IMPACT OF MASSIVE OPEN ONLINE COURSES (MOOCs) ON DISRUPTION OF BUSINESS MODEL IN ENGINEERING UNIVERSITIES OF PAKISTAN

Shehzeen Bakhsh Malik

Enrollment No: 01-246182-015

Supervisor: Associate Professor Dr. Abdul Baseer Qazi

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Approval Sheet

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Scholar's Name:	Shehzeen Bakhsh Malik	Registration No:	01-246182-015
Programme of Study:	MS Engineering Management		
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Date: 26 November, 2020 Name: Associate Professor Dr. Abdul Baseer Qazi

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ABSTRACT

MOOCs platforms are challenging higher education by providing accessible, flexible and affordable education to their customers. They emerge as disruptors in higher education through the introduction of new technologies and business models. The study is constructed on the value proposition component of business model provided by MOOCs and aims to identify its effect on the existing business model of engineering universities. Students are regarded as the internal customers while employers are the external customers of the university learning process. MOOCs help in developing skills among students and linking them to their potential employers as part of both of their value propositions. Career motivation is driving students towards MOOCs for development of skills that industries demand. Innovative industries are encouraging their employers for bringing uniqueness and creativity. This study utilized the deductive approach; online questionnaire was filled by 233 students enrolled in engineering universities and 212 employers having engineering background from IT/Engineering departments; who were involved in the hiring of the graduates. Their found a strong relationship between MOOCs and student's skill development which is strengthened by career motivation among students. Career motivation and MOOCs caused a 45% enhanced skills amid students. A moderate relationship exists between MOOCs and employer's employability propagation which is weakened by workplace innovation showing a damping effect. Employers are collaborating with MOOC platforms to refine their employee's skills, yet a majority of innovative workplaces lag behind in embracing MOOC skills. There observed an uncertainty of employer's trust on vocational skills platforms in recruiting process. Due to the recent pandemic, most of the students are getting involved in online education and all the institutions are compelled to take a step forward towards online education. Increasing MOOCs popularity among students and employers pose a threat to existing inadequate business model of universities. Things are changing and if not addressed properly, universities will face disruption in a course of time. The Higher education need to revise their course content and quality to stay competitive in the fast growing MOOCs trend. The research was limited to engineering universities of few cities only; a future study can be conducted on different universities in the backward areas of Pakistan having connectivity issues. The research provides basis for conducting financial analysis of the prevailing business models in higher education.

Key-words: MOOCs, Disruptive Innovation, Business Model, Student's Value Proposition, Employer's Value Proposition

DEDICATION

This research work is dedicated to my dear husband Fahad Farooq for being the continuous support and motivation for the achievement of my goals. His prayers and trust provided me the determination to complete this thesis.

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LIST OF ABBREVIATIONS

SYMBOLS		ABBREVIATIONS
MOOCs	-	Massive Open Online Course(s)
SSD	-	Student's Skill Development
EP	-	Employability Propagation
CM	-	Career Motivation
WI	-	Workplace Innovation
MQS	-	MOOCs Questions of Students
MQE	-	MOOCs Questions of Employers
SSDQ	-	Student's Skill Development Questions
EPQ	-	Employability Propagation Questions
CMQ	-	Career Motivation Questions
WIQ	-	Workplace Innovation Questions
RQ		Research Question
M1	-	Model 1
M2	-	Model 2

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CHAPTER 1

INTRODUCTION

The first chapter of the research comprises of background of the study followed by description and justification. It also corroborates the critical concepts of the study including problem statement clarification, research questions and objectives. In the end stated are the limitations and outline structure of the research.

1.1 Background

In numerous parts of the world, the increasing costs of higher education (HE) makes it unaffordable for many students. Due to excessive fee structures of private sector institutions; a big chunk of Pakistani students is deprived of quality higher education (Qureshi, 2016). Several scholars question tertiary institution's capability to prepare students for their professional careers and identified there lies a mismatch of skills students gain through higher education and perceptions of potential graduate employers (Hernández-March et al., 2009; Lowden et al., 2011; Md Yusoff et al., 2009). MOOCs act as a means to reduce this skill gap and support employability (Calonge & Shah, 2020; Dillahunt et al., 2016).

Massive open online courses (MOOCs) are recent advancement in online and distance learning phenomena (Qureshi, 2019). The term MOOCs was introduced first by Dave Cormier in 2008 to describe Siemens and Downes course called "Connectivism and Connective Knowledge". In 2011, a Stanford professor named Sebastian Thrun and few of his colleagues provided worldwide access to the course that they were teaching at university, "Introduction to Artificial Intelligence". This course managed to attract 160,000

students from more than 190 countries. Almost 23,000 students completed that AI course. Thrun was so overwhelmed with the response that he left Stanford and started his own MOOC platform called Udacity with the stated goal of democratizing education by offering courses to students at no cost. Two other Stanford professors named Daphne Koller and Andrew Ng co-founded Coursera. It started with partnership between top four universities- Stanford, the University of Pennsylvania, the University of Michigan and Princeton (Flynn, 2013). This proliferation of MOOCs began in 2012 and has invigorated several elite institutions to place their courses online by setting up open learning platforms, including edX (MIT and Harvard collaboration) (Yuan & Powell, 2013).

MOOCs are adapting the technologies and pedagogical approaches offered by online and open education resources (OER) but their novelty that attracted millions around the world is the concept of "free" availability of courses, material and content, though, most of them charge for certifications (Kalman, 2014). These free to low-cost courses also have global access i.e. anyone can participate in a course from anywhere in the world without demographic, economic and geographic constraints (Yuan & Powell, 2013). Many researchers indicated that MOOCs platforms provide a democratic and cost effective alternative to traditional university education, based on their capability to scale educational content to large number of learners at minimal costs (Al-Imarah & Shields, 2019; Kalman, 2014; Yuan & Powell, 2013). MOOCs provide convenient education without any bound of time than in traditional education, thus regarded as flexible courses (Al-Imarah & Shields, 2019).

MOOCs promise is that they will provide free to access, highly advanced and innovative courses that will reduce university education expenses and potentially disrupt the existing models of higher education (Yuan & Powell, 2013). The disruption phenomena of MOOCs employ Disruptive Innovation Theory (Bower & Christensen, 1995). This theory describes new technologies that redefine an entire market and can improve product and services in unexpected ways (Al-Imarah & Shields, 2019). Following are the two features of disruption: "New market disruption" which involves creating a new market that meets the previous unmet demands, and "low-end disruption" which involve new technologies that exceed the performance of currently established business models (C. M. Christensen et al.,

2015). Christensen and colleagues themselves describes disruption a process where a small company with less resource is able to successfully challenge established incumbents businesses with greater resources (Stepan, 2013). Entrants that prove disruption, enter in market by targeting overlooked customer segments gaining advantage by delivering enhanced functionality at lower prices. Disruption is not one time activity; it's a process to evolve a product or a service to a point until the quality catches up to the main stream customer's standards. The authors stated that smart disruptors improve their products and hence drive upmarket (C. M. Christensen et al., 2015).

Yuan and Powell identified that MOOCs contains the key characteristics of disruptive innovation i.e. a combination of new business models and an enabling technology (Yuan & Powell, 2013). Christensen supported that disruptors focus more on getting the business model right rather than just the product. Business model describes the essentials of an organization, how it creates and captures customer value and can be concisely represented by an interrelated set of elements that address the customer, value proposition, organizational architecture and economic dimensions (Fielt, 2013). Generally, the term business model is used to describe only the financial component of organizations but the three most commonly stated components of business model includes customers value proposition, organizations infrastructure and financial component. Customer value proposition are the way customer needs are met by the organization i.e. how organization creates value for customers for fulfilling their demands. Students are the primary customers while employers are the secondary customers of the universities learning process (Antonio & Pereira, 2003). Infrastructure comprises of resources and processes: physical resources such as lecture halls, campuses and human resources such as faculty and administrative staff. Financial aspect of the business model includes sources of income, profit margins and pricing. For success of any organization, a good fit between the three is required. MOOCs can open new business streams for higher education sector and contribute to universities business model by receiving governmental funding for MOOCs development and operation, charging for participant data to engage them with potential employer who desired specific skill-set, selling and adapting specified MOOCs material (Kalman, 2014).

Learner's professional motivation is a driving factor towards MOOCs. Career motivation strengthens the relation between MOOCs and development of skills among students (Loizzo et al., 2017). Studies identified that the factors including in student's participation in MOOCs are mainly getting the advantages of various skills that the platform offered. Career shift, career enhancement, skills improvement and professionalism are counted among highest importance factors (Hew & Cheung, 2014). The 21st century demanding market requires graduates to be excelled not in just engineering specified skills but also in creative and analytical thinking, analyzing work-place problems, coming up with novel ideas and strategies to help nourish organization. An innovative culture in an organization itself supports creativity, give preference to employees having unique skill-set and thrive for betterment of its organization (Chang & Lin, 2007). Innovative organizations regard highly of MOOCs and innovative culture strengthen the relationship between MOOCs and employer's employability propagation. (Karnouskos, 2017) MOOCs support employability and develop employability skills by adding to social capital (Dillahunt et al., 2016; Suarta et al., 2017).

1.2 Justification and Relevance

Rapidly advancing technologies such as artificial intelligence, internet of things, big data analytics and robotics have created a situation in which most of the content learned and skills gained from colleges and universities becomes outdated in a few short years (Marcus, 2019). Indeed, soft skills such as critical thinking, communication skills and leadership do not go outdated but hard skills i.e. technical skills are changing as technology undulates through society. These demand employees to be up skilled for changing generations of technology. This combination of skills and knowledge demands professionalism. Google and other giant techs started its IT support course on Coursera to train its employees and to hire new as well. This sudden cultural shift from big-wigs induces employer's trend for not seeking un-skilled graduates; chances are this could soon become an industry norm (Kolowich, 2012).

The threat to engineering education is the societal perceptions that skills of university graduates are inadequate to meet lifetime work challenges. The gap between shared needs and actual performance of university graduates is increasing and online education is an important factor to reduce this gap (Casner-Lotto & Barrington, 2006; Kalman, 2014).

Due to proliferation of MOOCs, big universities are shifting to MOOCs (Yuan & Powell, 2013). Small universities need to learn from them. Since MOOCs are using updated technology and free business models, they are attracting more learners by meeting their customers' demands. Quality content is another benefit that adds values to customers. If HEC fails to identify the coming disruptor's disruption, chances are they will become obsolete in a course of time. The study will contribute to higher education in adapting the new business model (value propositions) offered by MOOCs to attract their customers and meet their continually changing demands.

1.3 Problem Statement

Student debt load for graduates of Boston University increased by nearly 50% between 1997 and 2016, to $25,625. American's have racked up a total of $1.5 trillion in student debt (Berkley & Letzing, 2019). Students of Pakistan pay tuition fee approximately US$3,500 for undergraduate degree and US$1,140 per year for master's degree (Ed-Arabia, 2020).

Previous studies have identified that traditional universities are following old pedagogical approaches with continuous increase in annual fees. There lies a gap between employer's skill demands and graduate skill perceptions. MOOCs have a positive impact on graduates and employees skills development (Calonge & Shah, 2020).

Globally top ranked and elite universities are adapting MOOC platforms as an innovation to inhibit advanced business model in order to provide value to their customers. In context to this, Engineering universities of Pakistan are on the brinks of disruption with their present expensive and inadequate business model. Hence there is a dire need to identify the value propositions offered by MOOCs to the target market.

1.4 Research Questions

Utilizing customer's value proposition component of the business model, following will be the main research question of the study:

- What is the impact of MOOCs on business model relating to student's skill development in engineering universities?
- Does career motivation moderate the relationship of MOOCs and student's skill development?
- What is the influence of MOOCs on the employability propagation in engineering sector?
- Does workplace innovation moderate the relationship of MOOCs and employability propagation?

The study will discuss whether new technologies and freemium business models followed by MOOCs disrupt the traditional universities business models. Customer value proposition towards MOOCs can affect engineering universities either positively or negatively, thus measuring disruption.

1.5 Research Objectives

Following are the research objectives for the study:

- To analyze the impact of MOOCs on business model relating to student's skill development in engineering universities.
- To examine the moderation effect of career motivation on the relationship of MOOCs and student's skill development.
- To evaluate the influence of MOOCs on the employability propagation in engineering sector.
- To analyze the moderation effect of workplace innovation on the relationship of MOOCs and employability propagation.

The study aims to identify the disruption of business model in engineering universities by gauging customer's value propositions i.e. student's skill development and employer's employability propagation; with the help of MOOCs impact.

1.6 Limitations of Research

Given below are the limitations of this research:

- Only the mentioned variables will be considered for the study, any other variable beyond that will not be considered.
- Due to limited resources, students and managers having familiarity with MOOCs is considered as a valid response for consideration.
- Only organizations/institutions accessible to researcher (Government, semi-government, private) will be considered for the research.
- Due to limitation of time, responses received after 45 days of sending the survey will not be considered as part of the data.

1.7 Outline of the Research

The thesis comprises of five chapters. Chapter one is of introduction that contains the relevance and justification, problem statement, research questions, research objectives and limitations of the study. Chapter two will be the literature review in which the researcher will study the significant and existing literature relevant to the topic. The third chapter will be the methodology where researcher will sort the data for achieving the required objectives with use of appropriate methods. In the fourth chapter the researcher will analyze the data collected for the study and reach conclusive findings. In the last chapter the researcher will discuss and conclude the findings of the overall study and suggest future work as well.

CHAPTER 2

LITERATURE REVIEW

It is mandatory to take certain steps with a goal to find the answers of the research questions. These steps include the review of the relevant theories established on the concepts of disruptive innovation, MOOCs, prevailing business models and its elements. This chapter is developed for the achievement of this purpose and includes the findings of previously established theories on the relationship between the variables used for the research.

2.1 MOOCs (Massive Open Online Courses)

MOOCs provide a reasonable and flexible way to learn different skills, advance professional career and deliver quality educational experiences at scales. It helps in career development, changing career and lifelong learning. It provides global, open access through video based instructional content and discussion forums to higher number of participants; aiming to take a course. It has potential to open up higher education by providing free or low cost easily accessible, flexible, affordable and fast-track completion of courses to its learners (Shelley & Srivastava, 2016). In principle, a MOOC is denoted by (Gore, 2014):

- Massive: They can be offered to unlimited participants (sometimes enrollments exceeds hundred thousand);
- Open: As one can take advantage of widely available open education resources (OER) and their content with open registration (though some MOOCs platforms have pre-requisites, especially for degree programs);

- Online: Generally with no criterion for face-to-face attendance and delivered worldwide via the internet;
- Course: The concept of a pedagogically designed learning expedition.

Since their widespread appearance in 2012, massive open online courses (MOOCs) have become a common setup for individuals interested in learning without being constrained by time, location, or academic enrollment (Liu et al., 2020).

Some possible reasons for investing money in MOOCs in such a short time by (Stepan, 2013):

- MOOCs provide a live workroom for studying how people learn, how the mind works and how to improve education both face-to-face and online.
- MOOCs can be used to help understand why people forget things so that strategies can be created to prevent it.
- Study which teaching methods and tools are most successful.
- Tool for identifying top talent to charge recruitment fee and act as a career placement center e.g. Udacity.
- Large and diverse meeting place and forum for ideas and for networking. MOOC provide a large space for learners without personal interaction.

2.1.1 Key Characteristics of MOOCs

MOOCs characteristics comprise of novelty aspects compared to earlier distance and online learning initiatives, MOOCs motivation and benefits for learners. It also includes two economic specificities of MOOCs; supply/demand and profit/non-profit.

2.1.1.1 Novelty

The unique characteristics of MOOCs include free registration, open access to learning and a large and varied learner body. Learners; who not only have different backgrounds but also wide ranging motivations for enrolling in a course are shaping the

learning progression (Shelley & Srivastava, 2016). The Novelty of MOOCs lies in the first acronym "O" which defines openness. Learners can learn at a zero to very low costs for degree programs. There is no registration fee, entry barrier or any form of selection to take part in the open courses (Belleflamme & Jacqmin, 2016). The aim of MOOCs is to open up education and provide free access to tertiary level education for as many students as possible. In disparity to traditional university online courses, MOOCs have two key features identified by (Yuan & Powell, 2013):

- Open access - anyone can participate for free in an online course
- Scalability - courses are intended to facilitate an indefinite amount of participants

Completion and professional certificates of MOOCs demonstrates mandatory level of knowledge required for the understanding of the course and helps learners to utilize their skills based on certifications (Belleflamme & Jacqmin, 2016).

2.1.1.2 Engagement and Motivation for Learners

Learner's motivation towards MOOCs is a significant area of interest for many venture capitalists and higher education stakeholders. With invent of industry 4.0 and dynamic market demands, technology is taking shifts rapidly. What is in demand currently might not be the case in next two to three years, so learners craved for opportunities to enhance their skills based on demands (Lasi et al., 2014). Economic benefits, personal and professional identity development, challenges and achievements, enjoyment and fun are some of the major factors that influence learner's motivation to participate in MOOCs (Yuan & Powell, 2013). A lot of research has been done to find out the response of students on their motivation in MOOCs and participation in particular course revealed following four reasons (Hew & Cheung, 2014; Li, 2019; Liu et al., 2014; Shapiro et al., 2017):

1. To gain a lifelong experience and understanding in learning a new topic or to extend current knowledge.
2. For fun, entertainment, curiosity, social experience and intellectual incentive.
3. Convenience, to attain relaxation with barriers to traditional education options.

4. A desire to personal challenge and to obtain completion certificates.

All above reasons benefit learners in their own domain depending on the type of experience they are seeking. Age, gender and highest degree and number of courses previously taken also determine course taken by the participants (Li, 2019).

