly)



	2011	2012	2013	2014	2015
Jan - Feb - Mar	0	6	0	4	4
Apr - May - Jun	4	10	2	1	6
Jul - Aug - Sep	7	1	8	8	20
Oct - Nov - Dec	2	2	1	1	4

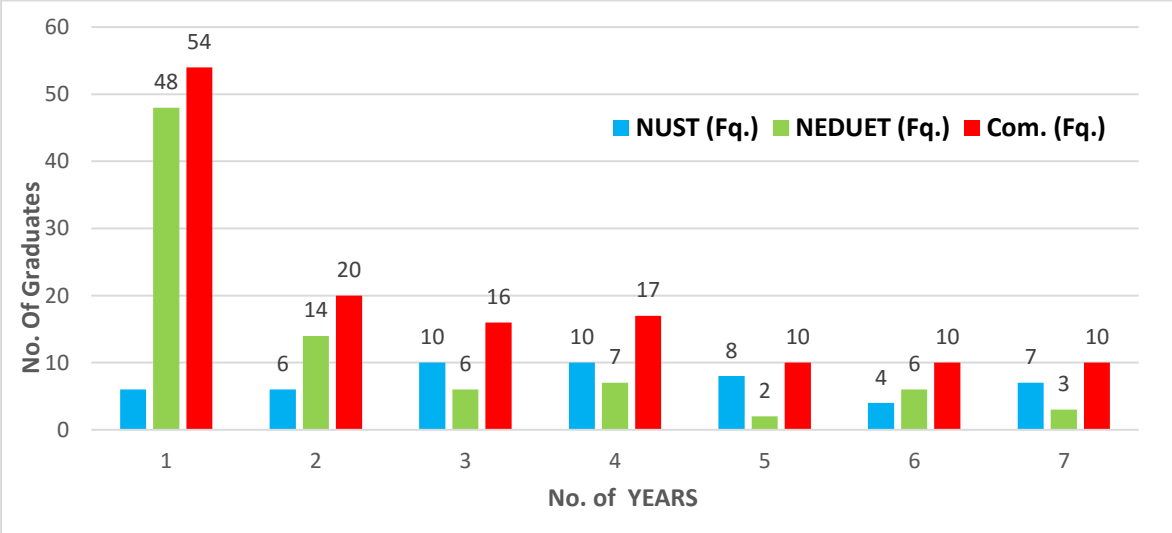
It is observed from Table 4.7, almost 36 (40%) students have been graduated during quarter 3 which spans from July to August. Other than this, out of 19 students, quarter 2 (April – June) of 2012 have observed second highest frequency 10 (52%) of students graduations.

4.4 CEM GRADUATES PROFESSIONAL DETAILS

4.4.1 Work experience post Bachelors Degree

Almost 54 (34%) students had an experience of 01 years at the time of enrolment in CEM masters program which shows the interest level of young graduates towards pertinent program. Students who had an experience of 02, 03 and 04 years were 20 (13%), 16 (10%) and 17 (11%), respectively as shown in Figure 4.7.

Figure 4.7: Work experience post Bachelors Degree



Other than graduates who had professional experience in industry in between 01 – 04 years, there were 4 (2.5%) graduates who had an experience of 15 years when entered masters program as shown in Table 4.8.

Table 4.8: Work experience post Bachelors Degree

Years	NUST (Fq.)	NEDUET (Fq.)	Cumm. (Fq.)	PDF (%)
1	6	48	54	34%
2	6	14	20	13%
3	10	6	16	10%
4	10	7	17	11%
5	8	2	10	6%
6	4	6	10	6%
7	7	3	10	6%
8	7	0	7	4%
9	5	0	5	3%
14	1	0	1	0.6%
15	4	0	4	2.5%
17	2	0	2	1.3%
19	1	0	1	0.6%
Total	71	86	157	100

4.4.2 Work experience post MS/ME degree

Almost 85 (54%) students who responded to survey, had an experience of 01 years after CEM masters program which indicates that young graduates are more enthusiastic towards exploration of industrial needs with the help of such research surveys. Graduates who had an experience of 02, 03 and 04 years were, 28 (18%), 17 (11%) and 16 (10%), respectively as shown in Figure 4.8 .

Figure 4.8: Work experience post Masters Degree

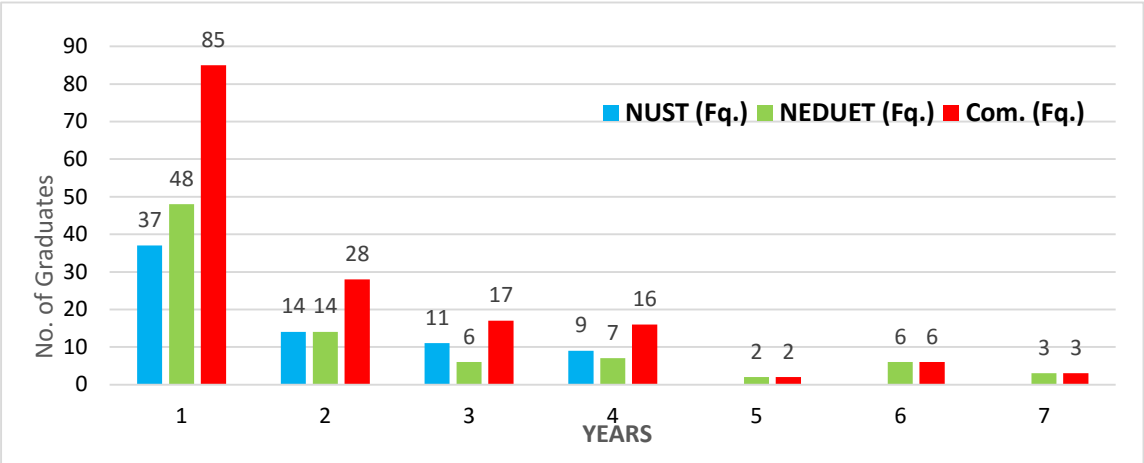


Table 4.9 shows that other than graduates who had post masters professional experience in industry in between 01 – 04 years, there were 6 (4%) and 7 (2%) graduates who had an experience of 06 and 07 years, respectively .