2013 was the year MOOCs were still in their infancy, students were more curious about knowing the details and offerings of the platform. Meanwhile, a portion of learners are focusing on their skill building and career development (G Christensen et al., 2013). Christensen and colleagues surveyed learner's motivation in University of Pennsylvania's 32 MOOC courses from both developing and developed countries. From the 34,779 participants both from developing and developed countries, the reason for MOOC motivations vary. 13.2% students were doing MOOCs to gain knowledge to get degree in which developing countries lead with 20.6%. 43.9% wants to gain specific skill to do job better, 17% desired to gain specific skill to get an new job while 50.05% were doing MOOC courses for curiosity and fun factor. In 2013, the ratio of learners doing MOOCs fell heavily in the entertainment side (Gayle Christensen & Alcorn, 2013).

Liu and colleagues analyzed learner's motivation in taking MOOCs courses offered through the Knight Center for Journalism in the Americas in the College of Communication at the University of Texas at Austin from spring to summer 2017. The results showed different learners motivations. Among 846 participants from 94 countries from the five continents, 70.8% were interested generally in the topic, 70% were doing MOOC course for personal growth and enrichment, and 66.8 % learners claim that the specific MOOC course was related to their job. In 2019, fun curiosity factor went down to 27.9%. 22.8 % wanted to earn a certificate to boost their career while 22.5% were interested in their career change. The unique percentage of students comes forward whose participation relies solely due to prestigious university professor teaching and they contribute to 26.4% of the total ratio (Liu et al., 2020).

With MOOCs proliferation, learners interested in different courses mainly comprises of working professionals to enhance their skill in specified technology for getting benefits in the job market and improve their expertise (G Christensen et al., 2013; Liu et al., 2020).

2.1.1.3 Learning Strategies

Apart from flexibility and accessibility, following are some of the features identified that add value to MOOCs compared to traditional face-to-face approach in higher education sector (Belleflamme & Jacqmin, 2016). These are as follows:

1. **Retrieval based learning:** It provides continuous feedback to the students using automatically graded tests and quizzes. Retrieval learning is a strategy that involves recalling information repeatedly through multiple studies, and it isn't time consuming as well. Retrieval does produce meaningful and long-term learning despite of rote and transient learning. Many researchers have found a positive and significant relationship between the exercise of retrieval and learning outcomes (Roediger & Karpicke, 2006).
2. **Student-centered learning experience:** Internet markets make the pricing low of adopting the content provided to the students and ability to utilize the data available on the platforms, classes can be watched, re-watched and stopped at any time depending on student's attention capacity (Levin, 2013). This implementation enhances multitasking skills of the younger generation, which can take more advantage of the stated learning (Carrier et al., 2009).
3. **Evidence-based education practices:** MOOC platforms offer a great environment for random trial experiments. Obligations to the massive amount of data concerning the learning process and the outcomes available at a very low cost, the internet gives a perfect setting for this type of experiments. By separating the control groups from the new technology, controlled trial experiments allow analysts to draw the conclusion how control groups responded learning outcomes differently. This give room for improvements on the MOOC platforms which can be adapted by higher education as well (Levin, 2013).

2.1.1.4 Economic Specificities

The two important specificities of MOOCs include supply and demand of the innovation. MOOCs differ from traditional courses both on the supply and on the demand

side, with prospective effects on the market structure of higher education. While the choice of organizational mode i.e. for or non-profit likely to have a larger impact on MOOC platforms than on traditional higher education institutions (Belleflamme & Jacqmin, 2016).

a) **Supply vs. Demand:** Depending on the supply side, the cost structure of MOOCs comprise largely of fixed costs, as they concern the development of the platform, the investment in a sufficiently large quantity, and the online adaptation of the course. The cost of the person providing the course is also larger depending on the platforms as Udacity professors charge for per course while Coursera and edX professors do not, they are still on payroll of the host university. In contrast, variable costs are much smaller as interactions between students and professors are now replaced by interactions with the platform to grade quizzes and by interactions among peers (Hollands et al., 2014). On demand side, MOOCs improve the accessibility of higher education: classes can be trailed at any time with no boundaries; there is no transportation cost and no need to move in to live near a campus or to shuttle. They are generally free of charge. Students can also decide the courses that they want to follow without having to stick to a specific course outline and the content (Belleflamme & Jacqmin, 2016).

b) **For-profit/ Non-profit:** The two modes of structure are prevailing among current MOOC platforms i.e. non-profit and for-profit platforms. Both are categorized in tabular form as:

Table 2.1: *For-profit vs. Non-profit Organizations*

For-profit	Non-profit
Incentives are distributed to the owners of the platforms and among peers.	These institutions are excluded from distributing their profits to their owners.
Surplus budget equally divides among the owners and venture capitalists.	Surplus budget reinvested into the institution.
Joint ventures among institutions for monetizing and other benefits.	Lack of collateral in start-up phase makes it difficult to access flexible capital.
Fund raising and donations, investments by venture capitalists and access to equity market.	Difficulty to access additional capital and to raise it via debt financing.
Professors are paid by the platforms to build network effects.	Lack of indirect network effects among students and professors
Monetized, customers attraction enhanced by offering certificates, industry-academia linkage.	Freemium model attracts customers, charge only for certifications.
Donations used for achieving certain objectives for foundations.	All donations invested on quality of education.

Source: Adapted and presented in tabular form from An Economic Appraisal of MOOC Platforms: Business Models and Impacts on Higher Education (Belleflamme & Jacqmin, 2016, p.155)

2.1.2 MOOCs Types

"Connectivism and Connective Knowledge" course was offered by Stephen Downes and George Siemens in 2008, set up a class of 25 tuition paying students at University of Manitoba, Canada. The course was also offered as an open version for free in which two thousand and three hundred students participated. This type of MOOC is coined cMOOC. xMOOC are different, they are affiliated with elite institutions and all are started back in 2012 (Stepan, 2013).

The research focuses on xMOOC; it is important first to understand the difference between the two types of MOOCs. The information contained in the table below has been adapted from research by Kesim and Altinpulluk and presented in tabular form for reader's facility.

Table 2.2: *cMOOCs vs. xMOOCs*

cMOOCs	xMOOCs
Referred as Canadian MOOCs, started in 2008 at University of Manitoba, Canada by George Siemens, Stephen Downes and Dave Cormier.	The well-financed providers, associated with top universities established in 2012 - Udacity, Coursera, edX.
Medium of knowledge transfer - Based on theory of connectivism (The learning process takes place as the learner gains their knowledge through making connections, mostly with the collective knowledge of the community i.e. network based learning).	Medium of knowledge transfer – Based on Behaviorist pedagogy (The traditional behaviorist model is primarily based on the transfer of information from the teacher to the student).
Focus on knowledge creation - content, biological/neural, conceptual and social/external context, people interaction in web environment (open learning and online network practices).	Focus on knowledge duplication – information transmission through video presentations, computer marked assignments and quizzes, peer assessments. Received learning information reduced their creative and cognitive development.
Emphasis on autonomy, creativity and social networking learning. Each learner structures and manages their own learning network. They are considered as extensions of personal learning environment (PLE).	Emphasis on traditional theoretical learning, lecture video and multiple-choice tests (video-taped lectures appear online). It is very beneficial for those who don't have access to quality learning materials at their institutions.
Instructor led - Learners are free to	Instructor facilitated - Lectures are

determine their own learning goals throughout the learning process.	provided by instructors but few platforms support open content by learners.
Monetary gains are quite difficult due to open nature of courses.	Infrastructure and financial support required to offer such courses are mostly provided by large corporations and foundation donations.
Tools utilized - RSS, LinkedIn, Flickr etc. (users inhabit their own space)	Tools - Learning Management System (LMS)

Source: Adapted and presented in tabular format from A Theoretical Analysis of MOOCs Types from a Perspective of Learning Theories (Kesim & Altınpulluk, 2015, p.15-19)

The xMOOC are further divided into two models: for-profit platforms and non-profit platforms to serve different purposes as discussed in section 2.1.2.4. xMOOCs have been criticized for lacking any innovation in what pedagogy is concerned. However, it gains a huge success amongst students, possibly because of the effervescent nature of their discussion forums and their available learning tools and virtual laboratories (Totschnig et al., 2013).

2.1.3 MOOCs Providers and Platforms

MOOCs initiative started with online lectures from Khan Academy in 2004 by Salman khan when one of his cousins and other relatives requested a help in mathematics, he started uploading tutorials on YouTube. In a short period videos got 200 millions of views and their popularity exploded. In 2006, Khan Academy was backed by Bill Gates Foundation and Google, it now have more than 3,300 video lectures on different subjects. The ability to gather significant financial support drew venture capitalists attention and one of the first MOOC was create. It did not take long for innovators in higher education and venture capitalists looking forward for business ventures to see MOOCs potential (Flynn, 2013).

In 2011, Stanford professors launched three free online courses open to public; these courses went massive and gather so much public attention that the courses cross over 100,000 enrollments. More than 900 universities around the world have launched free online courses since then. By 2018, more than 100 million students signed at least one MOOC course. Many national governments around the world have launched their own country specific MOOC platforms. The table in Appendix A contains 34 larger MOOC platforms performing worldwide and at national levels (Shah, 2019).

The current value propositions for its customers by institutions to engage with MOOCs are identified as experimentation, education access, branding and developing new revenue streams. MOOCs serves as a way to enter the higher education market for many commercial organizations, as they do so by providing a MOOC platform and developing partnerships with existing institutions and to explore new delivery models in higher education. For example, Udacity partners with Georgia Tech to launch Nano-degrees, a low-cost project, to engage students with technology related jobs (Shah, 2019). For those organizations, MOOCs have a practical role in the selection and recruitment process of talented employees (Yuan & Powell, 2013). The costs to initially produce a MOOC based on assumption that it requires around 100 hours of work to generate the content at an average cost of $15,000 to $50,000; the costs for running for a single MOOC are within the range of $25,000-$60,000 (Burd et al., 2014).

2.2 MOOCs Disruption and Innovation in Engineering Education

The term “disruptive innovation” refers to innovations that deliver a product or a service to consumers in an explicit way as to go beyond market expectations. This raises a question for higher education about online teaching innovation such as MOOCs, as it’s causing a change in their business models that poses a threat to their existing prototypes of degree courses provision (Yuan & Powell, 2013).

Literature shows that MOOCs are disruptive and a threat to traditional bricks and mortar, face-to-face instructional medium (Burd et al., 2014; Calonge & Shah, 2020; Flynn, 2013; J. Qureshi, 2016; Stepan, 2013; Venkatesh, 2014; Yuan & Powell, 2013).

2.2.1 Disruptive Innovation Theory

The theory of disruptive innovation (Bower & Christensen, 1995) explains as to why some of the innovations disrupt existing markets by the disbursement of incumbent players (Yuan & Powell, 2013). A disruptive innovation creates an entirely new market generally by lowering down the price or targeting a new market designed for a different set of consumers or for diverse needs of existing customers (Stepan, 2013).

Disruption describes a process in which a minor company is able to successfully challenge already established incumbent businesses with scarce resources. Explicitly, as incumbents focus on improving their offered products and services for their most demanding and profitable customers, they exceed the needs of some customer segments and ignores the needs of other segments. Entrants that prove to be disruptive begin by successfully targeting those overlooked customer segments and gaining a foothold by delivering services at a lower price (C. M. Christensen et al., 2015).

"Disruption drives prices down in a market"

(C. M. Christensen et al., 2015, p.47)

Disruption has occurred when incumbents failed to serve low-profile customers and put their focus entirely on profitability from high-demanding segments, entrants move up-market with a continuous progress. They deliver the performance that mainstream customers required, while focusing on the benefits that deliver their early success. With passage of time, incumbent's consumers begin to adopt entrant's offerings in bulk (C. M. Christensen et al., 2015).

The two markets for disruptors as identified by (C. M. Christensen et al., 2015):

1. Disruptive innovations mostly initiate in low-end or new-market footholds.
2. Disruptive innovations do not chase onto mainstream customers, until quality catches up to their high-end standards.

Based on Christensen's theory of disruptive innovation (1995), MOOCs do fit the disruptive model. Following the theory, conclusions by (Stepan, 2013):

- Serving non-consumers - MOOCs are open to everyone anywhere, therefore they do not target mainstream face-to-face learners of incumbents higher education.
- MOOCs are moving up-market – First MOOCs have been started since 2008 but now the technology has improved and captures a significant presence.
- Disruptive innovations improve quality standards - MOOCs are serving mainstream customers with its cost effectiveness leading people to question traditional education models.
- Separate autonomous business entity set-up by established firms (Bower & Christensen, 1995). Harvard and MIT did exactly that by creating their own MOOCs, edX, as a separate business unit (Harvard Gazette, 2012, p.3). Platforms such as Coursera and Udacity have adopted MOOCs as disruptive innovation with a main focus on developing new business models and new markets as well to serve different needs of apprentices (Yuan & Powell, 2013).

2.2.1.1 Disruptive vs. Sustaining Innovation

Christensen has identified two types of innovations which affect organizations and businesses, namely sustaining and disruptive innovations. Christensen and Overdorf provide the following definitions:

> *"Sustaining technologies are innovations which make a product or service performs better in ways that customers in the mainstream market already value. They are nearly always developed and introduced by established industry leaders. Disruptive innovations create an entirely new market over the introduction of a new kind of product or service, one that is actually worse, initially, as judged by the performance metrics that mainstream customer's value."*
>
> (C. Christensen & M Overdorf, 2000, p.6)

The differences between sustaining and disruptive innovation can be identified based on value networks which refers to how an organization delivers its value proposition. Value

networks requirements surrounds customer preferences, cost structures, business models for making profits, culture and strategic direction. For example, the customer preferences and relevant cost structures may differ significantly from one network to another network (Stepan, 2013). Some of the characteristics between the disruptive innovation and mainstream value networks are described in the following table:

Table 2.3: *Sustaining vs. Disruptive Innovation*

Mainstream/ Sustaining Innovation	**Disruptive Innovation**
Sustaining innovations object specific high-end customers, those demand better product or a service performance and they are prepared to pay even more for it.	Disrupts the mainstream trajectory by offering a service or a product that is not good enough as the main stream company's products. Disrupters started by appealing to low-end or un-served consumers, and then migrate to the mainstream market.
First mover is not always important.	First mover always gain advantage.
Moves upmarket.	Moves upmarket.
High margin product focus – Always focus on higher ends and even overshoot the performance requirement.	Low margin focus - Focus on developing products and performances that generate lower margins.
Upstream focus - Try to beat the competition by looking at competitors.	Downstream focus - Ignore the incumbents business and target non-served customers.
Pursue large markets with established higher served consumers.	Pursue two types of small markets- Low-end footholds (less-demanding customers) and New-market footholds (entirely new market of non-consumers).
Incumbents listen to their customers try to provide their most demanding, profitable and high-end customers with ever-improving products and services.	Looking for new and low-end customers.

Incumbents accelerate their innovations to succeed the market or acquire the entrants to stop disruption.	Strategic choices guided by disruption theory when new technology arrives, either captured by mainstream incumbents.
Higher cost ends products and services	Products are simpler, usually offered at lower prices than mainstream incumbents.
Mainstream customers have their own value network and initially do not respond to disruptors as success is uncertain and project may fail.	It should be set up as a separate business entity, serving new customers and not included as part of the mainstream value network.
Strategy followed is to increase the profit margins. Failure is not acceptable.	Strategy is trial and error. Every disruption does not succeed.

Source: Adapted from Clayton Christensen's book: The Innovator's Dilemma and is presented in tabular form. (C. Christensen, 1997)

2.2.2 Disruptive Innovation Elements

> *"Disruptive innovation is the process by which a segment that has previously serviced only a limited few, because its products and services were complicated, expensive and inaccessible, is transformed into one whose products and services are simple, affordable and convenient and serves many no matter where the wealth or expertise."*
>
> (C. M. Christensen et al., 2011, p.2)

With disruptive innovation, the product or service doesn't have to perform better than the mainstream technology; it only has to satisfy a need that is currently not being served. Students who want to take their courses online or participate in courses that are more interactive to make better use of online instructional mediums, university need to facilitate their demands; otherwise the students will search for other platforms, MOOCs in this case (Stepan, 2013).

According to Christensen, MOOCs contains two elements or key characteristics of a disruptive innovation. They are: a technology enabler and business model innovation (C. M. Christensen et al., 2011).

2.2.2.1 Technology Enabler

According to Christensen, a disruptive product is always at the bottom of the market, and is not usually as demanding as what the leaders are producing i.e. traditional university face-to-face courses, but the products are embraced by the least served customers in the market (C. Christensen, 1997).

> *"Disruption occurs in industries where there is an enabling technology that can scale upward and allow the disruptive entrants to take their low-cost business models up-market."*
>
> (C. M. Christensen et al., 2011, p.27)

The diagram below, adapted from the HBR article by Christensen, Raynor and McDonald shows how Christensen's disruptive innovation model works.

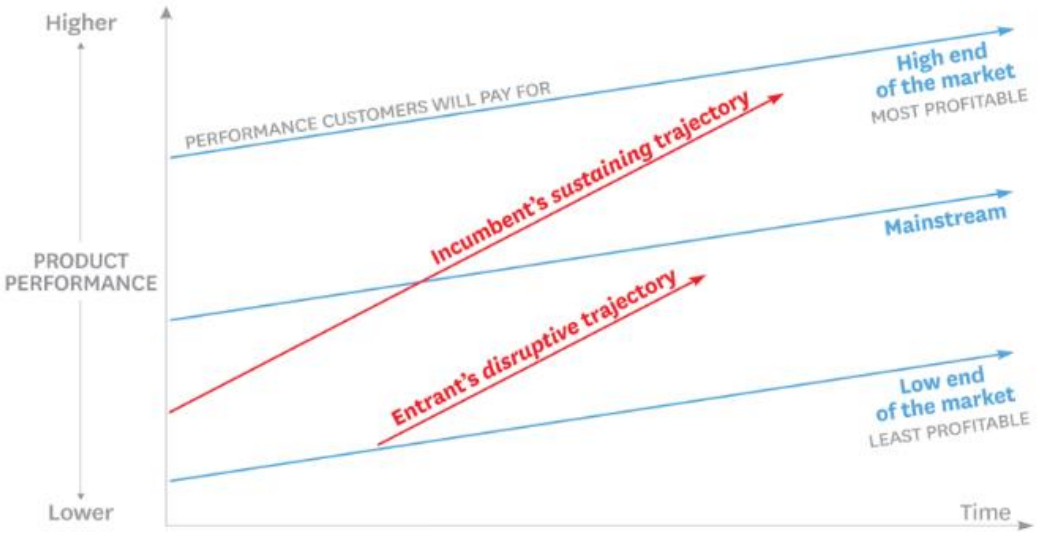

Figure 2.1 *Disruptive Innovation Progress*

Source: Diagram adapted from HBR article of (C. M. Christensen et al., 2015)

The diagram identifies that gradient of any disruptive trajectory shows how quickly the enabling technology improves. Universities in higher education, replicate the existing models in order to move up-market, replicating the cost structures and formats of the institutions they were trying to match. This is not disruptive. Today, online learning is an enabling technology that does not have to replicate and therefore changes the higher education market (C. M. Christensen & Raynor, 2003). Online learning has the potential to take business model of low-end universities upmarket (C. M. Christensen et al., 2011). Considering the rise in the number of students taking online courses, Christensen stated: "in 2003, roughly 10% of students took at least one online course. By 2008, that fraction grew to 25%, was nearly 30% in the fall of 2009 and is projected to rise to 50% by 2014" (C. M. Christensen et al., 2011, p.3).

2.2.2.2 Business Model Innovation

> *"Disrupters tend to focus more on getting the business model, rather than simply the product, just right. When they succeed, their movement from the fringe to the mainstream erodes first the incumbents' market share and then their profitability"*
>
> (C. M. Christensen et al., 2015, p.48)

Disrupters often build business models different than those of incumbent's players. An example of using an innovative business model to effect a disruption is Apple's iPhone that use innovative business model offered feature of Internet access through mobile back in 2007, thus disrupting laptop as primary access point to internet. This was achieved through the introduction of a new business model, not through product improvements (C. M. Christensen et al., 2015).

Universities currently try to do everything for everybody with multiple value propositions – research, teaching and preparing students for life and careers and meeting employers high end skill demands (Stepan, 2013). The table below highlights value propositions offered by traditional universities:

Table 2.4: *Multiple Business Models and Value Proposition*

Business Model	Value Proposition	Fee
Solution Shops	Knowledge Creation (Skill)	For service
Value-added Processes	Knowledge Proliferation (Academia)	For outcome measure
Facilitated User Networks	Preparation for life and careers	For membership

Source: Adapted from Disrupting College (C. M. Christensen et al., 2011, p.3 & 33)

Offering all three value propositions results in a costly and extremely complex organizational structure (Stepan, 2013). According to Christensen, in the absence of donations, universities could not exist. Students rarely get to see the research until they reached the PhD level. The significant overhead costs are at the expense of research and teaching. If teaching were separated from research then the overhead costs would be reduced (C. M. Christensen et al., 2011).

Disruptive innovations develop a new model that allows incumbent companies to offer customers increased simplicity and convenience at an affordable cost. Using online mechanism in a new business model based entirely on learning and focused on programs such as skill enhancement, careers development has given a significant cost advantage by several organizations. Further, combining disruptive innovation to an existing business model will not result in a transformation of the model (C. M. Christensen et al., 2011).

To follow a disruptive path, there exist a novel technology or business model that allows the new entrants to move upmarket without surpassing the incumbent's high costs structures. The answer to this enabling innovation is online learning, which is becoming broadly available. Costs for online courses are gradually falling and accessibility and quality are improving continuously. Innovators are making their ways into the mainstream market at a stunning pace (C. M. Christensen et al., 2015).

2.2.3 Are MOOCs a Threat?

The enhanced rate of technological advances has enabled the easy entrance of MOOCs within a very short period of time. This impact will lead to improvements in teaching and will encourage institutions to develop distinguishing missions. MOOCs may lead universities to embrace uniqueness and be less copied (Yuan & Powell, 2013).

MOOCs emerged as the dawn of a new technological age for higher education. The real threat may not be the MOOCs themselves but the segregation of higher education. If courses are organized according to employer-specific market needs, then their endorsement may change and this would constitute a threat to traditional bricks and mortar institutions. Universities will no longer have the monopoly (knowledge and credentialing) over the services offered (content, delivery and assessment, research, mentorship, affiliation, networking and job placement) (Stepan, 2013)

2.2.4 Limitations of Disruptive theory

Some disruptive innovations succeed while some don't. The theory doesn't say much about how to win in the new market or give any surety about that, the only way is to play the odds and avoid face-to-face competition with better resourced incumbents. A technology might be disruptive to one industry but sustaining to another, for example Uber, is a disruptive innovation to black cab business and sustaining to Taxi drivers (C. M. Christensen et al., 2015).

2.3 Business Model Definition

A business model is defined as the value logic of an organization. It tells how it creates and captures customer value and is concisely represented by an interrelated set of elements which address the customer, value proposition, organizational architecture and economics dimensions (Fielt, 2013).

> *"A business model describes the rationale of how an organization creates, delivers and captures value"*
>
> (Osterwalder & Pigneur, 2010, p.14)

> *"A business model defines how the enterprise creates and delivers value to customers, and then converts payments received to profits"*
>
> (Teece, 2010, p.173)

Most of the authors are not very obvious about what they mean with value, but other definitions seem to refer to customer value i.e. value for the customer (Osterwalder & Pigneur, 2010; Teece, 2010). The same technology or idea when taken to the market through two different business models will seem to produce two different economic outcomes (Chesbrough, 2010). Business models are essential because of the market economies features where there is consumer choice, diversity amongst consumers, transaction costs and producers and competition (Fielt, 2013). Business models have gathered significant attention from various disciplines, such as e-business, entrepreneurship, innovation, information systems management, strategy and financial side (Bouwman & Fielt, 2008; Morris et al., 2005; Teece, 2010; Zott & Amit, 2013). Identifying the compositional elements of a business model makes the business model concept more precise and makes it even appropriate for different purposes and contexts for example, business, strategy and innovation (Fielt, 2013).

2.3.1 Components of Business Model

Compositional elements are closely related to the business model definitions describing the made-off of a business model. The elements are also referred to as, for example, building blocks, components or functions (Osterwalder & Pigneur, 2010). Business model frameworks not only define the elements, they also define the relationships between them (Gordijn et al., 2005).

The most well-known and widely used framework is the Business Model Canvas (Osterwalder & Pigneur, 2010). The Business Model Canvas is presented as a landscape for depicting changes in the business models. In this framework, the elements are grouped into four categories: customer interface (segments, relationships and channels), product (value proposition), infrastructure management (activities, resources, and partners) and financial aspects (revenues and costs) (Fielt, 2013). The Four-Box Business Model and the Business Model Canvas have so many similarities. In latter framework, the elements included are: customer value proposition (Job-to-be-done, offering), profit formula (revenue model, cost structure, target unit and resource velocity), Key resources and key processes (behaviors and success metrics) (Johnson & Lafley, 2010). The main difference between the Business Model Canvas and the Four-Box Business Model is that the first has a customer pillar while the second does not have a separate customer box, but covers customer aspects to some extent in the value proposition box. The framework overview shows that there are significant similarities in terms of the elements that can be used to represent how an organization creates and captures customer value (Fielt, 2013).

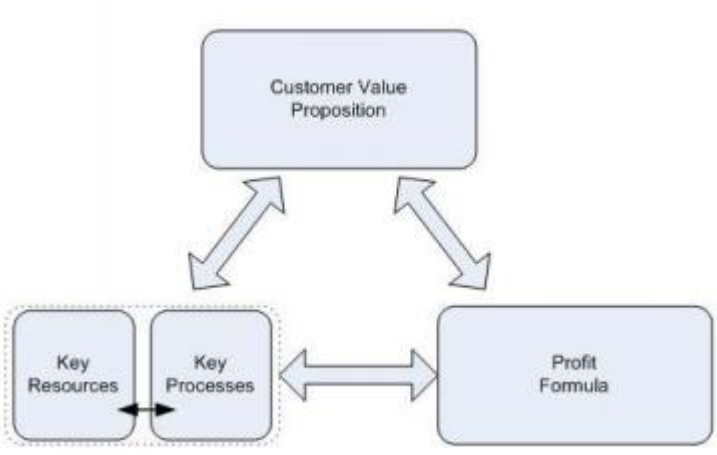

Figure: 2.2 *Four-Box Business Model Framework*

Source: Diagram adopted from Business Model Innovation: Review of The Concept, Importance, Classifications, and Elements (Alibage & Ahn, 2018, p.21)

The term “business” in the business model was developed in the context of for-profit businesses. Now it is applied to any type of organization, be it a for-profit, a non-profit, a governmental or any other organization. There are many frameworks of business models, a simple business model that comprises of three components which appear in almost every version are described (Kalman, 2014).

Table 2.5: *Generalized Business Model Components*

Business Model Component	**Description**	**Examples taken from Institutes of Higher Education**
Customer Value Proposition	The characteristics and needs of the organization’s customers, and the way these needs are met	The needs of full-time students are met differently at traditional universities than the needs of part-time students at open universities.
Infrastructure	The resources and processes of the organization	Physical resources are lecture halls and laboratories, human resources include faculty and administrative staff. Processes include student enrolment, quality assurance and fund raising.
Financial	The financial principles according to which the organization operates	Fixed and variable costs, sources of income (tuition, external funding, contributions), profit margins and pricing.

Source: Reproduced from A race to the bottom: MOOCs and higher education business models (Kalman, 2014, p.7)

2.3.1.1 Customer Value proposition

The main task is of how to create and capture value in the face of a changing business environment. Different frames emphasize different aspects of the same problem

i.e. value creation and proposition. Generating revenues and managing relationships depend deeply in creating value in the unsettled Digital Economy (Fielt, 2013).

The first and most important component is the customer value proposition which includes the characteristics of the organization's customers and their needs, and the way these need i.e. how the organization creates value for the customer (Kalman, 2014).

A comparison between the customer value propositions of traditional universities with that of open universities provides an inner insight. Traditional universities in Western countries typically offer their students a program that enables them to complete the bachelor's degree in three to four years in an environment that facilitates social activities, opportunities, societal involvement and part-time employment etc. In contrast, the value proposition at an open university is more in line with students who wish to combine full-time employment and higher education by a variety of other types of students who are not well served by the traditional institutions (Kalman, 2014).

2.3.1.2 Infrastructure

The second component of the business model is the organization's infrastructure. Infrastructure is divided into resources and processes. A university's resources include the building structure, lecture halls and classrooms, research laboratories, offices, faculty, administrators, IT infrastructure etc. Resources are not necessarily physical, for example, a university's reputation is one of its most important resources. Processes at a university could include student registration and enrolment, research funding, budget control, quality control, course approval, hiring and promotion, and hundreds of other processes (Kalman, 2014). The commodity Internet and programming assets create the infrastructure for MOOCs (Baker & Passmore, 2016).

2.3.1.3 Financial Analysis

The third component of the business model is the financial component which describes profit margins and revenues generated. This can include pricing, fixed and variable costs, income sources etc. (Kalman, 2014). Variable costs depend on an organizations product or a service delivery i.e. customers serve. For example, variable costs include components such as the cost of bandwidth and processing power consumption of MOOC participants. Other is fixed costs, which comprises of the initial costs required by the organization for installment of new business model or strategy. For example, in the case of MOOCs, the fixed costs include cost of time dedicated by academic and technical staff to develop and to maintain the course. VCM describes a situation where in the variable costs are minimal to almost zero, thus called variable costs minimization (VCM) because the difference between serving a small or a large number of customers is negligible (Belleflamme & Jacqmin, 2016).

Revenue streams for MOOCs evolve as organizations offer information about how MOOCs add value to fulfill investor's requirements and student's educational needs for financial returns (Baker & Passmore, 2016).

2.3.2 MOOCs Business Model

MOOCs, commonly advertised as free to students, there is no such thing that is completely free, actually they are subsidized heavily by universities and venture capitalists. The disruptive nature of MOOCs could threaten the very roots of the business model that directs most higher education institutions. MOOCs business model comprises of five possible value propositions with pricing strategies associated with these value propositions (Baker & Passmore, 2016).

2.3.2.1 Value Propositions for MOOCs

A business model starts with a value proposition that offer a supposition of benefits that will result from a good or service purchased. The following five value propositions provided by MOOCs are presented in tabular form for reader's facility.

Table 2.6: *Value Propositions for MOOCs*

Value Propositions for MOOCs	Description
Headhunting	MOOCs offer services to employers that provide information about skills of MOOC students. Both students and employers might have an incentive to pay for this service. For example, Coursera announced an employee-matching service, called Coursera Career Services in 2012.
Certification	A number of MOOCs providers offer certificates of completion for MOOC courses. In 2014, Penn universities offered academic credit for MOOC completion.
Premium Learning Services	Face-to-face courses might attract MOOC participants who want opportunities to supplement their MOOC experience with interaction with an instructor. MOOC participants might want matchmaking services that create networks among like-minded or geographically co-located MOOC participants.
External Services	MOOC developers could license MOOC technology to alter and brand MOOCs for their own good. Another possibility is the mining of information from MOOC operations for use in other markets. Branding rights could be a strong value proposition that MOOCs could offer.
MOOC data use for Marketing	A common thinking among many university MOOC providers and designers is the application of MOOCs to market higher education institutions.

Source: Adapted and produced in tabular form from Value and Pricing of MOOCs (Baker & Passmore, 2016, p.5)

2.3.2.2 Pricing Strategies for MOOCs

Following are the pricing strategies coupled with value propositions of MOOCs.

Table 2.7: *Pricing Strategies for MOOCs*

Pricing Strategies for MOOCs	**Description**
Cross-subsidy	This strategy follows reallocation of funds. For instance, funds earned through a university's revenue generating academic program or other services are primarily used to establish and operate a university MOOC.
Third-Party	Neither MOOC operators nor MOOC participants have any or all costs but a third party covers some or all costs. For example, AT&T provided subsidy to Georgia Institute to team-up with Udacity in 2013 to deliver an online master's degree in computer science.
Freemium	In this approach, one product is provided at no price to customer while the other product, one that complements the free product, is sold at a price. For example, MOOC enrollment is free but to receive premium services i.e. face-to-face classes, to contact with an instructor, the participant must pay.
Non-monetary	MOOC participation is without any monetary return expected. As, Red Cross might offer a MOOC for free that teaches principles of first aid. The Red Cross would not benefit directly but Red Cross would pay the costs of MOOC operation and recipient parties derive benefits, not the Red Cross.

Source: Adapted and produced in tabular form for user facility from Value and Pricing of MOOCs (Baker & Passmore, 2016, p.6-7)

2.4 MOOCs, HEC, Graduate skills and Employability

Nowadays college graduates face a dynamic and demanding job market; in which they encounter an evolving skill needs, reduced hiring, and increasing competition among workers. Higher education can be looked upon for development of knowledge, skills, and

expertise. Possession of these attributes can replace what today's college graduates might have with one that greets and utilizes them fully (Eisner, 2010). Rapid and drastic changes are creating higher demands for employability skills in the workforce nowadays in this era of economic and technological growth. Labor market is becoming more and more competitive and depends on quality of knowledge and skills as the globalization come across in all industries. The employers generally have high expectations with fresh engineering graduates to perform well in their organization as soon as they are hired. Engineering employability skills are therefore necessary worldwide to remain competitive in the global market (Md Yusoff et al., 2009).

Employers expect graduates to have the technical competences from their degrees, but also require graduates to demonstrate a range of broader skills and attributes that include team-working, communication, leadership, creative thinking, critical thinking, problem solving and often managerial abilities or potential. Above all, the literature has highlighted the importance of internships, placements and work-based learning opportunities as an effective way of providing university students with relevant employment skills. Knowledge and awareness of employer culture is also required. Apart from numerous initiatives among employers and higher education to promote employability skills, there are still barriers and issues particularly in terms of differences in mindset, expectations and priorities. There lies some frustration from employers about courses not meeting their needs. However, there's no clear evidence why higher education and employers cannot reach a consensus on educational measures that promote employability (Lowden et al., 2011).

Personal growth and enrichment, relevance to job, and career change were the top reasons for working professionals to enroll in MOOCs (Liu et al., 2020). With the proliferation of MOOCs since 2012, there emerges some interest among companies to examine whether MOOCs could help reduce the gap in skills of their newly recruited university graduate employees. Further, they have attracted the attention of educators and have raised hopes of change in higher education. MOOCs, through their accessible and flexible foundation have the potential to bridge the graduate skills gap as they offer on demand affordable education (Gayle Christensen & Alcorn, 2013). Calonge and Shah (2016) have found that MOOCs have a positive impact on graduates' and employees skills development. MOOCs are

becoming clear worldwide stakeholders in enhancing opportunities, both for new seekers of employment, as well as corporations seeking skilled personnel's (Calonge & Shah, 2020).

HEC is revamping education to ensure that students get a useful, meaningful, and practical education, which increases the likelihood of their success. The objective of revamping is to provide Competence-Based Education (CBE), which comprises the following four measurable aspects as stated by (Higher Education Commission, 2020, p.2-3):

- Knowledge, based on facts and principles of a particular field.
- Skills, which is the ability to perform physical or mental activities in a particular profession; as well as to think critically and creatively.
- Behavioral attributes, which include characteristics like adaptability, curiosity, honesty and punctuality.
- Interpersonal qualities that include self-confidence, empathy, leadership, and collaboration.