Table 4.9: Work experience post Masters Degree

Years	NUST (Fq.)	NEDUET (Fq.)	Cum. (Fq.)	PDF (%)
1	37	48	85	54%
2	14	14	28	18%
3	11	6	17	11%
4	9	7	16	10%
5	0	2	2	1%
6	0	6	6	4%
7	0	3	3	2%
Total	71	86	157	100

4.4.3 Job Designation

When CEM graduates were asked about their current job designation, vast range of designations were received from graduates of both universities as shown in Table 4.10.

Table 4.10: Job Designations

Designation	NUST (Fq.)	NEDUET (Fq.)	Comm. (Fq.)	PDF (%)
Planning Engineer	9	19	28	18
Site Engineer	3	16	19	12
Manager Civil Works	6	10	16	10
Civil Engineer	5	6	11	7
Assistant Engineer	3	6	9	6
Project Engineer	5	4	9	6
Junior engineer	1	7	8	5
Project Coordinator	3	4	7	4
Project Manager	6	0	6	4
Asst. Resident Engineer	1	4	5	3
Operation Manager	1	4	5	3
Team Leader	5	0	5	3
Assistant Executive Engineer	1	2	3	2
Lecturer	2	1	3	2
Manager Contracts	1	2	3	2
Other	3	0	3	2
Quality Control/ QA Engineer	2	0	2	1
Senior Engineer	1	1	2	1
Administration Officer	1	0	1	1
Architect/ Assistant Prof.	1	0	1	1
Asst Director	1	0	1	1
Asst Project Manager	1	0	1	1
Contract manager	1	0	1	1
Director	1	0	1	1
General manger	1	0	1	1
Head PM Team	1	0	1	1
Partner	1	0	1	1
Progress officer	1	0	1	1
Research Assistant	1	0	1	1
Senior Planning Engineer	1	0	1	1
Site Inspector	1	0	1	1
Total	71	86	157	100

Top 05 designation, where CEM graduates are working after their masters degree, were Planning Engineer (28, 18%), Site Engineer (19,12%), Manager Civil works (16,10%), Civil Engineer (11,07%) and Assistant Engineer (09, 06%). It was observed that those who started of their construction management career, joined industry as a planning engineer with experience of 01 – 05 years. Few (01%) graduates who worked in the capacity of senior designations like General Manager, Site Inspector & Senior Planning engineers were those who already had 05 – 10 years of experience before acquiring masters degree in pertinent program as shown in Figure 4.9.

Designation	Job Experience after Bachelors (Years)			
	1 to 5	5 to 10	10 to 15	15 - 20
Administration Officer	-	-	-	1
Architect/ Assistant Prof.	-	-	-	1
Assistant Engineer	3	-	-	-
Assistant Executive Engineer	1	-	-	-
Asst Director		1	-	-
Asst Project Manager	-	1	-	-
Asst. Resident Engineer	-	1	-	-
Civil Engineer	2	2	-	1
Contract manager	1	1	-	-
Director	-	1	-	-
General manger	-	-	1	-
Head PM Team	-	1	-	-
Junior engineer	1	-	-	-
Lecturer	2	-	-	-
Manager Civil Works	-	5	1	-
Operation Manager	-	1	-	-
other	3	-	-	-
Partner	-	1	-	-
Planning Engineer	7	2	-	-
Progress officer	1	-	-	-
Project Coordinator	3	-	-	-
Project Director	-	-	1	-
Project Engineer	3	2		-
Project Manager	1	2	3	-
Quality Control/ QA Engineer	1	1	-	-
Research Assistant	-	1	-	-
Senior Engineer	1	-	-	-
Site Engineer	3	-	-	-
Site Inspector	1	-	-	-
Team Leader	4	1	-	-

Figure 4.9: Job Designation w.r.t Work experience

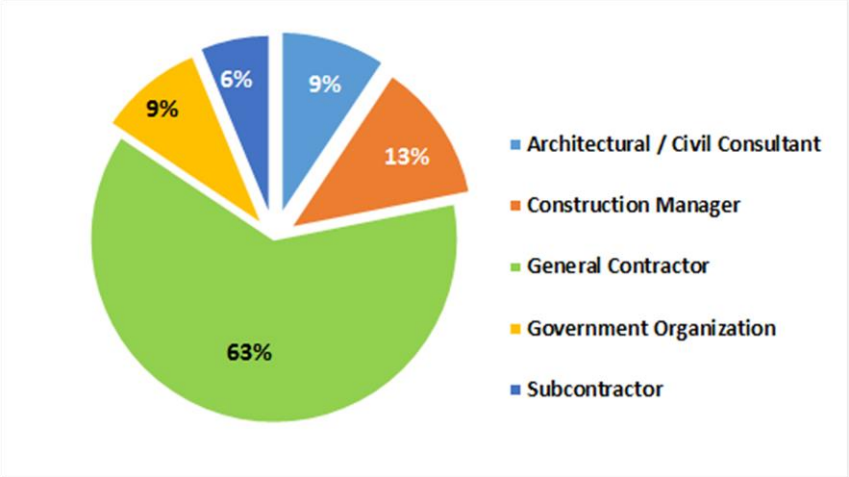
Designation	Job Experience after Bachelors (Years)			
	1 to 5	5 to 10	10 to 15	15 - 20
Administration Officer	-	-	-	1
Architect/ Assistant Prof.	-	-	-	1
Assistant Engineer	3	-	-	-
Assistant Executive Engineer	1	-	-	-
Asst Director		1	-	-
Asst Project Manager	-	1	-	-
Asst. Resident Engineer	-	1	-	-
Civil Engineer	2	2	-	1
Contract manager	1	1	-	-
Director	-	1	-	-
General manger	-	-	1	-
Head PM Team	-	1	-	-
Junior engineer	1	-	-	-
Lecturer	2	-	-	-
Manager Civil Works	-	5	1	-
Operation Manager	-	1	-	-
other	3	-	-	-
Partner	-	1	-	-
Planning Engineer	7	2	-	-
Progress officer	1	-	-	-
Project Coordinator	3	-	-	-
Project Director	-	-	1	-
Project Engineer	3	2		-
Project Manager	1	2	3	-
Quality Control/ QA Engineer	1	1	-	-
Research Assistant	-	1	-	-
Senior Engineer	1	-	-	-
Site Engineer	3	-	-	-
Site Inspector	1	-	-	-
Team Leader	4	1	-	-

4.5 PART – II : EMPLOYERS BACKGROUND

40 construction firms (employers) were identified from the information received from CEM graduates where they were employed. Out of 40, 26 firms responded to the survey, which provided a response rate of 65%. Around 05 (12%) incomplete responses were also received which were not included in analysis.

Employers who responded belonged to five categories; (1) general contractor (GC), (2) subcontractor, (3) Architectural/Civil consultant (A/E); (4) Construction Management consultant (CM) and (5) Government Organization. (GO). GC was the top (63%) respondent followed by CM (13%) as shown in Figure 4.10. Two of the responding firms indicated they worked as subcontractor and CM.

Figure 4.10: Employers Category



Employers were asked to select the types of projects they delivered among four types; (1) Residential Construction, (2) Commercial Building construction, (3) Heavy Engineering/Infrastructure, (4) Industrial Construction and (5) Institutional (Hospitals/Schools). Residential was the most answered project type with majority

of the respondents (25%) followed by commercial building projects type (24%) as shown in Figure 4.11 below;

Figure 4.11: Project Types

Since employer survey had to be representative of the Pakistan's construction industry therefore the employers contacted for feedback ranged from various small sized subcontracting firms of under 50 employees to large contractors with close to 300 or more permanent employees with work volume of Rs. 5000 million or more. The major respondent group with respect to the work volume was in the range of Rs. 1000 million to 5000 million (21, 66%).

In regard to the number of permanent employees, the maximum employers (17,53%) had permanent employees in the range of 50 – 149 and these employers were usually contractors. Almost 08 (25%) employer had an employee range of under 50 and these were mainly A/E consultants. In terms of involvement with private - public projects (see Table 4.11), response indicated that for more than 63% of the firms, their proportion (%) of private - public projects was 100 – 0 of their total work volume. For 16% of the 02 responding firms, private - public projects was 80 – 20 and 60 – 40, respectively.

Table 4.11: Professional Background of Employers

Background	Firms Responded N (%)
Volume of Work (in Millions Rs.)	
Between 500 M to 1000 M	01 (03)
Between 1000 M to 5000 M	21 (66)
More than 5000 M	10 (31)
No. of Permanent Employees	
Under 50	08 (25)
50-149	17 (53)
150-299	05 (16)
300 or over	02 (06)
Proportion of Works: Private - Public (%)	
20 - 80	01 (3)
40 - 60	01 (3)
60 - 40	05 (16)
80 - 20	05 (16)
100 - 0	20 (63)
Geographical Location - Head Office	
Islamabad/RWP	06 (23)
Karachi	14 (54)
Lahore	06 (23)
City of Operations	
Hyderabad	23 (19)
Islamabad	25 (21)
Karachi	31 (26)
Lahore	28 (23)
Peshawar	09 (08)
Quetta	04 (03)

The last question related to the profile of the responding firms asked about their area of operations/projects in Pakistan and their head offices location. The respondents were asked to select among majors cities of Pakistan as shown in Table 4.11.

Response revealed almost 54% of the firms with head offices in Karachi operated in more than one city of Pakistan in south region and Karachi city being rated at top of operation with 26% followed by Hyderabad (19%). As compared to the rest 46% of the firms in North region, employers had an equal number of projects operations (23%) in Islamabad and Lahore. It implied that south region of Pakistan have more influence over country's construction industry and its potential market for CEM graduates.

4.6 PART – III : MS/ME CEM PROGRAM & GRADUATES

In this part of questionnaire, different types of questions were asked from graduates, employers and faculty members to evaluate their experiences, observations, and recommendation for the program. The results and responses received are given in percentages along with overall comparisons are shown, wherever necessary. The responses are as follows;

4.6.1 Reason for pursuing Masters Program in CEM

The feedback of this question was limited to one answer only so that core reason could be identified. As shown in Table 4.12, almost 37% graduates agreed that they entered in pertinent program to enhance their project management competency level and improve skills while few graduates opted for this degree after realizing the need of obtaining professional education in construction management (37, 23.6%) followed by the reasons to remain competitive in local market (31,19.7%), to approach international market (17,10.8%), due to job-competition among co-workers.