The revamping aims at preparing students to apply the acquired knowledge and skills to life's challenges, rather than just acquiring theoretical knowledge. It emphasizes exploration, curiosity, discovery, and creativity amongst students (Higher Education Commission, 2020, p.2-3).

HEC worked tirelessly in the Covid-19 pandemic to minimize academic disruption, develop and guide universities to acquire online readiness, provide supplementary resources of Rs.1.20 billion to institutions, deploy live dashboard to monitor quality of online delivery, build free online academic content and resources, motivate students to continue learning and usage of platforms such as virtual think tanks to carve out imaginative solutions. Efforts are being put up by HEC to resolve connectivity issues faced by students (Higher Education Commission, 2020, p.4).

2.5 Relation between Variables

Using Four-Box business model, the following are the requirements for the customer value proposition as identified by (Alibage & Ahn, 2018):

- Target Costumer: Specify who the customers of the company are; what their wants, needs, desires, are etc. The customers included are Managerial Employees and Students.
- Offering: What is fulfilling the need? It involves quality of the product i.e. skill required by the customers to enhance their value.
- Job to be done: To solve an important problem for the target customer. It makes sure the availability of the required product by the firm.

Christensen mentioned multiple business models namely solution shops, processes and user networks as presented in Table 2.4 of section 2.2.2.2. The research utilizes Christensen's value-addition business model, the basic purpose of which is knowledge creation and proliferation for convenience to customers. In case of university learning process, those customers are the ones that are directly benefit from them. Students are identified as the internal customers and employers are the external customers of a university learning process (Antonio & Pereira, 2003). MOOCs platforms formulate such strategies that attract students and prepare them with knowledge based education to boost career and to be able to compete in the working environment.

A research conducted in KSA found the impact of MOOCs on higher education by improving education outcomes, developing student's skills and effective communication (Alhazzani, 2020). In this research, student's skill development is retained as a component of measuring value proposition offered by MOOCs to their internal customers of university learning. Another survey conducted in USA on 441 learners found that MOOCs support employability, most of the learners opt for the platform to enhance their chances of getting employed (Dillahunt et al., 2016). This research utilizes the relation to find MOOCs impact in Pakistan's industrial sector from the external customers of the university learning process. Taking the reference from section 2.1.1.2, career enhancement and professionalism are the key factors that indulge students in MOOCs to enhance their technical and soft

skills. An innovative organization hunt for individuality and uniqueness among its employees (Chang & Lin, 2007). Taking uniqueness in context of MOOCs, innovative organizations prefer MOOCs certifications during recruitment process.

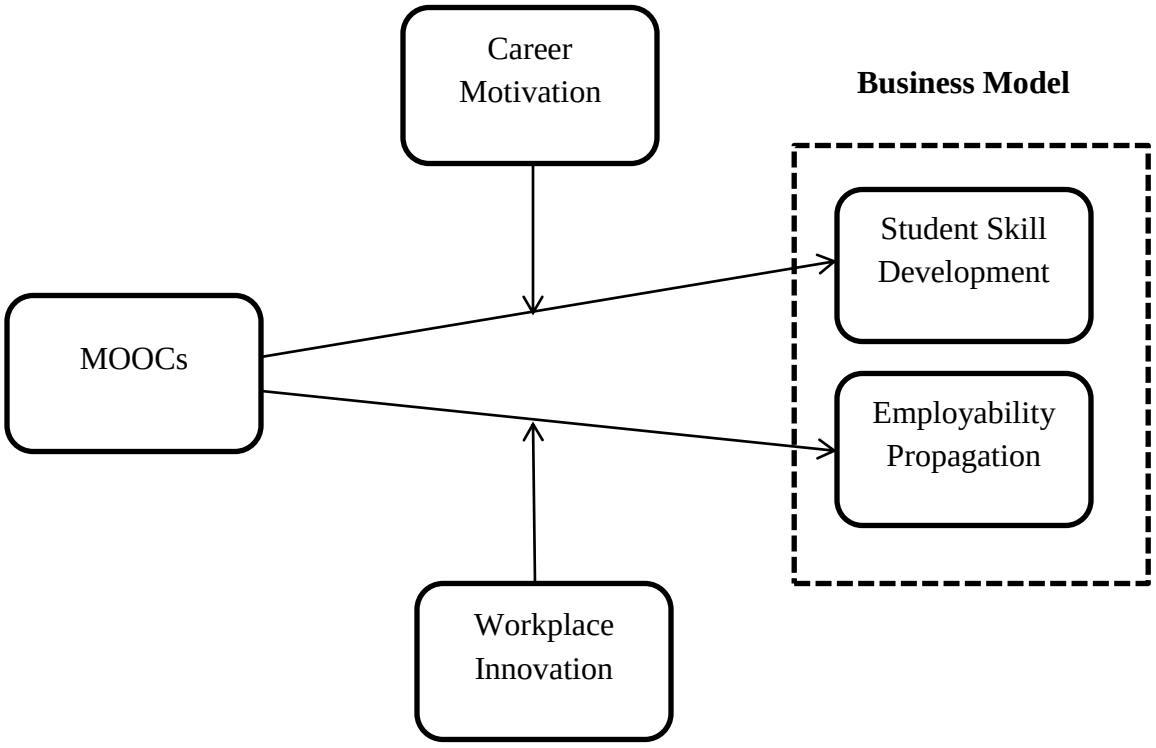

Figure: 2.3 *Theoretical Framework*

2.5.1 Relationship between MOOCs, Career Motivation and Skill Development

Many researchers have studied student's motivation in enrollment to MOOCs programs. The varied motivations to enroll in MOOCs include interest in knowledge, curiosity, entertainment, recognition, and professional relevance (Chen et al., 2019). Apart

from curiosity and gaining basic knowledge, majority of enrollments in MOOCs counter for career building, career planning, career change, professional development, relevant to job, gaining new skills, gaining skills related to job, relevance to current role and relevance to future career (Hew & Cheung, 2014; Loizzo et al., 2017; Milligan & Littlejohn, 2017; Ren´ et al., 2015). Some of the motivational characteristics of MOOC learners are explained (Barak et al., 2016).

- Problem-solvers: They are individuals motivated by the desire to solve real scientific and engineering problems that they have encountered at the work place.
- Networkers: Their motivation is to be a part of community of people with similar interests, desires and expertise in order to collaborate with them to share ideas and gain valued suggestions and knowledge.
- Benefactors: They are the well-wishers of the society and the country whose motivation is to bring advancement through knowledge gain.
- Innovation-seekers: These are the ones who always looked forward for learning something new, to innovate and create novel things and to be informed about the latest trends prevailing in the market regarding technology and innovation.
- Complementary-learners: Mostly students are motivated by the desire to deepen their knowledge in curriculum and build up new skills.

Professional career development by learning new skills lies among the main reasons for student's devotion towards MOOCs (G Christensen et al., 2013). MOOCs made some contribution to the capabilities of students to write clearly, analyze quantitative problems and think critically. Among professional development the main focus lies on learning technical skills, speaking skills may not lie among the specialty of MOOCs but they do contribute in bringing up writing skills. Future preparation is the career motivation that includes impressing the potential employers to secure positions in the well renowned organizations (Zheng et al., 2015).

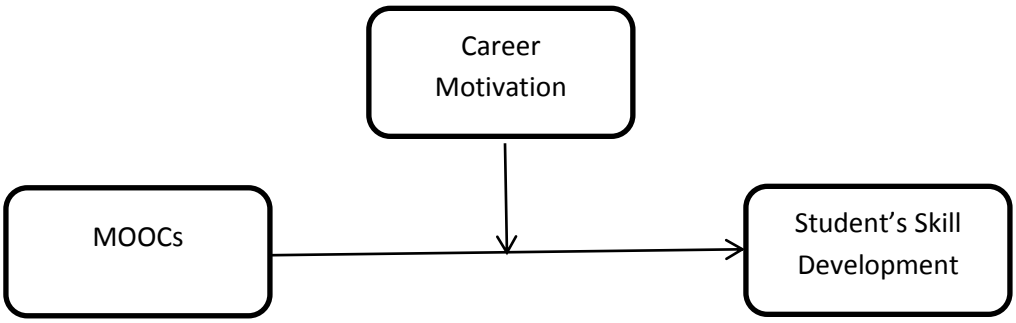

Figure: 2.4 *Model 1 (Student's Value Proposition)*

H1= MOOCs have a positive significant relationship with Student's Skill Development.

H2= Career Motivation will positively and significantly strengthen the relationship of MOOCs and Student's Skill Development.

2.5.2 Relationship between MOOCs, Work-Place Innovation and Employability Propagation

Innovativeness is a cultural trait that can be characterized by the flexibility placements in the model of organization, with a focus on creativity, dynamic behavior, entrepreneurship and adaptability. An innovative organization is open to uniqueness among its employees and supports all innovative traits. The company that emphasizes innovativeness supports a fully creative and dynamic environment (Chang & Lin, 2007). For an organization to improve its innovation capacity should encourage higher level of creativeness. Creativeness help firms to solve their problems related to knowledge creation and absorptive capacity. Creativity involves generation of novel ideas, products and more. Research suggested for an organization to become innovative should emphasize on variables such as quality of ideas, technology strategies, acquisition and manipulation (Škerlavaj et al., 2010).

Many learners are using MOOCs for employment can be categorized into following by (Dillahunt et al., 2016):

- Those learners who are looking for a refresher in their current job or area of work;
- Learners looking to be promoted and get benefit in their current field or job;
- Learners that are looking for new positions in their current fields or jobs to have a career plan;
- And those transitioning to new fields.

Many learners use MOOCs for employment for the following benefits as indicated by (Dillahunt et al., 2016):

- Easy to access resources;
- Improve their expertise and skills in their current lines of work;
- Enhance their credibility;
- To better understand the processes and operations of their existing workplace.

MOOCs provide some support for social capital, career identity and personal adaptability. MOOCs medium of knowledge emphasis its learners to learn new traits in their specified domains, built their critical and analytical thinking. The workforce in the 21st century demands graduates to be equipped with a number of skills and attributes along with high academic qualifications as represented by the subject and degree class. The employer's demand indicates that only occupation-specific skills are not just sufficient for graduates, rather they prefer to hire graduates who can manage change and bring creativity. They preferred flexible and adaptable workers who are quick to learn and fit in changing circumstances. Now-a-days graduates' attributes are labeled as more important than the graduates 'degree subjects. Some important attributes of employability skills include communication skills, problem-solving and decision-making skills and collaborative or teamwork skills. In addition, graduates are also expected to have a number of personal attributes which includes: self-confidence, self-awareness, emotional intelligence, flexibility and adaptability, creativity and implementation, willingness to learn, positive response, stress tolerance, lifelong learning, independence and professional behavior (Suarta et al., 2017).

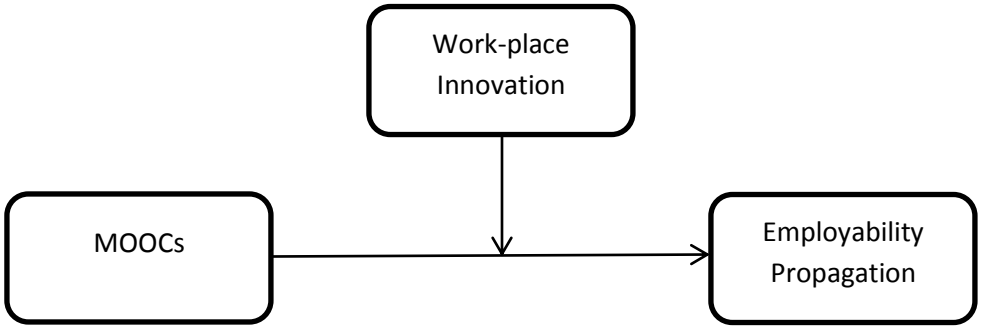

Figure: 2.5 *Model 2 (Employer's Value Proposition)*

H3= MOOCs have a positive significant relationship with Employability Propagation.

H4= Work-place Innovation will positively and significantly strengthen the relationship of MOOCs and Employability Propagation.

CHAPTER 3

METHODOLOGY

In previous chapter, literature review associated with MOOCs, business model and theory of disruptive innovation has been studied. This chapter is concerned with derivation of current patterns in the study with the help of methods, design and approach used for data collection and following data analysis. The selected population and sample size of the study is also mentioned in this chapter.

3.1 Research Philosophy

The term research philosophy refers to a system of views and assumptions developing knowledge in a particular field (Saunders et al., 2015). For the study, the approach of "positivism" is utilized. Positivism constitutes scientific methods, observable and measurable facts, law-like generalizations, underlying explanation and prediction as contribution (Saunders et al., 2015). A methodology that needs to be adopted in case of positivism philosophy should be highly structured involving hypotheses testing and statistical tools i.e. a quantitative method.

3.2 Research Approach

If research starts with a theory that often developed from reading the academic literature, and research strategy is designed to test the theory then it is called a deductive approach (Saunders et al., 2015). Deductive reasoning occurs when the conclusion is derived logically from a set of premises, the conclusion needs to be true when all the

premises are true (Ketokivi & Mantere, 2010). The study is based on deductive approach as it utilized Theory of Disruptive Innovation (Bower & Christensen, 1995).

3.3 Research Duration

It's a cross-sectional descriptive study. The practicality of things is determined in descriptive research. This study decision was made because of the fact that this study involves observations as a mean of collecting data to test hypotheses. The duration of the study was six months from 15th March to 15th September, 2020.

3.4 Data Collection

Data is collected by the following techniques:

3.4.1 Research Design

The research design explains how data will be collected and among which population. A descriptive and quantitative approach will be used for answering research questions. Data collection tool i.e. questionnaire will be used for collecting primary data for the research questions.

3.4.2 Research Area

The research was conducted in firms with IT/Engineering departments and Engineering universities of Federal Capital Territory and Punjab Province of Pakistan.

3.4.3 Research Population

The questionnaire was distributed to employers of IT/Engineering departments of different companies involved in the hiring process of graduates, and students of engineering universities enrolled in any engineering discipline. A descriptive note was written on the

front of the questionnaire that describes research purpose, its aims and objectives and significance. Written consent was also there for confidentially of the respondents.

3.4.4 Sample Size

Sample size was measured with the help of Power and Precision v4 tool. The correlation r among reference research found to be 0.23 (1-tailed) (Chang & Lin, 2007). At alpha=0.05, with 95% power, the number of cases calculated are N= 200 (Appendix B).

3.4.5 Sampling Technique

Convenience and judgmental sampling technique was used for collecting data from managers and students. Questionnaire was developed on the Microsoft forms and link was shared through e-mail and social media apps to respective population with a deadline of one and a half month. Reminders were sent thrice for collecting the calculated sample size.

3.4.6 Inclusion and Exclusion Criteria

3.4.6.1 Inclusion Criteria

- Employers are the Managers/ Team Leads, who must be involved in hiring or formulating job design for employee recruitment.
- Students must have done internship in any industry to have an idea of work-place skills.
- Employers and Students who are familiar with MOOCs.

3.4.6.2 Exclusion Criteria

- Managers who were not part of the employee recruitment.

- Students who did not have done any internship or have any experience of work-place.
- Employers and Students who are not familiar with MOOCs.

3.4.7 Variables of the Study

Following are the variables included in the research:

Table 3.1: *Independent, Dependent and Moderating Variables*

Independent Variable	Dependent Variable	Moderating Variable
MOOCs	Employability Propagation	Work-place Innovation
	Students Skill Development	Career Motivation

Independent variable is MOOCs while dependent variables are derived from business model component i.e. customer value proposition, which will measure MOOCs impact on university business model. Work-place Innovation act as a moderating variable among MOOCs and Employability propagation, whose basic purpose is to strengthen the relationship between independent and dependent variable. Career Motivation is a moderating variable for MOOCs and Students Skills Development; it has a direct effect on both the variables of Model 1. It also describes the strength of association among the predictor and outcome variable.

3.4.8 Data Collection Tool

The instrument used for collecting data was a structured questionnaire comprised of close ended questions. The survey questionnaire consists of series of questions based on respective variables, adapted from surveys for gathering information from respondents.

Following are the research instruments used for this study:

- Science Motivation Questionnaire II (Glynn et al., 2011). This questionnaire was used for having Career Motivation Questions (CMQ). Career motivation act as a moderator among MOOCs and Students skill development. This questionnaire has five variables to measure student's motivation in science, namely intrinsic motivation, career motivation, self-determination, self-efficacy and grade motivation. The variable deal with the study was career motivation. It has 5 items with factor loadings 0.84, 0.84, 0.82, 0.76 and 0.57 respectively. The items were modified according to the research topic. It has more influence in measuring student's motivation towards career than any other motivational survey.
- Exploring Organizational Culture Questionnaire (Chang & Lin, 2007). Work-place Innovation Questions (WIQ) was derived from this survey questionnaire. It has 4 factors namely cooperativeness, innovativeness, consistency and effectiveness. Innovativeness described the work-place culture and its impact on hiring process was comprised of 6 items with alpha value of 0.892. Items were adopted with a slight change in wording to fit the research model. Work-place Innovation worked as a moderator among MOOCs and Employability Propagation.
- MOOC Analysis Survey (Venkatesh, 2014). The independent variable MOOCs Questions (MQ) was derived from this survey. The questionnaire has 11 questions among which 6 questions were adapted. The rest of the questions were removed because of difficulty in understanding among respondent and outdated content with advancement in the phenomena.
- Student Engagement in Online Learning Survey (Robinson et al., 2008). Model 1 dependent variable namely Students Skill Development Questions (SSDQ) was adapted from this survey. The survey measures student's engagement in online learning with the help of four factors namely level of academic challenge, student-faculty interaction, collaborative and active learning and enriching educational experience. The academic challenge factor measures mental activities and skills development. Total 7 items were modified according to advancement in online learning to gauge the impact of MOOCs in development of skills among students.