Table 4.12 : Reasons for pursuing CEM Masters program

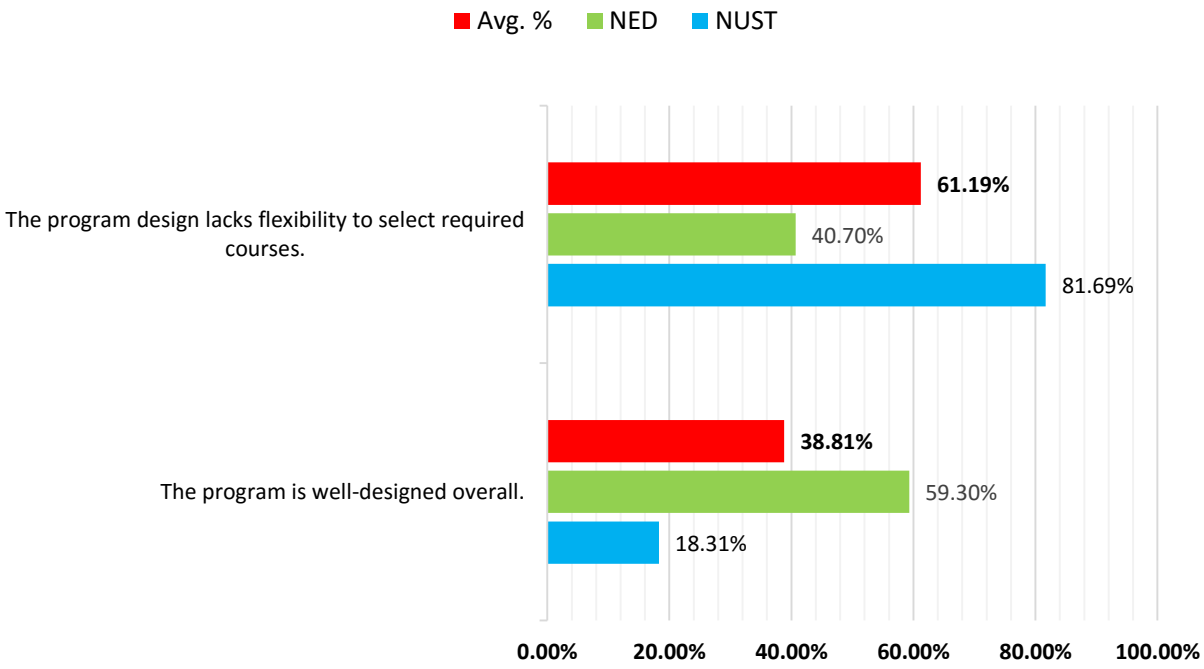
Code	REASONS	NUST (Fq.)	NEDUET (Fq.)	Com. (Fq.)	PFD (%)
A	Perception that completing the program would instil skills that would allow to excel in construction Industry	29	29	58	**36.9**
B	Realization to attain professional education in construction/ project management	14	23	37	**23.6**
C	Need for a masters' degree to remain competitive in local market	14	17	31	**19.7**
D	Need for a masters' degree to approach international market	7	10	17	**10.8**
E	Job competition among co-workers	3	5	8	**5.1**
F	The program is one-of-a-kind and this fact provided motivation	2	0	2	**1.3**
G	Employer encouragement	1	1	2	**1.3**
H	Motivation during Bachelor's studies	1	0	1	**0.6**
I	It's manageable to pursue a Masters' degree while continuing with your job	0	1	1	**0.6**
-	**TOTAL**	**71**	**86**	**157**	**100.0**

Only 01 (0.6%) graduate pursued masters as it was their bachelors motivation to pursue such specialized program and manage job along with studies.

4.6.2 Design of the program

When graduates were asked about their overall views regarding design of the program, almost 61% graduates were generally satisfied with the program (see Figure 4.12). The remaining population (39%) demanded the flexibility in course selection according to their job or industry needs resulting into a major curriculum reform.

Figure 4.12: Views regarding Design of Program



4.6.3 Views regarding Compulsory and Optional courses

The next question asked about the views about optional and compulsory courses and its answer was not limited to one answer, from graduates and faculty members to understand their degree of agreement over academic grounds. The responses are shown in Table 4.13.

Table 4.13: Views regarding Compulsory and Optional Courses

Option	Compulsory Courses				Optional Courses			
Views about Courses Content	NUST	NEDUET	AVG. %	Acad. %	NUST	NEDUET	AVG. %	Acad. %
The content of courses needs substantial improvement.	62%	35%	48%	30%	68%	35%	51%	55%
The courses adequately provide the core knowledge and skills needed for construction management.	37%	59%	48%	67%	17%	63%	40%	35%
Others	1%	6%	4%	3%	15%	2%	9%	10%

Responses indicated that the both graduates and academia mutually agreed that compulsory courses offered in program adequately provide the core knowledge needed for construction management industry which implies that construction industry needs and requirements were analyzed and taken into consideration during design of core courses. Whereas, for elective (optional) course offerings, both respondent groups urged for substantial improvement in its contents. This may be due to the construction industry's gradual development with technological advancements (Ofori, 2000) which can be captured by variety of technical courses meeting with indutry's requirements as and when identified.

4.6.4 Delivery Mode of Courses

Graduates were asked to give their views regarding the instruction of courses as they perceived in percentage for following 3 statements as shown in Table 4.14.

Table 4.14: Views regarding Instruction of Courses

Statements	Perceived in Percentage	Graduates Feedback (PDF%)		
		NUST	NEDUET	AVG.
Major course content is adequately delivered by well versed and competent course instructors	More than 80%	52	32	42%
	60-80%	37	41	39%
	40-60%	7	27	17%
	20-40%	4	0	2%
	Less than 20%	0	0	0
	Disagree	0	0	0
The course instruction is highly imbalanced: few highly competent instructors and others with quite low competence	More than 80%	06	8	7%
	60-80%	13	22	17.5%
	40-60%	11	11	11%
	20-40%	20	23	21.5%
	Less than 20%	21	16	18.5%
	Disagree	30	20	25%
There is general lack of seriousness of purpose from the instructors	More than 80%	0	5	2.5%
	60-80%	10	10	10%
	40-60%	4	18	11%
	20-40%	8	9	8.5%
	Less than 20%	24	23	23.5%
	Disagree	54	35	44.5%

Though results reveal that maximum graduates (42%) were more than 80% satisfied with the competency of their instructors/faculty members and totally agreed that instructors are dedicated to their roles, this proportion is significantly low overall. However, if considered collectively the levels of satisfaction 80% and 60-80%, more than 80% graduates showed their confidence on the mode of deliverance. This indicated

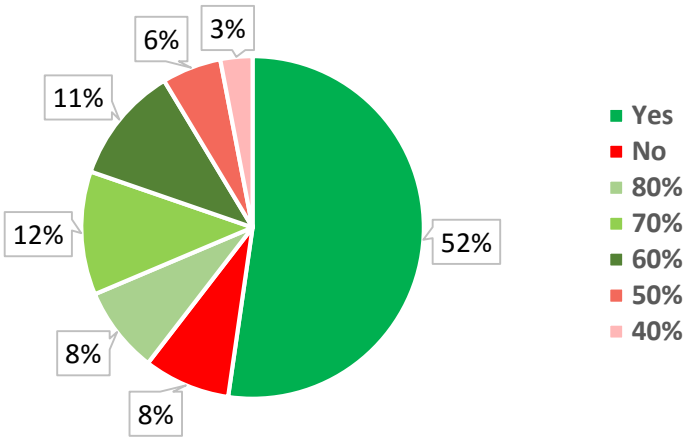
that faculty members involved in CEM education are qualified and professionals towards their job as established by the majority (65% and 75%) of graduates not reporting any lack of competence or interest, and seriousness of purpose from the instructors, respectively.

4.6.5 Expectations from Masters program

This question was asked from graduates to provide their overall satisfaction level about the pertinent program. Huda et al. (2008) found that around 40% graduates were fully satisfied with the expectations of the program and 60% were partially satisfied which was mainly due to the insufficient course offerings and inadequate deliverance during that study period (see However, the findings of current study reveal that the expectations of graduates are being positively met; almost 52% graduates agreed that pertinent program is up to their expectations which is probably because with passage of time, CEM education standards are being improved. However, a respectable portion (48%) of sample has reported their concernsand showed dissatisfaction which can be mitigated by hiring more specialized construction management faculty along with overhauling the curriculum as per indutry requirements.

Figure 4.13). However, the findings of current study reveal that the expectations of graduates are being positively met; almost 52% graduates agreed that pertinent program is up to their expectations which is probably because with passage of time, CEM education standards are being improved. However, a respectable portion (48%) of sample has reported their concernsand showed dissatisfaction which can be mitigated by hiring more specialized construction management faculty along with overhauling the curriculum as per indutry requirements.

Figure 4.13: Expectation from Masters program



4.6.6 Changes in Personality after Masters CEM program completion

This next question was asked from the graduates to assess any changes in their personality, way of working, professionalism, etc. after completing masters program and following results were revealed as shown in Table 4.15.

Table 4.15: Change in Personality after Masters CEM program

Code.	Change in Personality after Masters CEM program	NUST (%)	NEDUET (%)	Avg. (%)
A	Yes, quite substantially	22.5	33.7	28.1%
B	Partially: although it has changed views but have not had a chance to make changes in my work environment as yet	21.1	26.7	23.9%
C	Partially: although it has changed views but unable to change the work environment.	40.8	19.7	30.3%
D	The program was not well suited for Pakistani construction industry	4.2	11.6	7.9%
E	Too early to comment but expect a positive change.	9.8	6.9	8.4%
F	Too early to comment but personally do not expect any change.	0	1.1	0.5%
G	Other	1.4	0	0.7%

A respectable portion of graduates (28%) expressed subtantial improvement in their working technique and personality attributes. This points towards the focus of course content offered during the program on both engineering and management knowledge.

However, the largest chunk (30%) report a partial improvement in their personality with a reservation that it is hard to apply their knowledge into the field due to existing outdated trends in the local construction industry. Another important finding in this context is the possible disparity in the regional development of industry: southern part (NEDUET graduates) reports lower contraints as compared to the northern part (NUST) in terms of constraints on changing the work environment. Even though the NEDUET graduates are younger in terms of graduation year than those of NUST, they enjoy a more dynamic and accepting environment mainly due to being in the developed part of construction industry.

In addition to above, when graduates were asked how their employer and colleagues perceived their personality after masters program completion, approximately 50% of graduates received appreciation for the improvement in conduct and professional attitude from their employers, 21% continued their job without any appraisal which implies that industry is open to qualified construction professionals and knowledge brought by them. However, 9% graduates left their jobs immediately to work effectively in more conducive environment which points to the need of making industry more acceptable to the changes implied by modern knowledge.

4.6.7 Increment in Salary

Results revealed that employers do appreciate their employees personality advancement post masters qualification but with no other incentives like increment in salaries (see Table 4.16). Only 30% graduates had increment in their salaries but remaining 70% experienced only verbal appreciation and no monetary benefits. Such unrewarding attitude of employers towards their qualified employees asserts negative impact over

their personalities and demotivates them in long run. It may lead to resignation from the current job.

Table 4.16: Increment in Salary

Increment in Salary	NUST (%)	NEDUET(%)	Avg. %	Over All
No	63.38%	75.58%	69.48%	69.48%
Yes - 50%	16.90%	8.14%	12.52%	30.52
Yes - 20%	7.04%	0.00%	3.52%	
I changed my job for better salary	5.63%	9.30%	7.47%	
Yes - 30%	4.23%	3.49%	3.86%	
Yes - 40%	2.82%	0.00%	1.41%	
Yes - 100%	0.00%	3.49%	1.74%	

4.7 Improvement/Development of Skills after Masters program

In order to determine the perception of the construction graduates about the skills which they acquired after masters completion to work effectively in the industry, they were asked to give their views about the skills they felt was more developed or improved after pertinent program (see Table 4.17).

Further, to have industrial point of view, same question was also asked from the employers to assess which skills they observed in their employees after masters program completion. To test the internal consistency reliability of the survey responses, the Cronbach's alpha (α) was calculated (Bhattacharjee et al., 2013) which was found to be $\alpha = 0.89$ and $\alpha = 0.95$ for the graduates' and employers' feedback, respectively. According to Santos (1999), the threshold value of $\alpha = 0.70$ is acceptable for reliability, so data received was considered reliable for measuring the perceptions of the graduates against employer's expectation.