- Graduate Recruitment Survey (Carless, 2007). Model 2 dependent variable Employability Propagation Questions (EPQ) was obtained from graduate recruitment survey. The survey was done for assessing the recruiting strengths. The survey was conducted in Australia with total of 13 strengths, 6 matches with the research content. Upon testing validity further 1 item was dropped from the variable. So 5 items used to measure the current phenomena of hiring going on in the industry.

3.4.8.1 Instrument Design

The adapted questionnaire was separated into two parts.

- Section A: This portion of the questionnaire includes Model 1 items. It has total of 23 questions with 5 demographics questions (Gender, Age, Qualification, Institution and Engineering Branch) and 18 variables questions (MQ, CMQ, SSDQ). Engineering students were directed to fill this section (Appendix C).
- Section B: This part of questionnaire was distributed to Engineering Managers and has items of Model 2. This portion has total of 23 items among which 5 are demographic questions (Gender, Age. Qualification, Nature of Company and Company Background) and the remaining 18 measure the relationship between the variables (MQ, WIQ, EPQ) (Appendix C).

3.5 Data Analysis

After three reminders, the total responses obtained in a month were 272 for employers and 304 for students. Based on exclusion criteria, those who were not aware of MOOCs were eliminated from both managers and students sections. Among 272 manager responses, 60 were found unaware of the MOOC learning and their impact on employee's performance. Upon excluding those, 212 responses was left, which will be further analyzed for finding the results.

304 responses were collected from engineering students. Among them, 48 students were not familiar with MOOCs, 12 students were not having any internship or work experience and 11 were neither familiar with MOOCs nor have done internship. Eliminating these responses 233 responses were left which will be used for finding the impact of MOOCs on student's value proposition. Power analysis assumes perfect distributions, so sample size can be increased by 10-20% to compensate for skewness and outliers in a continuous variable (Giil, 2018).

3.5.1 Data Analysis Plan

- IBM SPSS version 26 will be used for checking the validity and reliability of the questionnaire and for carrying out results and obtain diagrams.
- In the first step, input data will be explored for any missing values and outliers, and then calculate demographics descriptions.
- Normality will be checked for each variable namely MOOCs, Employability propagation, Students Skill Development, Career Motivation and Workplace Innovation.
- Correlation and Regression tests will analyze the relation among variables and influence of interaction term on predictor and outcome variables respectively.

3.5.2 Measurement of Questionnaire

The questionnaire was then tested for validity and reliability.

A. Reliability

Reliability indicates the consistency of a measure in the dataset. For measuring the instrument reliability, Cronbach's Alpha of every variable is calculated. It tells how strongly correlated are the items of a variable. The acceptable Cronbach's Alpha value is 0.7-0.9 (Field, 2009).

Table 3.2: *Measurement of Reliability*

Variables	Cronbach's Alpha	Number of Items
MOOCs (MQS)	.744	6
MOOCs (MQE)	.741	6
Student's Skill Development (SSD)	.801	7
Employability Propagation (EP)	.814	6
Career Motivation (CM)	.726	5
Work-place Innovation (WI)	.768	6

The items of MOOCs have a Cronbach's Alpha value of 0.744 and 0.741 among its 6 items. There were 7 items of Students Skill Development with an alpha value of 0.801 which shows that the items used for measuring the variable are highly reliable. The alpha value for Employability was calculated to be 0.814 showing highly correlated items. Career Motivation has 5 items with 0.726 alpha values and Work-place Innovation has 6 items with an Alpha value of 0.768 showing good reliability among items of the respective variable.

B. Validity

Validity defines whether the instrument measures the variables accurately for what they are intended to measure. Exploratory Factor Analysis (EFA) was done for finding the validity of the questionnaire. KMO test was performed for assessing the sample size adequacy and Bartlett's test signifies the strength of relationship between the variables i.e. variables are related to one another for performing a significant EFA. If the KMO values lies above 0.5, the sample size is considered appropriate. 0.5-0.7 KMO value is considered moderate, 0.7-0.8 good, and above 0.9 shows that the sample size is excellent. Bartlett test provide a chi-square value that should be significant i.e. the value is not more than 0.05 (Chan & Idris, 2017).

Table 3.3: *Results of KMO and Bartlett's Test*

Variable	Kaiser-Meyer-Olkin Measure of Sampling Adequacy	Bartlett's Test of Sphericity		
		Chi-Square	Df	Sig.
MOOCs (MQS)	0.688	242.69	15	0.00
MOOCs (MQE)	0.698	269.37	15	0.00
Skill Development	0.675	378.34	21	0.00
Employability Propagation	0.690	318.42	10	0.00
Career Motivation	0.745	176.52	10	0.00
Workplace Innovation	0.752	198.48	15	0.00

The KMO value for independent variable MOOCs and dependent variables Students Skill Development and Employability propagation are close to 0.7 while the moderator values lie above 0.7 which means that the sample size is good.

Principle Component Analysis (PCA) is the extraction technique most commonly used which considered all the available variances. Researchers need to start with this technique and then follow up with Principle Axis Factoring (PAF). The factor loadings from PCA and PAF are almost the same, importance is of rotation performed regardless of the extraction technique or factoring method (Tabachnick & Fidell, 2007; Yong & Pearce, 2013).

Rotation clearly differentiate factor loadings which facilitate interpretation, the type of rotation applied is orthogonal rotation. Orthogonal rotation assumes that the variables are not correlated. Factor loading of each item was calculated and it was greater than 0.5. There found a problem in EPQ2 factor loading as shown in table below.

Table 3.4: *Rotated Component Matrix[a] of Employability Propagation*

	Component	
	1	2
EPQ1	.594	.195
EPQ2	-.015	.874
EPQ3	.765	-.146
EPQ4	.619	.365
EPQ5	.704	.362
EPQ6	.844	.206

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 3 iterations.

Item EPQ2 was then removed to obtain the corrected factor loadings.

Table 3.5: *Corrected Loading of Employability Propagation*

Component Matrix[a]	
	Component
	1
EPQ1	.671
EPQ3	.811
EPQ4	.644
EPQ5	.756
EPQ6	.751

Extraction Method: Principal Component Analysis.

a. 1 component extracted.

The factor loading for each item is given in Appendix C. Factor loading from above table shows a strong correlation among the items of particular variables. Communalities are the variable's variances that are extracted from the factors given in table 3.6.

Table 3.6: *Communalities of Variables*

Communalities

	Initial	**Extraction**
MOOCs (MQS)	1.000	.661
Student's Skill Development	1.000	.753
Career Motivation	1.000	.717
MOOCs (MQE)	1.000	.672
Employability Propagation	1.000	.770
Workplace Innovation	1.000	.671

Extraction Method: Principal Component Analysis

In PCA, communalities are the sum of the squared factor loadings. Average Variance Extracted (AVE) was also calculated for the variables that are above the value of 0.5 thresholds which are acceptable. The factor loadings and AVE values proves the convergent validity which states how closely indicators are related to their respective variables (Chan & Idris, 2017).

Discriminant validity states how much variables are different and uncorrelated from each other. The square root of average should be greater than the inter-construct correlations. One of the methods is to examine the factor correlation matrix. Correlation between factors should not exceed 0.7 i.e. 49% shared variance (Gaskin, 2016). The observed values in factor correlation matrix were less than the threshold of 0.7. The factors load only on their specific variable and no cross loadings observed. This proves evidence about the discriminant validity as well.

Face validity is quite simple which states that the variables which are similar in nature load together on the same factor (Gaskin, 2016). One can generally look into the factors and if they do make sense and their nature matches with the other variables of the same factor, then it confirms that the questionnaire measures the variables for which it is designed.

All the above validities namely, convergent, divergent and face validity proves the construct validity. Hence the questionnaire used for the research is a valid tool.

3.6 Ethical Consideration

- Consent of participants (where required) is obtained before sending them survey to answer the mentioned questions.
- All queries of respondents were resolved throughout the period of data collection, responded to their emails, and will share results with those who demanded.
- Professional decency was maintained with assurance of societal norms.

CHAPTER 4

RESULTS

In the previous chapter, the data was collected from Engineering/IT managers and Engineering students from various organizations and institutions of Federal Capital territory and Punjab Province. This data is analyzed by eliminating the false and forged responses. SPSS version 26 is then used for obtaining the results for the hypotheses.

4.1 Model 1 (Student's Value Proposition):

This model was designed for analyzing the impact of MOOCs on Student's Skill Development. Career motivation acts as a moderator among the independent and dependent variables.

4.1.1 Exploring Data

In the first step, data is explored for any missing values, outliers and for finding normality.

4.1.1.1 Missing Values

Frequency distribution is checked for finding missing values in the data. Total valid entries come out to be 233 and Missing values 0. This provides evidence that there are no missing values in the data set.

4.1.1.2 Outliers

Normality test is executed to check how much data is spread out and if there are any outliers present in the data. Outliers are very different scores than the rest as they bias the mean and increase the standard deviation. There are possible two-ways to check outliers i.e. draw boxplots or find z-scores (Field, 2009). Each variable is explored; boxplot shows the exact location for the outliers. In SSDQ, case 31, 136 and 174 have some outliers; in MQS a case holds double entry. Upon finding all above, the data will further be explored for normality after descriptive analysis.

4.1.2 Descriptive Analysis

Descriptive test is performed first on the data, mean and standard deviation of demographics and variable items is calculated. Frequency of occurrence and percentage is also analyzed.

4.1.2.1 Descriptive Statistics

Below are the values for the demographics, dependent, independent and moderating variables descriptive statistics, mean calculates the average value of data occurrence, median calculates the mid-value and mode is repetition of data i.e. the highest value, standard deviation shows model fit i.e. how much the data deviates from the mean value.

Table 4.1:*M1 Descriptive Statistics*

	N	Minimum	Maximum	Mean	Std. Deviation
Gender	233	1	2	1.45	.498
Age	233	1	3	2.16	.564
Qualification	233	2	4	2.61	.538
Institution	233	1	4	2.15	.998
Engineering Branch	233	1	10	4.55	2.684
MQS	233	2.67	4.17	3.5544	.37702
CMQ	233	2.40	4.40	3.5227	.44937
SSDQ	233	2.57	4.43	3.5451	.45147
Valid N (listwise)	233				

The mean shows observed age of respondent lies in between 20-40 years. Most respondents are enrolled in BS and MS degree programs in different institutions with specific engineering domains. The main variables mean and descriptive statistics are also mentioned in the above table.

A. Gender

Frequency statistics of gender of the students are given in the table below:

Table 4.2: *M1 Frequency Table of Gender*

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	129	55.4	55.4	55.4
	Female	104	44.6	44.6	100.0
	Total	233	100.0	100.0	

Among 233 respondents, more than half i.e. 129 (55.4 %) are male students and 104 (44.6%) are female students.

B. Age

Frequency statistics of age of the students are given in the table below:

Table 4.3: *M1 Frequency Table of Age*

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	less than 20	21	9.0	9.0	9.0
	20-29	153	65.7	65.7	74.7
	30-39	59	25.3	25.3	100.0
	Total	233	100.0	100.0	

In the research a large number of students found to be in between age 20-29 years with frequency of 153 (65.7 %). Rest 80 (34.3%) is either below 20 or more than 30 years of age. No student is observed above 40 years of age in the data set.

C. Degree Enrolled

Statistics show that students belong to different degree programs responded to the questionnaire. The table below shows their frequency:

Table 4.4: *M1Frequency Table of Degree Enrolled*

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	BS	96	41.2	41.2	41.2
	MS	131	56.2	56.2	97.4
	PhD	6	2.6	2.6	100.0
	Total	233	100.0	100.0	

Demographics show that highest numbers of respondents are master's level students with total of 131 (56.2%) students in the data set. BS students constitute the second majority of 96 (41.2 %). Only 6 (2.6%) belongs to PhD program.

D. Institution

Frequency statistics finds that students were enrolled in different types of institutions as shown below:

Table 4.5: *M1 Frequency Table of Institution*

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Public	88	37.8	37.8	37.8
	Semi-Public	36	15.5	15.5	53.2
	Local Private	96	41.2	41.2	94.4
	Local Foreign Private	13	5.6	5.6	100.0
	Total	233	100.0	100.0	

The table shows the institution of the students they are currently enrolled. 96 (41.2%) of students are from private institutions that respond to the survey. 88 (37.8%) belong to public sector institutions while the rest 49 (21.1%) are from semi-public and local foreign private organizations.

E. Branch of Engineering

Responded students belong to several different branches of engineering as given below:

Table 4.6: *M1 Frequency Table of Engineering Branch*

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Electrical	43	18.5	18.5	18.5
	Mechanical	25	10.7	10.7	29.2
	Civil	9	3.9	3.9	33.0
	Software	43	18.5	18.5	51.5
	Computer	36	15.5	15.5	67.0
	Electronics	21	9.0	9.0	76.0
	Telecom	27	11.6	11.6	87.6
	Mechatronics	8	3.4	3.4	91.0
	Other	21	9.0	9.0	100.0
	Total	233	100.0	100.0	

A large majority of students i.e. 43 (18.5%) are from Electrical and Software background. 25 (10.7%) from Mechanical, 9 (3.9%) from Civil, 36 (15.5%) from Computer, rest 77 (33%) are from Electronics, Telecom, Mechatronics and other background.

4.1.3 Inferential Analysis

After descriptive analysis, inferential analysis is performed to find correlation and regression among the variables. The normality tests are performed on variables to find that the data is normally distributed.

4.1.3.1 Normality Test

Normality of variables is necessary to observe before testing the variables relation. The above found outliers are transformed to obtain normal statistics. Normality statistics of the study are shown in the table. It contains the mean and the standard deviation of the study variables. The mean is the average value i.e. average response from the respondents shown in the table, while standard deviation is the difference form the mean value. The table shows that students are slightly satisfied with their skills development through MOOCs. Career motivation is also high among students.

Table 4.7: *M1 Normality Statistics*

	N	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
MQS	233	3.5544	.37702	-.463	.159	-.006	.318
CMQ	233	3.5227	.44937	-.535	.159	.254	.318
SSDQ	233	3.5451	.45147	-.108	.159	-.547	.318
Valid N (listwise)	233						

The last two columns of the table show the value of skewness and kurtosis for the data set. According to Andy fields, the value of z-score should not be greater than 1.96 (positively and negatively) for data less than 200, and for data greater than 200, the z-score should be less than 2.58 (Field, 2009). The z-score is obtained by dividing the statistical value with the standard error. The obtained z-scores from the above table for different variables of the model are 0.02, 0.79 and 1.72. All the scores lies within range, hence the data is normally distributed. We can further analyzed normality by drawing histograms, normal Q-Q plots and boxplots (also known as box whisker plots).

Histograms are a good approach to spot the problems in the data. The histogram bar shows how many times a certain value occurred in a data set (Field, 2009). Figure shows the histogram for Students Skill Development.

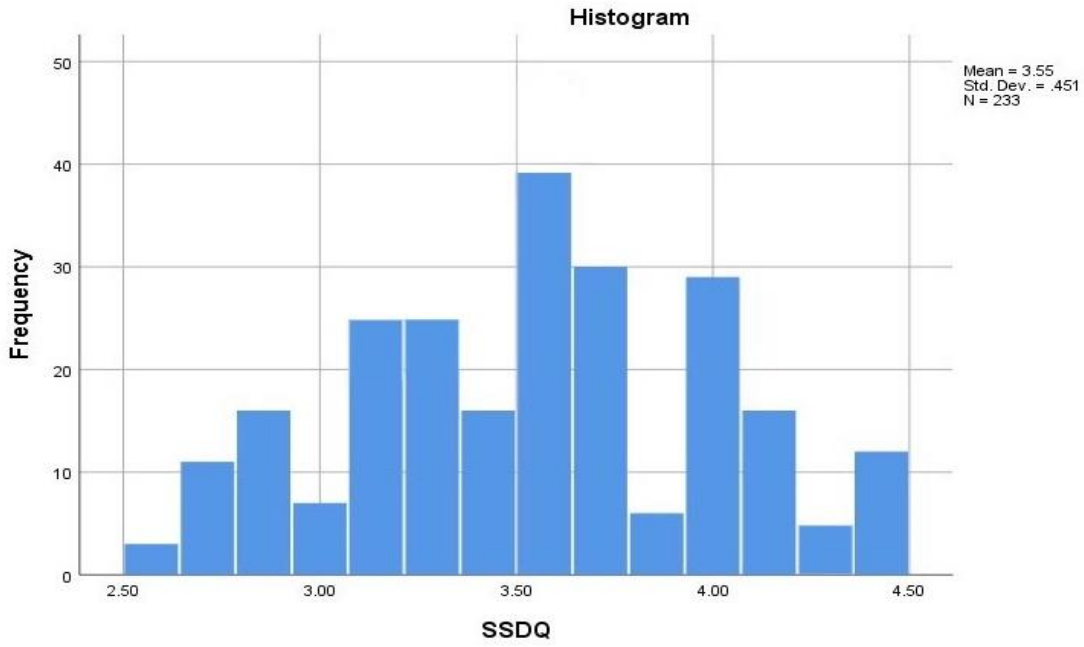

Figure 4.1 *Histogram of Student's Skill Development*

The normal Q–Q chart plots the values observed in the data set on expected values. The expected values are a straight diagonal line while the observed values are plotted as points on the straight line. If the data is normally distributed, then the observed values fall exactly on the straight line in the graph. Any deviation in these dots points a deviation in normality (Field, 2009). The figure shows that the data is near or on the line, hence normally distributed.