Table 4.17: Skills improved after Masters Completion

Skills Improved/Acquired after MS/ME CEM	NUST	NEDUET	Avgerage	Employer
More positive approach to work now	13.75%	12.82%	13.28%	20.26%
More competent in approaching work now	12.12%	10.83%	11.48%	16.99%
More structured approach to work/ problem solving now	10.49%	7.04%	8.76%	9.80%
More proactive approach to work/ problem solving now	6.06%	5.78%	5.92%	9.15%
Improved Project Management Skills	6.76%	10.29%	8.52%	8.50%
Improved Decision Making Skills	6.99%	6.50%	6.75%	5.88%
Improved Technical Skills	2.10%	4.69%	3.40%	5.88%
Improved Project Oversight Skills	10.72%	4.33%	7.53%	5.23%
Improved Ethics & Responsibility Taking	4.43%	2.53%	3.48%	3.92%
Improved Team Coordination Skills	3.26%	7.40%	5.33%	3.27%
Improved Communication Skills	3.96%	7.04%	5.50%	2.61%
Improved Team Building Skills	3.96%	4.69%	4.33%	2.61%
Improved Leadership skills	3.73%	4.33%	4.03%	1.96%
Improved Negotiation Skills	3.26%	3.25%	3.26%	1.96%
Improved Time Management Skills	4.43%	5.23%	4.83%	1.31%
Improved Resource Management Skills	3.26%	2.89%	3.08%	0.65%

The results reveal that collectively 24% graduates report having increased positive and competent approach to work in the industry. They also felt substantial improvement in their overall project management skills (8%) and critical project insight attitude (7%). Whereas, graduates showed no confidence in leadership, technical (software), negotiation and human resource management skills advancement and it is because most of the CEM program contents are based upon technical grounds and no considerations are applied towards the soft skill development of students during studies .

To assess the employer's expectation against graduates perception, Spearman's Rank Correlation test was performed and Coefficient $r = 0.86$ was found, with $p<0.01$, (two tailed), $df = 18$. Statistical analysis revealed that there was not much difference of perceptions among the both respondent groups and the graduates opting for specialization in CEM program were much aware of the skills required by the industry.

4.7.1 Recommendation of Masters Program to other

As shown in Table 4.18, approximately 54% of graduates agreed that pertinent program was very effective to help improve their skills while 46% of graduates were not much satisfied completely in terms of recommending pertinent program to other colleagues. This might be due to the reason that after developing skills, the current industry trends are not welcoming to practice the acquired knowledge. Further, there are not much course selection choices available restricting the academic flexibility.

Table 4.18: Recommendation of Masters Program

Recommendation of MS/ME CEM program to others	NUST (%)	NEDUET (%)	Average (%)
Yes. (The program provides a good platform for improving skills.)	50.70%	56.98%	53.84%
May be. (The program is just OK.)	49.30%	43.02%	46.16%
No. (The program is not worth it)	-	-	-

4.8 EMPLOYERS AND ACADEMIA PERCEPTIONS

Few specific question related to job continuation along with masters studies, skills need to be acquired by graduates, identification and bridging of gaps between industry and academia, etc, were also asked from employers and academia.

The results are given below.

4.8.1 Continuation of Masters studies with Job in hand

Approximately 68% of employers agreed that graduates must continue their job along with masters studies as this allows them to apply current knowledge and understandings to their existing professional tasks (see

Table 4.19).

Table 4.19: Continuation of Masters along with Job in Hand

Agreement	Employer	Academia
Agree	50%	43%
Strongly agree	28%	-
Neither agree no disagree	19%	14%
Disagree	3%	43%
Total	**100%**	100%

On other hand, responses received from faculty members were in between agreement and disagreement. This might be due to diverse professional backgrounds of faculty members and since masters programs are specialized knowledge programs which demands keen physical and mental attention therefore aggressive professional commitments may effect students' overall performance. However, the regional maturity on industry seems to play a vital role here: most of the graduates of NEDUET continued their job during the masters program which hints towards cooperation by their employers. Whereas their northen counterparts (NUST graduates) seem to solely focus on academic engagement without opting for professional committment.

4.8.2 MS/ME Employee / Graduate Performance

Both employers from construction industry and faculty members of universities agreed that CEM graduates demonstrates average performance (see Table 4.20) in their respective roles graduates somehow manages a balance in between their job and studies which not only helps them to acquire specialised degree but also boosts career progression in respective industry.

Table 4.20: Graduates performance as Employee and Student

MS employee/graduate Performance - Rating	Employer (%)	Academia (%)	Average (%)
Average	63	71	67
Above Average	38	29	33
Total	**100**	100	100

Another question was asked from academia and employees about the necessity of CEM industry needs and graduates evaluation on regular basis. More than 80% of both respondents agreed that evaluation of construction management industry needs is very important as it enables to analyze and build consensus among different tiers of industry over technical grounds.

4.8.3 Gaps between Industrial needs & Academic offerings

When both respondent groups were inquired about their views regarding gaps between industry – academia linkage, almost 95% of respondents agreed that there are certain gaps between perceptions of industrial need and academia offerings as shown in Table 4.21.

Table 4.21: Gap bridging b/w Industrial Needs & Academia Offering

Gap bridging b/w Industrial Needs & Academia Offering	Employer (%)	Academia (%)	Average (%)
Update curriculum content frequently as per latest techniques/technologies	29	32	31
Inviting field experts in class rooms for lectures more frequently	28	26	27
Increase internship opportunities for students	28	26	27
Improve mode of teachings in class rooms	14	16	15
Total	**100**	**100**	**100**

These gaps could be bridged by updating curriculum with changing trends of construction industry (31%), inviting more field experts from industry for lectures during academic sessions (27%) and increasing internship opportunities for students during their studies (27%) which could also become positive communication linkage in between.

4.8.4 Qualified Construction Managers

When Employers were asked about their views regarding qualified construction manager against those with no formal training, results showed that employers are more comfortable with employee having minimum of 5 years professional experience along with formal education in management against those individuals who are practising professionals but with no education or formal training as shown in Table 4.22.

Table 4.22: Qualified Construction Manager – Employer Perspective

Statements	Agreement Perceived in %	Response (%)
Employee with more than 5 years of professional experience performs better as a skilled construction manager after having formal CM education than with employee having no formal training in management.	More than 80%	75
	60-80%	25
	40-60%	0
	20-40%	0
	Less than 20%	0
	Disagree	0
There is no influence of formal construction management education over existing trends of construction management practices.	More than 80%	16
	60-80%	13
	40-60%	28
	20-40%	28
	Less than 20%	16
	Disagree	0

Further, maximum employers partially agreed that existing trends of construction management practices are not completely favorable for formally trained construction

managers to apply earned knowledge and there is no influence of specialized education. But, approximately 48% employers agreed that construction managers having strong professional educational background do influence the industrial practices. This implies that graduates, once employed, are partially equipped with technical knowledge and perform better as compared to their counter parts with no formal construction management education.

Similarly, when faculty members were asked to give their extent of agreement for statements concerning influences of professional background effecting students learning process, following responses were received as shown in Table 4.23.

Table 4.23: Students with Professional Background – Academia Perspective

Statements	Agreement Perceived in %	Response (%)
"MS students with more than 2 years of professional experience demonstrates better understanding of construction management studies and required skill sets in industry than with students of no experience.	More than 80%	14
	60-80%	57
	40-60%	14
	20-40%	-
	Less than 20%	-
	Disagree	14
There is no influence of professional experience over understanding of construction management studies at MS level.	More than 80%	-
	60-80%	-
	40-60%	29
	20-40%	57
	Less than 20%	-
	Disagree	14

It was observed that faculty members agreed more than 60% that students who had prior field experience before joining masters program demonstrate better understanding than those who with no industrial exposure. It might be due to the nature of construction technology itself which demands core field exposure from a manager to effectively handle and deliver projects accordingly.

4.9 CONSTRUCTION TECHNICAL KNOWLEDGE

To compare the perception of the CEM graduates against expectation of the employers for technical skills which they deemed necessary to work competently in the industry, graduates were asked to rate the 26 skills identified from literature (Bhattacharjee et al., 2013; Egbu, 1999; Hwang and Ng, 2013; Odusami, 2002). Employers were also asked to rate skills according to their expectations which they consider important to be possessed by fresh graduates. Internal consistency reliability of the survey feedback was tested by finding the Cronbach's alpha (α) which was calculated as $\alpha = 0.86$ for the graduates and $\alpha = 0.94$ for the employers feedback.

Further, the RIIs for each of skills were calculated from both respondents responses followed by rank ordering according to their RII values (see Table 4.24). After calculating RII values, SRCC test was performed on the ranks given by employers and graduates. A significant positive correlation between the ranks of the various construction knowledge items was found amongst the graduates and employers ($r = 0.87$, $p < 0.01$ [two tailed], $df = 26$). It implies that views of the graduates and the expectation of employers about the required knowledge to work competently in the construction industry are at high degree of agreement.

According to results, both the graduates and employers agreed that the ability to read and interpret construction documents was the most important knowledge required to work in the industry. While for some of the skills, graduate's perceptions were completely aligned with the expectation of the employers and there were also skills where considerable mismatch was noticed.

The opinion difference was observed in regard to the importance of being familiar with the knowledge about HVAC systems and their working principles. Based on the survey results, the employers perceived it to be partially an important knowledge to succeed in the industry and expect the new graduates to have a basic knowledge about the HVAC systems. This could be due to high number of general contracting organization being respondents of the survey who perhaps felt that construction manager remains in coordination with the specialized designers during execution of a project and possessing pertinent knowledge surely allows satisfactory project handling and control.

As shown in Table 4.24, a prominent trend noticed was the lack of agreement between the both respondent groups in regard to the importance of knowledge of scheduling. The questionnaire had three skills related to scheduling: identification of project activities and their relationships, schedule development/updating, and knowledge of software package for schedule development. Except fo the first skill, employers did not perceive the other two skills as very important to succeed in the construction industry.

In addition, difference of perception was also observed in skills concerning usage of modern technical software as graduates perceived this expertise important for their career progression while employers rated it low. It is because graduates are exposed to latest modern software during their studies while existing trends of industrial practices are still outdated and need to be upgraded according to international standard practices. This could be one of the reasons that local managers are prone to physical site management more rather computer based handling.

Table 4.24: Construction Technical Skills – Employers & Graduates Perception

Technical Skills	Category	Employers expectation		Students expectation		Dif. In Rank
		R.I.I	Rank	R.I.I	Rank	
Quality Control	Materials & methods (M&M)	0.938	1	0.868	**3**	2
Ability to interpret construction documents	Construction Contract (C.C)	0.925	2	0.896	**1**	1
Quantity takeoff	Estimation	0.900	3	0.845	**4**	1
OSHA regulations about construction related safety hazards	Safety	0.875	4	0.815	7	3
Identification of project activities and their relationships	Scheduling	0.869	5*	0.882	**2**	3
Familiarity with building codes	C.C	0.869	6	0.797	9	3
Properties, composition and characteristics of building materials	(M&M)	0.825	7	0.783	11	4
Risk analysis and management	Safety	0.813	8	0.807	8	0
Ability to interpret MEP drawings	MEP systems	0.800	9	0.789	10	1
Components of bid documents	Estimation	0.775	10	0.834	6	4
Interoperability	BIM	0.769	11	0.767	13	2
Basic knowledge about sustainability	Sustainability	0.763	12	0.772	12	0
Model development	BIM	0.750	13	0.733	16	3
Knowledge about HVAC systems & their working principle	MEP systems	0.706	14	0.688	19	5
Schedule development, updating	Scheduling	0.669	15*	0.838	**5**	10
Residential / commercial techniques	(M&M)	0.669	16	0.737	15	1
Sustainable construction materials and methods	Sustainability	0.600	17	0.669	**22**	5
Model specification	BIM	0.556	18*	0.687	20	2
In-depth knowledge about sustainability principles & design applications	Sustainability	0.556	19	0.677	21	2
Model validation	BIM	0.550	20	0.656	**23**	3
Software package for estimation	Estimation	0.538	21	0.709	17	4
Software package for schedule development	Scheduling	0.519	22	0.746	14	8
Safety record keeping	Safety	0.513	23*	0.689	18	5
Model access management	BIM	0.513	24	0.651	**24**	0
LEED process and requirements	Sustainability	0.506	25	0.590	**25**	0
Knowledge about circuit theory, electrical systems & equipment	MEP systems	0.375	26	0.535	**26**	0

* Equal R.I ; ranked in accordance with no. of maximum value (5) assigned to item by respondent.