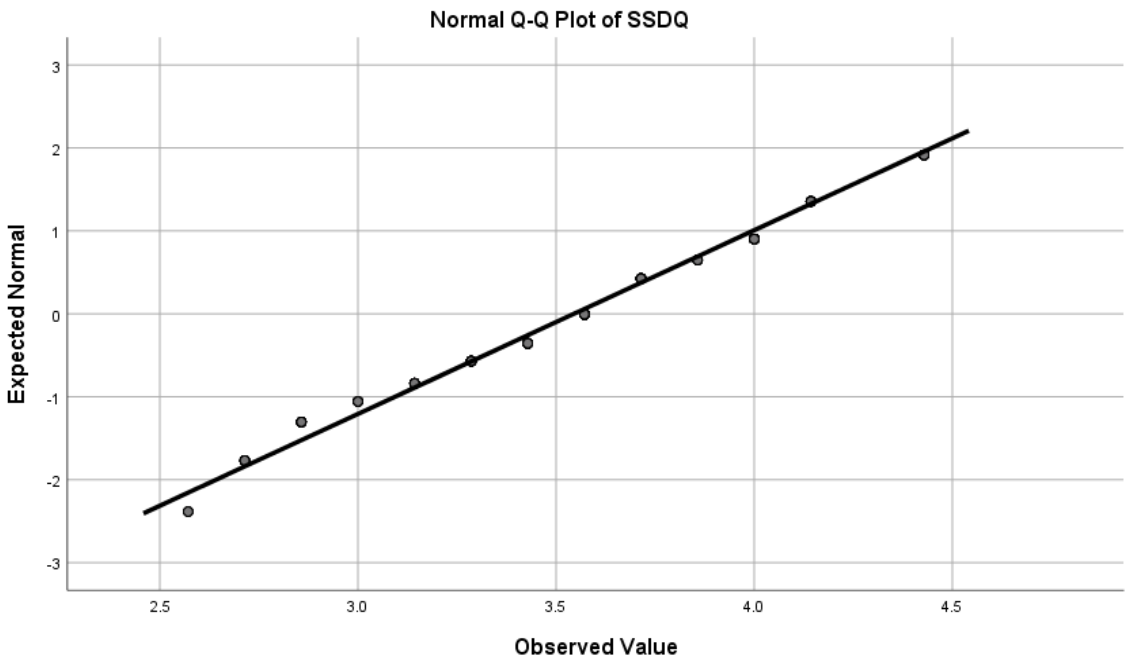

Figure 4.2 *Normal Q-Q plot of Student's Skill Development*

Boxplots or box-whisker diagrams show the distribution of the data. Like histograms, boxplots also tell us whether the distribution of data is symmetrical or skewed. The center line is the median value, above and below is the upper and lower quartiles respectively that show the equal distribution of observations among the data (Field, 2009). Boxplots are used to show the outliers with steric and the number of the case. If the whiskers or quartiles are not equal than the data is asymmetrical, the figure below shows that the data is equally distributed around its mean.

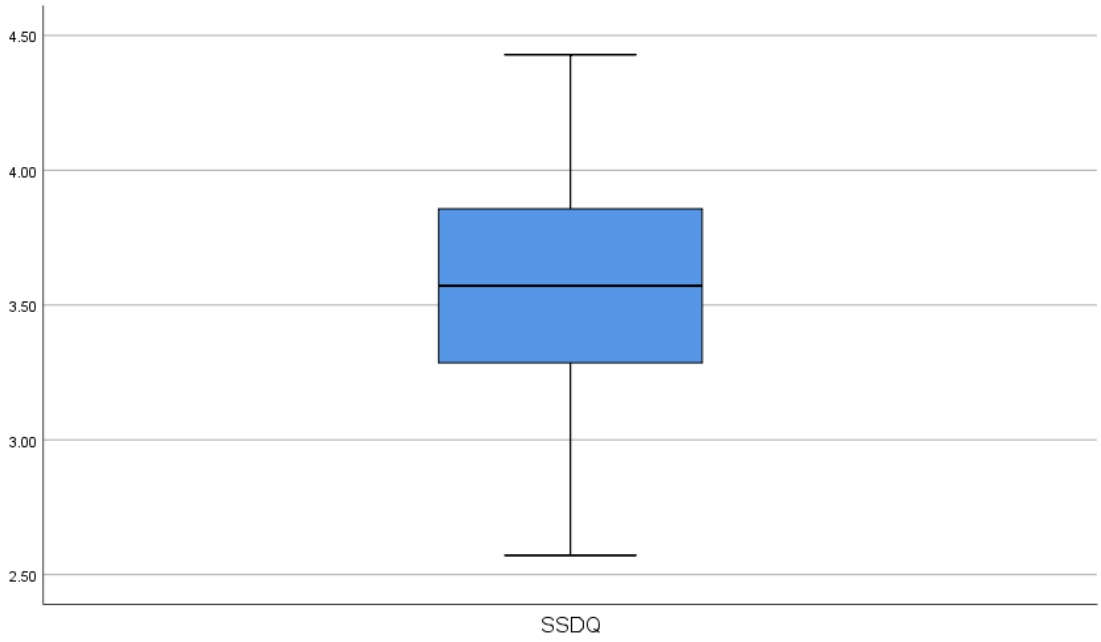

Figure 4.3 *Box plot of Student's Skill Development*

In normality test, the histograms, normal Q-Q plots and boxplots of all independent, dependent and moderator values are observed. Removal of outliers results in normal distribution of the data set. The normality plots of the remaining two variables are attached in Appendix D.

4.1.3.2 Correlation

A correlation describes the measure of association between the variables. A bivariate correlation is used to check the relationship between two variables. The correlation coefficient values ranges from +1 to -1. A value of +1 indicates that the variables are perfectly positively correlated i.e. increase in one variable will result a proportionate increase in the other variable while a value of -1 indicates a perfect negative correlation i.e. if one variable increases, the other decreases (Field, 2009). A value of zero shows that no correlation exists between the variables. If the correlation coefficient value lies between values 0 to 0.2, there is a weak correlation or small effect among the variables. 0.3-0.4 shows a moderate correlation and a strong correlation exists if the values are above 0.5 (Field, 2009). The table below shows the correlation among the variables of the M1.

Table 4.8: *M1 Correlations*

	Mean	Std. Deviation	MOOCs	Career Motivation	Student's Skill Development
MOOCs	3.5544	.37702	*.744*		
Career Motivation	3.5227	.44937	.522**	*.726*	
Student's Skill Development	3.5451	.45147	.537**	.602**	*.801*

**. *Correlation is significant at the 0.01 level (1-tailed).*

Cronbach's Alpha is reported on diagonal in italic.

The correlation between the variables is obtained from Pearson's Correlation. It is find from the table that a moderate correlation is present between MOOCs and Career Motivation ($\gamma = 0.522$; $\rho < 0.01$). Relationship between MOOCs and Students Skill Development is also moderate ($\gamma = 0.537$; $\rho < 0.01$) while a strong correlation exists between Career Motivation and Students Skill Development ($\gamma = 0.602$; $\rho < 0.01$).

The positive correlation ($\gamma = 0.537$; $\rho < 0.01$) between MOOCs (Independent variable) and Students Skill Development (Dependent variable) proves hypothesis H1 that is; MOOCs have a positive significant relationship with Student's Skill Development. The positive coefficient shows that a direct correlation exists between the dependent and independent variables.

4.1.3.3 Linear Regression

Simple linear regression is a way of predicting an outcome variable from a predictor variable (Field, 2009). It is basically done to find the influence of independent variable on dependent variable. The value of adjusted R square explained the percentage of variance in the dependent variable caused by the independent variable. Coefficient B represents the change in outcome variable resulting from a unit change in the predictor variable.

Table 4.9: *Linear Regression Model Summary of M1*

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.537[a]	.289	.286	.38161

a. Predictors: (Constant), MQS

Table 4.10: *M1 Linear Regression Table of ANOVA*[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	13.648	1	13.648	93.717	.000[b]
	Residual	33.639	231	.146		
	Total	47.287	232			

a. Dependent Variable: SSDQ

b. Predictors: (Constant), MQS

Table 4.11: *M1 Linear Regression of Coefficients*[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	T	Sig.
1	(Constant)	1.259	.238		5.299	.000
	MQS	.643	.066	.537	9.681	.000

a. Dependent Variable: SSDQ

Table 4.9 show the value of adjusted R square as 0.286, which means that 28.6% variance in dependent variable is explained by independent variable. This means that 28.6% of skills developed among students is due to MOOCs. The value of Coefficient is 0.643 which tells us that for every 1 unit change in MOOCs, there is a 0.643 unit change in the Skill Development. It represents the change in the outcome variable associated with a unit

change in the predictor variable. If unit of measurement is taken on thousand steps, then the Model 1 predicts for 1000 students enrolled in MOOCs, 643 students will have their skills developed by MOOCs. This states the influence of MOOCs on student's skill development, as increase in MOOCs enrollment will result in higher skills development among students. The ρ value is less than 0.05 so MOOCs has a statistically significant and positive impact on Student's Skill Development, it supports H1.

4.1.3.4 Moderation Regression

A moderator is a variable that specifies the impact of predictor on outcome variable under its influence. Moderation induces an interaction effect which changes the direction or magnitude of a relationship between the two variables. In order to correctly analyze the impact of the moderating variable, the researcher has chosen to adopt the Hayes process. The Process v3.5 syntax file was integrated with SPSS v26 to scrutinize the impact of moderation and to see whether the interaction effect is significant and helps explain the variation in the outcome variable. The results of the moderation are shown in the tables below:

```
OUTCOME VARIABLE:
 SSDQ

Model Summary
          R       R-sq        MSE          F        df1        df2        p
      .6732      .4533      .1129    63.2817     3.0000   229.0000   .0000
```

The value of R shows the correlation among the variables. The value of R square shows that 45.33% variance in the outcome is due to MOOCs and career motivation.

Table 4.12: *Moderation Regression Results of M1*

Predictors	B	Se	T	P
Constant	3.5148	0.0241	145.791	0.0000
	[3.47, 3.56]			
MOOCs (centered)	0.3657	0.0686	5.331	0.0000
	[0.23, 0.50]			
Career Motivation (centered)	0.4795	0.0587	8.168	0.0000
	[0.36, 0.60]			
MOOCs x Career Motivation	0.3439	0.1117	3.080	0.0023
	[0.12, 0.56]			

Dependent Variable: Student's Skill Development

The table above shows the effect of MOOCs and Career Motivation on Student's Skill Development. The effect of MOOCs on student's skill development is positive and significant (b= 0.3657, se= 0.0686, p= 0.000) while the effect of career motivation on student's skill development is also positive and significant (b= 0.4795, se= 0.0587, p= 0.000). The interaction term is significant which shows that moderation has occurred. The interaction effect is positive which shows that as career motivation increases, the effect of MOOCs on student's skill development also increases.

```
Test(s) of highest order unconditional interaction(s):
       R2-chng          F        df1        df2          p
X*W      .0226     9.4842     1.0000   229.0000      .0023
```

The interaction term between MOOCs and career motivation was accounted for a significant proportion of variance in students skill development, as $\Delta R2 = .02$, $\Delta F\ (1, 229) = 9.48$, $p = .0023$, $b = 0.344$, $t\ (229) = 3.08$, $p < .05$.

The conditional effect of focal predictor at moderator values will provide a clear picture of the moderation result in strengthening of relation between the predictor and the outcome variable.

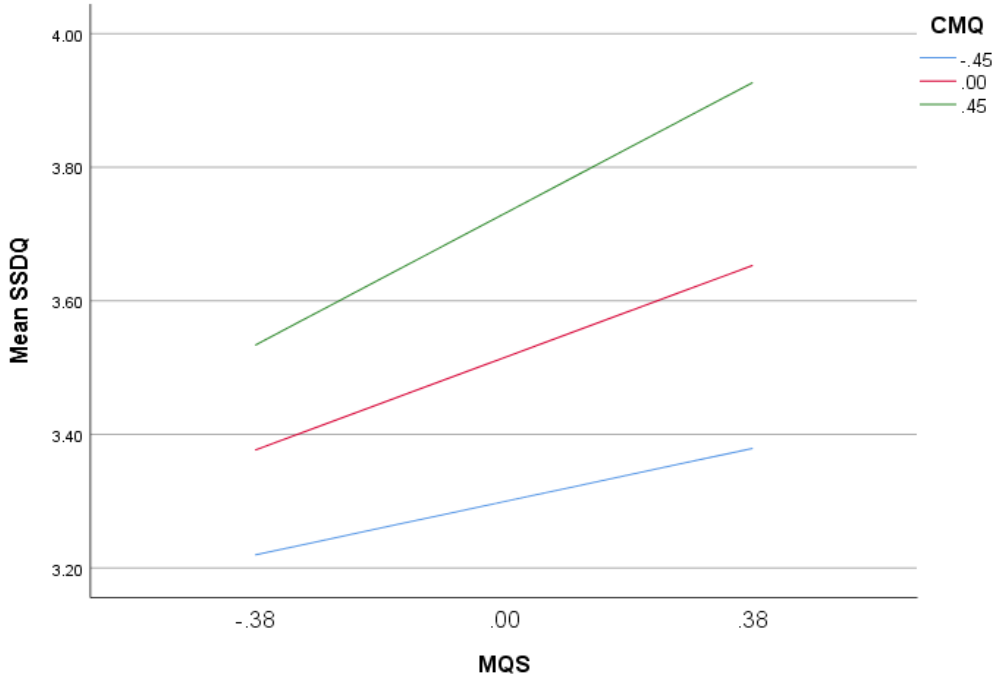

Figure 4.4 *Multiple Line Plot of M1 Moderation Effect*

Examination of plot shows an enhancing effect of MOOCs and Career Motivation on Students Skill Development. The lines represent the slopes of MOOCs at below SD, Mean and above SD on career motivation. The lower line represents below standard deviation effect, as with low career motivation, the effect of MOOCs in development of skills among students is relatively lower, as can be seen in the graph as a lower steep slope. Taking the mean 0 as an average, the center line represents that at an average career motivation, the effect of MOOCs in student's skill development is moderate. The upper line represents above standard deviation effect of career motivation. It shows that at higher career motivation, increasing MOOCs demand will result in highest development of skills among students. This proves hypothesis H2, that is Career Motivation positively and statistically strengthen the relationship of MOOCs and Student's Skill Development. A complete Process matrix result is given in Appendix F.

4.2 Model 2 (Employer's Value Proposition):

The model 2 of the research is designed for analyzing the impact of MOOCs on industries employability propagation. Work-place innovation acts as a moderator among the independent and dependent variables.

4.2.1 Exploring Data

In the first step, data is explored for any missing values, outliers and for finding normality.

4.2.1.1 Missing Values

As done previously, data is explored for missing values in the data set. Frequency distribution is checked for the data and total valid entries come out to be 212 and no missing value is present in the data. This provides evidence that the data is carefully placed without any error.

4.2.1.2 Outliers

In the given data set, each variable is explored; boxplot shows the exact location for the outliers. In MQE, case 19, 58, 123 and 204 have some outliers; there also some outliers in EPQ and WIQ. Upon removing/replacing all above, the data will further be explored for normality after descriptive analysis.

4.2.2 Descriptive Analysis

Descriptive test is performed first on the data, mean and standard deviation of demographics and variable items is calculated. Frequency of occurrence and percentage is also analyzed.

4.2.2.1 Descriptive Statistics

Below are the values for the demographics descriptive statistics, mean calculates the average value of data occurrence, median calculates the mid-value and mode is repetition of data i.e. the highest value, standard deviation shows model fit i.e. how much the data deviates from the mean value.

Table 4.13: *M2 Descriptive Statistics*

	N	Minimum	Maximum	Mean	Std. Deviation
Gender	212	1	2	1.39	.488
Age	212	2	5	2.69	.614
Qualification	212	2	4	2.60	.536
Company Nature	212	1	4	2.66	.933
Company Background	212	1	10	4.46	2.676
MQE	212	2.67	4.83	3.6958	.52686
WIQ	212	2.67	4.33	3.6077	.39053
EPQ	212	2.00	4.40	3.4830	.55885
Valid N (listwise)	212				

The mean statistics shows that the large majority of respondents are male employees with age between 30 years and qualification of majorly master's level. Most of the managers belong to private companies and serving in different departments. The mean and standard deviation values for different variables are also mentioned in the above table.

A. Gender

Frequency statistics of gender of managers are given in the table below:

Table 4.14: *M2 Frequency Table of Gender*

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	130	61.3	61.3	61.3
	Female	82	38.7	38.7	100.0
	Total	212	100.0	100.0	

Results show that 130 (61.3%) male and 82 (38.7%) female responded to the survey.

B. Age

Frequency statistics of age range of managers responded is given in below table:

Table 4.15: *M2 Frequency Table of Age*

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20-29	82	38.7	38.7	38.7
	30-39	115	54.2	54.2	92.9
	40-49	14	6.6	6.6	99.5
	50-59	1	.5	.5	100.0
	Total	212	100.0	100.0	

Table shows that a large number of managers are between the age range 30-39, as they constitute the highest 115 (54.2%) of the response rate. Second majority is from 20-29 age group and they are 82 (38.7%) in total. 14 (6.6%) are above 40 years and only 1 (0.5%) is above 50 years.

C. Qualification

Managers having different qualification backgrounds responded to the questionnaire. Their frequency statistics are mentioned below:

Table 4.16: *M2 Frequency Table of Qualification*

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	BS	89	42.0	42.0	42.0
	MS	118	55.7	55.7	97.6
	PhD	5	2.4	2.4	100.0
	Total	212	100.0	100.0	

The above table describes the qualification of the managers. 118 (55.7%) have done MS, 89 (42%) have done BS and only 5 (2.4%) have done PhD.