But some modern tools are irresistible, such as BIM (Becerik-Gerber and Kensek, 2009). The employer's expectations were very much in line with graduates perceptions in regard of skills related to BIM, safety, sustainability, estimation, and the construction materials and methods as shown in see Table 4.24. Findings of this study were compared with the study conducted by Bhattacharjee et al. (2013) in which they identified the top 5 technical skills (Ability to interpret construction documents, Quantity takeoff, OSHA safety regulations, Activities and their relationship identification and Quality control) for USA construction industry and it is observed that these skills are were very much valid for the construction industry of developing countries like Pakistan. This implies that construction industries of such nations are progressing efficiently according to modern trends and techniques may be at a slow pace but in right direction .

Chapter 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

This chapter concludes the research by asserting and summarizing the findings and recommendations. It helps to understand the core of the study results and broadening future research ways for the pertinent area.

5.2 CONCLUSIONS

This study aimed to obtain a better understanding of current expectations of employer's needs which they have from the graduates who practices in industry after specialized training in construction engineering management as well as to assert overall performance of graduates and academic offerings.

The postgraduate program in Construction Engineering Management at NUST and NEDUET are specially designed for those engineers and architects who are aiming for career progression in terms of technical management responsibilities and their objective is to strengthen professional practices in construction industries. Unlike other graduate degrees in science or engineering specialty or project management, this degree stresses on technical and managerial skill development specifically required in construction industrial practices. To attain this objective, the curriculum blends technical contents and managerial knowledge in a practical framework as needed by the industry. It allows graduates to grow professionally and apply newly acquired/improved skills immediately in their practices.

Graduates who responded usually belonged to different sectors of construction industry and already had professional experiences. Some of them were working on senior and junior level positions in their respective organizations.

The reason for them to pursue this program was to improve their technical skills and enhance their project management competencies for their organizations. Such program helped graduates to remain competitive in industry. The key skills which are highly deemed necessary for construction industry have also been identified such as project management, decision making, team building, time management, etc.

Majority of graduates were found satisfied with overall design of program but few also stressed over incorporating more flexibility in the elective (optional) course selection during study period. Responses showed that the some improvement must be made in course content in accordance to the technological needs and advancements of industries. It could only be possible if industrial trends are evaluated on regular basis and more qualified faculty members are hired for dynamic positive results coupled with healthy industry-academia collaboration.

Approximately 81% respondents agreed that more than 60% major course content was effectively delivered by proficient and well versed course instructors. This is due to the universities have qualified professional instructors and are competent in their subjects. The popular management courses of the program among graduates were estimation, scheduling, risk management, safety management, etc.

The program is reported to boost the personality and professional dynamics of approximately 52% graduates partially but they were unable to make changes in their current job environment. They felt more competent and organized towards their tasks,

a more practical attitude to problem solving and team coordination skills were also improved. These factors led graduates to encourage and motivate their colleagues to improve their skills and knowledge also by taking postgraduate construction engineering and management program.

Another section of the study evaluated the difference of perceptions among graduates and employers regrading technical skills ratings. Findings concluded that the degree of agreement between the perception of the graduates and the expectation of the employers is high about the required technical knowledge to work proficiently in the construction industry.

The results confirmed that most of the technical skills (such as knowledge about contract and safety regulations, quality management, scheduling techniques and sustainable construction) specific to construction industry that employers identified as important were similarly categorized important by the construction graduates too. This implies that the construction management program offerings are partially meeting industry's need. But since construction industry faces many challenges with passage of time and incorporation of new technologies, it is imperative to keep reassessing the industrial trends and current curricula at universities with focus on preparing the future graduates equipped with desired technical attributes.

5.3 RECOMMENDATIONS

Based upon the findings and results, following recommendations are given for the improvement of construction engineering and management programs as well as to meet construction industry need.

1. More faculty members to be hired in universities so that course offerings during study period should be flexible and on job students could continue with their practice and academics in parallel. It will help train them as better professionals.
2. Qualified instructors of construction management with international exposure must be invited for a periodic review, lectures or conferences.
3. Introduce extensive training modules over technical soft wares for planning, estimating and management system.
4. Proportions of theoretical content against physical exposure to management must be reviewed and balanced by increasing more field tours/surveys.
5. Industry demands communication and presentation skills along with technical knowledge. These domains should be also be focused during masters studies
6. Semester projects should be as per industrial needs and students should be encouraged to have an internship during their tenure.
7. Invite Contractors/consultants during academic offerings to share their experiences and take real life projects from industry to help execute them with the help of CM students during studies.
8. University programs must regularly assess if graduates academic trainings meet industry expectations.

Few specialized courses (as shown below) are also recommended to be taught at master's level education as also identified by academia personal as well as employers keeping construction management practices in consideration.

i. Business Communication
ii. Human Resource Management
iii. Infrastructure Management
iv. Procurement Management
v. Project Finance
vi. Quality Management
vii. Real Estate Management
viii. Supply Chain Management
ix. Sustainable Construction Management
x. Building Information Modelling
xi. Urban / Infrastructure Management
xii. Value Engineering in Construction

5.4 FUTURE DIRECTIONS

Based upon results, a measured plan for the improvement of CEM curriculum could be developed at the postgraduate level by addressing the gaps and limitations of curricula across the institutes of Pakistan to improve and strengthen the graduating student's skills and knowledge as well as effectiveness and aptitude and of research and teaching efforts.

5.5 LIMITATIONS

This research was specific to the critical assessment of perceptions differences, among CEM graduates, employers and academia concerning construction engineering management program offerings and skills development with respect to industrial needs. To improve the state of education and practice, research in pertinent areas need to be carried out on regular basis to help bridge the gap between industrial requirements and academia offerings. This research was geographically limited to two universities of north and south regions of Pakistan which had mature postgraduate programs but few other institutes could also be added in for survey from other regions for more generalized and complete picture.

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