D. Nature of Company

Different managers work in different sectors of organizations. Below table shows their statistics:

Table 4.17: *M2 Frequency Table of Company Nature*

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Government	36	17.0	17.0	17.0
	Semi-Government	32	15.1	15.1	32.1
	Private	112	52.8	52.8	84.9
	Multinational	32	15.1	15.1	100.0
	Total	212	100.0	100.0	

A large majority of managers responded belong to private companies as they constitute 112 (52.8%) of the total responses. 36 (17%) belongs to government organizations and 64 (30.2%) are semi-government or multinational employees.

E. Background of Company

Statistics below describes the different departments, the managers are working in.

Table 4.18: *M2 Frequency Table of Company Background*

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	IT/Software	45	21.2	21.2	21.2
	Manufacturing	18	8.5	8.5	29.7
	Transportation	5	2.4	2.4	32.1
	Telecommunication	50	23.6	23.6	55.7
	Education	31	14.6	14.6	70.3
	Medical Services	11	5.2	5.2	75.5
	Retail	16	7.5	7.5	83.0
	Banking/Insurance	21	9.9	9.9	92.9
	Military	2	.9	.9	93.9
	Other	13	6.1	6.1	100.0
	Total	212	100.0	100.0	

45 (21.2%) managers belong to Software department, 50 (23.6%) from Telecom industry, 31 (14.6%) from education sector, 21 (9.9%) from banking and the rest 65 (30.6%) belonged to manufacturing, transportation, medical, retail, military and other organizations.

4.2.3 Inferential Analysis

After descriptive analysis, inferential analysis is performed to find correlation and regression among the variables. The normality tests are performed on variables to find that the data is normally distributed.

4.2.3.1 Normality Test

Normality test is performed before correlation and regression tests. The above found outliers are then transformed to obtain normality curve of variables. Normality statistics of the study are shown in the table. It contains the mean and the standard deviation of the study variables. The mean is the average value i.e. average response from the respondents shown in the table, while standard deviation is the difference form the mean value (Field, 2009). The table shows that employers are inclined towards skills in their demands for employees and are in favor of MOOCs. Work-place innovation plays an important role in defining the mindset for the employers.

Table 4.19: *M2 Normality Statistics*

	N	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
MQE	212	3.6958	.52686	.077	.167	-.865	.333
WIQ	212	3.6077	.39053	-.493	.167	-.270	.333
EPQ	212	3.4830	.55885	-.476	.167	-.737	.333
Valid N (listwise)	212						

The last two columns of the table show the value of skewness and kurtosis for the data set. As mentioned earlier, for sample size less than 200 z-score should not be more than 1.96 and for sample above 200 z-score should not be more than 2.58 (Field, 2009). The z-score is obtained by dividing the statistical value with the standard error. The obtained z-scores from the above table for different variables of the model are 2.58, 0.81 and 2.21. All the scores lies within range, hence the data is normally distributed. We can further analyzed normality by drawing histogram, normal Q-Q plots and boxplots (also known as box whisker plots).

Histograms are a good approach to spot the problems in the data. The histogram bar shows how many times a certain value occurred in a data set (Field, 2009). Figure shows the histogram for MOOCs score obtained as a response from managers.

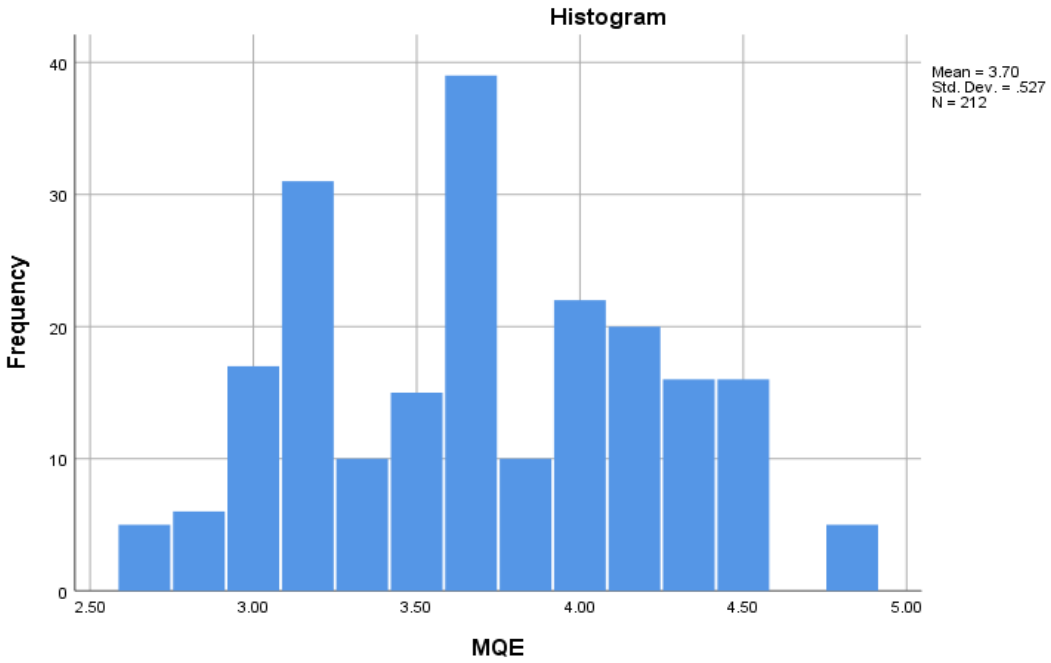

Figure 4.5*Histogram of MOOCs*

As described before, the normal Q–Q chart plots the values observed in the data set on expected values. The expected values are a clear straight diagonal line while the observed values are plotted as points on the straight line. If the data is normally distributed then the observed values fall exactly on the straight line. Any deviation in these dots points a deviation in normality (Field, 2009). The figure shows that the data is near or on the line, hence normally distributed.

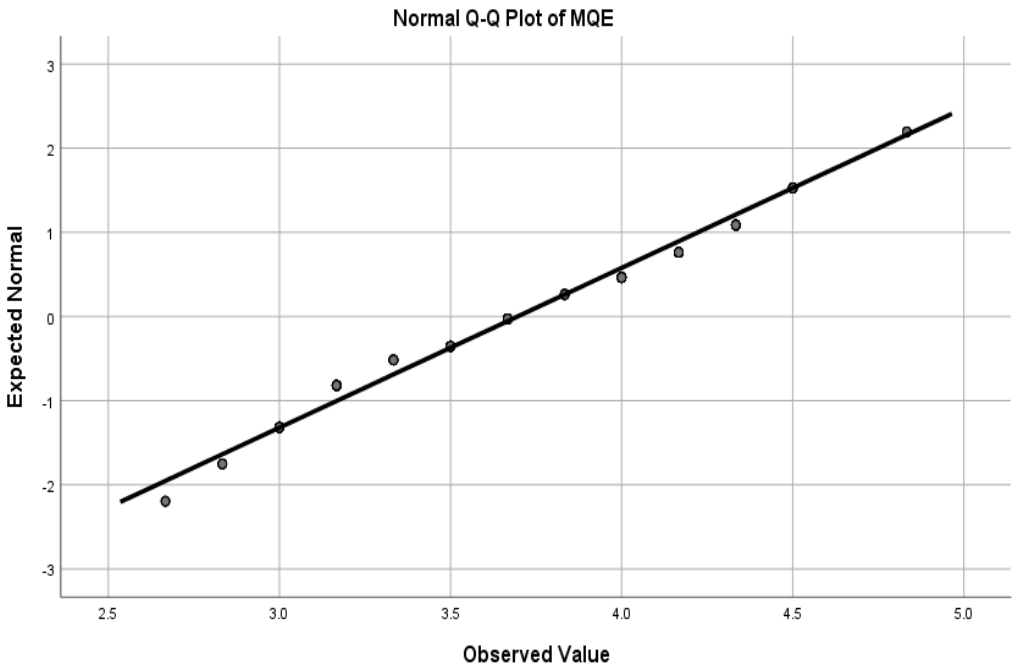

Figure 4.6 *Normal Q-Q plot of MOOCs*

Boxplots or box-whisker diagrams show the distribution of the data. Like histograms, boxplots also tell us whether the distribution of data is symmetrical or skewed. The center line is the median value, above and below is the upper and lower quartiles respectively that show the equal distribution of observations among the data (Field, 2009). Boxplots are used to show the outliers with steric and the number of the case. If the whiskers or quartiles are not equal than the data is asymmetrical, the figure below shows that the data is equally distributed around its mean.

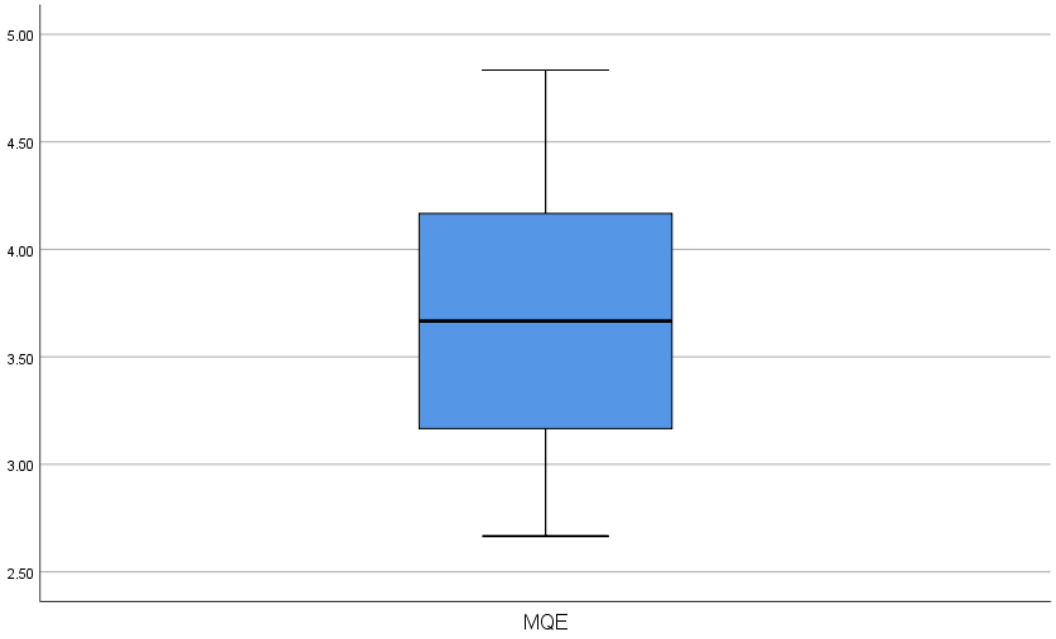

Figure 4.7 *Box plot of MOOCs*

In normality test, the histograms, normal Q-Q plots and boxplots of all independent, dependent and moderator values are observed. Removal of outliers results in normal distribution of the data set. The normality plots of the remaining two variables are attached in Appendix E.

4.2.3.2 Correlation

A correlation describes the measure of association between the variables. A bivariate correlation is used to check the relationship between two variables. The correlation coefficient values ranges from +1 to -1. A value of +1 indicates that the variables are perfectly positively correlated i.e. increase in one variable will result a proportionate increase in the other variable while a value of -1 indicates a perfect negative correlation i.e. if one variable increases, the other decreases (Field, 2009). A value of zero shows that no correlation exists between the variables. If the correlation coefficient value lies between values 0 to 0.2, there is a weak correlation among the variables. 0.3-0.4 shows

a moderate correlation and a strong correlation exists if the values are above 0.5 (Field, 2009). The table below shows the correlation among the variables of the M2.

Table 4.20: *M2 Correlations*

	Mean	Std. Deviation	MOOCs	Work-place Innovation	Employability Propagation
MOOCs	3.6958	.52686	*.741*		
Work-place Innovation	3.6077	.39053	.223**	*.768*	
Employability Propagation	3.4830	.55885	.359**	.605**	*.814*

**. *Correlation is significant at the 0.01 level (1-tailed).*

Cronbach's Alpha is reported on diagonal in italic.

The correlation between the variables is obtained from Pearson's Correlation. The table shows that all variables are in significant relationship with each other. It is found from the table that a relatively weak correlation is present between MOOCs and Wok-place Innovation ($\gamma = 0.223$; $\rho < 0.01$). Relationship between MOOCs and Employability Propagation is moderate ($\gamma = 0.359$; $\rho < 0.01$) while a relatively strong correlation exists between Work-place Innovation and Employability Propagation ($\gamma = 0.605$; $\rho < 0.01$).

The significant positive correlation ($\gamma = 0.359$; $\rho < 0.01$) between MOOCs (Independent variable) and Employability Propagation (Dependent variable) proves hypothesis H3 that is; MOOCs have a positive significant relationship with Employability Propagation. The positive coefficient shows that a direct correlation exists between the dependent and independent variables.

4.2.3.3 Linear Regression

Simple linear regression is a way of predicting an outcome variable from a predictor variable (Field, 2009). It is basically done to find the influence of independent variable on dependent variable. The value of adjusted R square explained the percentage of variance in

the dependent variable caused by the independent variable. Coefficient B represents the change in outcome variable resulting from a unit change in the predictor variable.

Table 4.21: *Linear Regression Model Summary of M2*

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.359[a]	.219	.215	.52289

a. Predictors: (Constant), MQE

Table 4.22: *M2 Linear Regression Table of ANOVA[a]*

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	8.481	1	8.481	31.020	.000[b]
	Residual	57.418	210	.273		
	Total	65.899	211			

a. Dependent Variable: EPQ

b. Predictors: (Constant), MQE

Table 4.23: *M2 Linear Regression Table of Coefficients[a]*

		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	T	Sig.
1	(Constant)	2.077	.255		8.142	.000
	MQE	.381	.068	.359	5.570	.000

a. Dependent Variable: EPQ

Table 21 shows the value of adjusted R square as 0.215, which means that 21.5% variance in dependent variable is explained by independent variable. This means that 21.5% of employability is due to MOOCs. The value of Coefficient is 0.381 which tells us that for every 1 unit change in MOOCs, there is a 0.381 unit change in the Employability

Propagation. It represents the change in the outcome variable associated with a unit change in the predictor variable. If unit of measurement is taken on thousand steps, then the model 2 predicts for 1000 employees having certifications in MOOCs, 381 employees will have the chance to be hired by the managers. From the results, we can state that increasing MOOCs demand will result in higher employability propagation. The p value is less than 0.05 so MOOCs has a statistically significant and positive impact on Employability Propagation, it supports H3.

4.2.3.4 Moderation Regression

A moderator is a variable that specifies the impact of predictor on outcome variable under its influence. Moderation induces an interaction effect which changes the direction or magnitude of a relationship between the two variables. In order to correctly analyze the impact of the moderating variable, the researcher has chosen to adopt the Hayes process. The Process v3.5 syntax file was integrated with SPSS v26 to scrutinize the impact of moderation and to see whether the interaction effect is significant and helps explain the variation in the outcome variable. The results of the moderation are shown in the tables below:

```
OUTCOME VARIABLE:
 EPQ

Model Summary
        R       R-sq        MSE          F        df1        df2      p
      .6231      .3882      .1822    43.9968     3.0000   208.0000 .0000
```

The value of R shows the correlation between the variables, the value of R square shows 38.82% variance in the employability is due to MOOCs and workplace innovation.

Table 4.24: *Moderation Regression Results of M2*

Predictors	B	se	T	P
Constant	3.5242	0.0304	115.945	0.0000
	[3.46, 3.58]			
MOOCs (centered)	0.2227	0.0527	4.227	0.0000
	[0.12, 0.33]			
Workplace Innovation (Centered)	0.7061	0.0781	9.040	0.0000
	[0.55, 0.86]			
MOOCs x Workplace Innovation	-0.3282	0.1497	-2.192	0.0295
	[-0.62, -0.03]			

Dependent Variable: Employability Propagation

The table above shows the effect of MOOCs and Workplace Innovation on Employability Propagation. The effect of MOOCs on employability is positive and significant (b= 0.2227, se= 0.0527, p= 0.000) while the effect of workplace innovation on employability propagation is also positive and significant (b= 0.7061, se= 0.0781, p= 0.000). The interaction term is statistically significant which shows that moderation has occurred. However, the interaction effect is negative which shows if workplace innovation increases then effect of MOOCs on Employability propagation decreases. Alternatively, if workplace innovation decreases then MOOCs will result in more employability.

```
Test(s) of highest order unconditional interaction(s):
       R2-chng          F        df1        df2          p
X*W      .0141     4.8064     1.0000   208.0000      .0295
```

The interaction term between MOOCs and workplace innovation is accounted for a significant proportion of variance in employability propagation, as $\Delta R2 = .014$, $\Delta F\ (1, 208) = 4.81$, $p = .0295$, $b = -0.3282$, $t\ (208) = -2.192$, $p < .05$.

The conditional effect of focal predictor at moderator values will provide a clear picture of the moderation result in strengthening or weakening of relation between the predictor and the outcome variable.

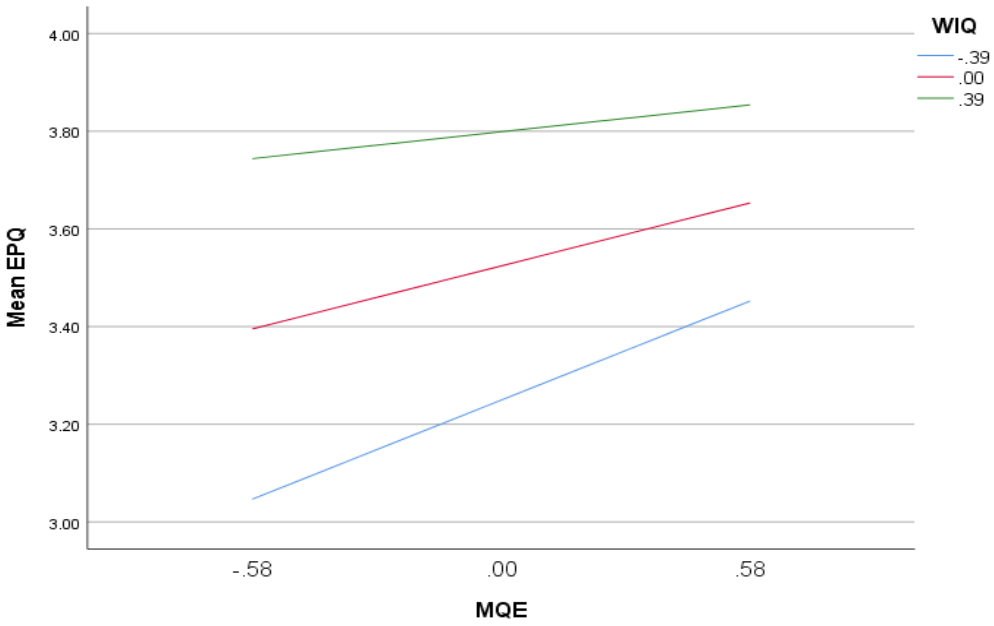

Figure 4.8 *Multiple Line Plot of M2 Moderation Effect*

Examination of plot shows an enhanced picture of effect of MOOCs and Workplace Innovation on Employability Propagation. The direction of slopes represents an inverse relation between the variables. The lines represent the slopes of MOOCs at below SD, Mean and above SD on workplace innovation. The below line represents below standard deviation effect, as higher MOOCs demand causes a rapid decrease in employability at lower workplace innovation. Taking the mean 0 as an average, the center line represents a relatively moderate decrease in employability caused by MOOCs with an average level of workplace innovation. The upper line represents above standard deviation effect of workplace innovation on relation of MOOCs and employability propagation. It shows that at higher workplace innovation, increasing MOOCs will result in relatively lower shift in employability propagation, though the effect is slightly lower as compared to lower workplace innovation, but it shows a decrease in employability with increase in MOOCs at higher workplace innovation. This rejects hypothesis H4, that is Workplace Innovation strengthen the relationship between MOOCs and Employability Propagation. The above results show that increasing innovation trickle down the relation between MOOCs and Employability Propagation. A complete Process matrix result is given in Appendix G.

CHAPTER 5

DISCUSSION

The present study was cross-sectional study that involved 233 engineering students and 212 engineering managers from reputed organizations. As now a day, online courses emerge as a new trend in education sector. A large majority of students, graduates, employees and professionals are enrolling in these courses to earn badges, certificates and professional training. These certificates not only enhance their skills but also provide them leverage in their current degrees, jobs and professional careers. The name coined for providing such courses is Massive Open Online Courses (MOOCs). There are several platforms working under the name as Cousera, edX, Udacity, Udemy, FutureLearn etc. Theses platforms are formed from the collaboration of elite universities across the globe whose basic purpose is to provide education to every single being without any financial, demographical and geographical constraints. As the offered courses are free to register and can be available to anyone interested, these courses not only terminate the class divide in the traditional education sector but also provide accessibility, flexibility and cost-effective alternative to unprivileged and un-served customers. So the main purpose of conducting the study was to investigate the impact of MOOCs on current models of education prevailing in institutions and their pros and cons in engineering students and professional managers that are the valued customers of university's learning process. Since customer satisfaction is the most contributed component to the business model of universities after financial analysis, this study has investigated their perception, participation and trends in adapting the new platforms for knowledge gain. This gave an idea about the challenges universities have to face in order to manage their prevailing business model against the MOOCs value additions, so that it won't get destroyed in a course of time. This contributes in bringing the

value addition business model introduced by MOOCs to higher education for meeting their customer's need related to the market demands.

According to the study, 23.35% students and 22.06% managers weren't aware of MOOCs. Among the rest 76.65% students, who were aware of MOOCs, only 31.75% students have done any MOOCs courses or certifications. In case of mangers, 77.94% who were aware of MOOCs, only 14.15% have done any professional certification. Though the awareness level among both populations regarding the courses and certifications and their benefits found to be quiet high but their adaption rate is very low. MOOCs are still in its infancy among students and managers.

Form Model 1, we found that 55.4% of male students responded to the survey than the 44.6% female students. 65.7% of students responded belong to the age group of 20-29 which shows that a large portion of young students are heading towards MOOCs for gaining skills. 56.2% of students were enrolled in MS and 41.2% were enrolled in BS while only 2.6% were doing PhD. Students belonging to different fields and from various institutions responded. A generalized observation based on the statistics is most students with IT/software and electrical background is inclined towards MOOCs with both 18.5% response rates as compared to students belonging to other engineering domains.

From descriptive statistics, researcher find that MOOCs provide all sorts of leverages they claim i.e. accessibility, flexibility, affordability and quality. Students are attracting towards the offerings they made, majorly as a boost in their career, and are optimistic in their response of different skills they gain through the platforms. Findings also suggest that students prefer these platforms to have career advantage since they offered latest trends and quality education; sooner or later this will affect the way traditional universities are doing their businesses as their customer's demands are changing. They need to review their course content and offerings they made to their customers to stay competitive in the fast moving era of technology.

The correlation analysis from the items shows that MOOCs and career motivation are moderately correlated with $\gamma = .522$, MOOCs and students skill development are also moderately correlated with $\gamma = .537$, while career motivation and student's skill

development are highly correlated with γ= .602. As students are motivated to build their career, they opt for MOOCs for developing skills that will benefit them in their career, and boost their professional skills. H1 proved that MOOCs have a positive significant relation with student's skill development. The result is parallel with the previous studies conducted by researchers (Alhazzani, 2020; Calonge & Shah, 2020).

The linear regression analysis shows the direction of influence, MOOCs have 28.7% variance in student's skill development that directs positive influence of MOOCs on student's skill development which proves that greater students enrollment in MOOCs will result in higher development of skills among them. From the correlation and linear regression analysis, we answer our RQ1; MOOCs positive relation shows that students are optimistic towards the platform for their skills development. Thus MOOCs have disruptive impact on prevailing business model in engineering universities as students are attracted towards new value propositions offered by MOOCs. However, low influence of MOOCs means it will take a long time for them to prove fully disruptive for higher education business models.

Moderation regression was done to evaluate the impact of MOOCs on student's skill development under the influence of career motivation. 45.33% variance in students skill development were found by MOOCs, career motivation and interaction term. The interaction term was statistically significant and ΔR2= .0226 proves that moderation has occurred. The interaction term was positive as b= 0.3439 which means as Career motivation increases, the effect of MOOCs on student's skill development also increases. Alternatively if career motivation decreases, the effect of MOOCs on student's skill development also decreases. The graphical representation of MOOCs slopes on career motivation also provides evidence that with low career motivation, the effect of MOOCs on student's skill development was also low, as there observes a slight increase in skills with increase in MOOCs. With an average career motivation at 0 mean, the effect of MOOCs on student's skill development is moderate. Higher career motivation resulted in an increased effect of MOOCs on student's skill development. This enhancing effect provides evidence that career motivation positively and significantly strengthens the relation between MOOCs

and student's skill development and thus proved H2. The result is parallel with the previous studies conducted by researchers (Liu et al., 2020; Shapiro et al., 2017).

The evaluation of descriptive and inferential statistics describes student's behavior towards MOOCs. Students find MOOCs cost-effective and burden relaxant. They believe in development of technical, communication, analytical, creative, problem-solving, technical writing and team player skills among them. Career motivation drives students to enroll in MOOCs and get hands-on to skills prevailing in the market. Increasing enrollments in MOOCs resulted in higher development of skills are moderated by career motivation. This answers our second research question RQ2; career motivation moderates the relationship of MOOCs and student's skill development. The moderation effect is enhancing as increasing the moderator would increase the effect of MOOCs on skill development.

From Model 2, we found that 61.3% male and 38.7% female students responded to the survey with 54.2% in age group of 30-39 years, 38.7% belongs to 20-29 age group while the rest 7.1% were above 40 years of age. 42% managers did BS, 55.7% had MS degree while only 2.4% were PhD's. 52.8% managers responded were from private companies, 15.1% were from semi-government and multinational leads while 17% belonged to government organizations. 21.2% belonged to software departments, 23.6% belonged to telecom industries while the rest were from several different technical departments in different organizations.

From the survey, manager's familiarity with MOOCs found to be higher than those of students, yet fewer have earned certifications. Workplace innovation is the key factor in leading organizations towards success. An innovative culture supports its employees and motivates them to acquire new skills, cherish their creativity and appreciate uniqueness in them. An innovative organization always looks forward for an enthusiastic blood who will lead their organization to new roads. Workplace innovation plays an important role in defining the behavior and attitude of the employees in responding to innovation and their consideration in hiring new skills. From descriptive mean of workplace innovation, researcher concluded that mangers themselves are very enthusiast in hiring and supporting innovative staff but most of them found their companies to be less encouraging. Others

found their organizations to be innovative, ambitious and creative; they believe in themselves and have vision to lead their organizations to new heights.

The correlation analysis provides evidence that MOOCs and employability are correlated with γ= .359, the results show a moderate relation, though employers are in favor of MOOCs, most of the companies are concerned with skills, either by MOOC platforms or from tertiary institutes. MOOCs help in increasing skills among recruits, as students prefer MOOC courses to gain skills, a moderate correlation supports the argument that MOOCs help them further in getting employed. This relation further strengthens or weakens depending on the organization culture. There exists a weak correlation, γ=.223 between MOOCs and workplace innovation which means that an innovative organization that value skills among students, not necessarily give preference to MOOCs courses or skills. A strong correlation, γ=.605 exists between workplace innovation and employability propagation which shows that an innovative organization responds highly of creativity, always welcome innovation. MOOCs itself regard as disruptive innovation. So such organizations that value innovation tends to hire recruits more with diverse skills, as they believe in all sorts of skills the platform is providing and the students doing MOOC certifications have rich knowledge of latest trends in technology. This proved hypothesis H3 that MOOCs have a positive significant relationship with employability propagation. This result is parallel with the study that MOOCs support employability (Dillahunt et al., 2016; Suarta et al., 2017).

The linear regression analysis among MOOCs and employability propagation show that MOOCs have 21.5% variance in employability propagation. Though the influence is not so high but it did show some variance in employability propagation. So we can describe the relation among MOOCs and employability propagation, as higher MOOCs demand will result in enhanced employability propagation. From the correlation and linear regression analysis, we answer our third research question RQ3; MOOCs support employability means that graduates with MOOCs certifications are more likely to be hired by the respective employers. Thus MOOCs provide value to their external customers by giving them the skilled professionals. Employers seem to be more interested in hiring certified professionals showing the disruptive influence of MOOCs in engineering universities.

However, the influence was quite low which means that employers are optimistic towards MOOC certifications and offer more leverage to them compared to tertiary institution graduates, yet the process is very slow.

Moderation regression was done to analyze the impact of MOOCs on employability propagation under the influence of work place innovation. The predictors accounts for 38.82% variance in employability. MOOCs and workplace innovation tends to have positive influence on employability individually. The interaction term was statistically significant with $\Delta R2=0.014$ which showed that moderation has occurred. The interaction effect was negative, which means an inverse relation is present, with an increase in workplace innovation, the effect of MOOCs in employability propagation decreases. Alternatively, if workplace innovation decreases, the effect of MOOCs in employability propagation will increase. Multiple line plots confirmed the results, as lower SD i.e. low workplace innovation results in steep MOOC slope which means the effect of MOOCs in employability propagation enhanced at lower work place innovation. At mean 0 i.e. at an average workplace innovation, the effect of MOOCs in employability propagation is moderate and at above SD i.e. at higher workplace innovation, the slope is very low, which shows the effect of MOOCs in employability propagation is low at higher workplace innovation. We can say that as innovation increases in an organization, they will not tend to hire recruits mainly with MOOCs certifications only. However, with organizations having lower level of innovation have even drastic decline in hiring MOOC graduates. Based on results, H4 rejected which states that workplace innovation strengthens the relation between MOOC and employability. Though workplace innovation is highly correlated with employability and employers seemed to give preference to skills among new recruits, yet these skills are not necessarily to be obtained from the MOOC certifications. The results showed that workplace innovation weakens the relation between MOOCs and employability propagation. Highly innovative organizations seemed to be less reluctant to MOOCs compared to less innovative organizations. Employers show their interest in skills from reputable institutions. We answer our fourth research question RQ4 that workplace innovation moderates the relationship of MOOCs and employability propagation. The moderation effect is buffering as increasing moderator would decrease the effect of MOOCs on employability propagation.

The descriptive and inferential statistics describes industries behavior towards MOOCs and new recruits. Most of the employers find new recruits efficient and professional in their job designation. Workplace innovation plays vital role in defining manager's mindset towards their staff growth and development. Innovative organizations always search for innovation among its employees and new recruits. Managers found to be cooperative and prefer innovation and uniqueness among recruits. Managers somehow fancy MOOCs platform for skills development and tending to give preference to recruits having skills, still organizations with innovative culture are reluctant to rely fully on individuals having MOOC courses. Innovative culture open paths and ways for employability among graduates and applicants with skills are trending among these organizations, as they have higher knowledge of the latest technology.

From the results, it is stated that MOOCs fulfill development of skills among students and employers demand of skills for graduates and new recruits. This provide evidence that both the customers i.e. students and industries are satisfied with their value proposition through MOOCs. However, workplace innovation decreases the effect of MOOCs in employability propagation. Career motivation on the other hand strengthens the relationship among MOOCs and student's skill development. Providing the best to customers and meet their needs and desires is the new business model trend that MOOC platforms are adapting. MOOCs platforms introduce new business model in which they provide value to their customers at lower prices by fulfilling their needs and demands, so they are the disruptors in the incumbent higher education market. Industries that are claiming to be innovative and preferring skill among new recruits are yet to embrace the diversity of MOOCs. The diverse attributes of MOOCs poses a threat to traditional universities business model, who are sticking to old business models since decades as students with higher career motivations are attracting to these platforms for skills development. MOOCs are providing them with what is missing in traditional education, i.e. skills at lower prices. Thus serving the lower-end market customers, and slightly moving upmarket with improving quality of their offered products. These quality skills help them in getting employed. With all the facts, still it's a whole lot process of change in which higher education personnel and industrialists begin to value the diverse forms of education, whose only purpose is to serve its

consumers. These findings reveal that MOOCs will disrupt the existing business model of universities eventually with its new business models yet it will take time for industries and higher education in Pakistan to accept different mediums of education and to focus more on every sort of skills rather than just earning degrees.

5.1 Conclusion

MOOCs are challenging higher education by providing accessible, flexible and affordable education to its consumers. They emerge as disruptors in higher education by bridging the mismatch in skills among graduates and potential employers. Career motivation is driving students towards MOOCs for development of skills that industries demand. Innovative industries are encouraging their employers for bringing uniqueness and creativity. For capturing new business opportunities employers are looking for skills among new recruits that leads their organization to have higher market ends meet. To entertain both students and employer's needs, MOOCs introduce new business model of providing value proposition to its customers. Quality content with skillful learning in feasible environment gain popularity among students and employers tend to hire those with suitable skills. They believe in employees skills more than the medium for obtaining the desired set of skills. Companies are collaborating with MOOC platforms to refine their employee's skills, yet a majority of innovative workplaces lag behind in embracing MOOC skills. Though the influence is low but increasing MOOCs demand among students and employers poses a threat to existing business model of universities. It shows things are changing and if not addressed properly, universities will face disruption in a course of time. Higher education need to revise their course content and cost structures to stay competitive in the fast growing MOOCs trend.

5.2 Recommendations

Following are the few recommendations derived from the conclusions:

- Online learning is becoming global phenomena as more and more elite universities are collaborating to facilitate students. As seen in COVID-19, universities were not prepared which lend them in serious situation, and made them do temporary arrangements for taking online classes unofficially. While virtual universities continue to provide online classes properly. This is the intimidation which higher education is neglecting from decades. World is changing rapidly and technologies advances, authorities need to take swift action on this. Worldwide collaboration of universities is producing quality content, our higher education need to follow them and adapt the latest content and ways of learning. This is important to stay competitive and keep their students engaged so they cannot move to other platforms in search of quality education.
- Online education apart from flexibility is a source for development of vocational skills. At any geographical location, with a good internet and medium knowledge anyone can get benefit from MOOC platforms, which are open to everyone. Following MOOCs platform, universities can introduce hybrid or flip-flops classrooms. In offering online education, costs can be saved for complex infrastructures, which can further be invested in upbringing of latest technology in education departments like video conferencing, video lectures etc.
- Higher education should make policies to link graduate with relative employers to reduce un-employability among new graduates.
- Higher education should start accrediting MOOC credits, transfer of credits and faster completion of degrees after obtaining the specified credits.
- Higher education needs to collaborate with information and technology ministry to introduce technological changes within education sector. Providing internet facilities and encouraging citizens to get skillful education should be done on immediate measures.
- New business models based on customers, value proposition, finance and infrastructure should be adopted to provide leverage to students and industries.

5.3 Limitations and Future Research

There exist few limitations which need to be addressed in future. Following research can be done in future:

- Research was limited to engineering universities of Pakistan.
- Researcher found lack of awareness among students regarding the professional and skilled courses. A research on awareness of such courses and certifications should be conducted in future.
- Students were found to be unaware of professional skills that the market demands. A future study should be conducted related to Industry-Academia linkage, to explore the impact of MOOCs on Pakistani academia and their efforts in training their students to meet potential employer's demands.
- Due to unavailability of MOOC platforms in Pakistan or any collaboration among universities, a future research should be done to explore the financial component of the business model to estimate offering of such courses and building these platforms to entertain students.
- Due to time and resource constraints, researcher restricted to Capital Territory and Punjab Province only, a similar research can be conducted in other provinces of Pakistan for exploring the opportunities and challenges students will face in adapting such platforms. As some areas of Pakistan are still deprived of electricity and internet facilities.
- Medium of instructions can also be discovered in future research.

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Appendix A: Envisioning the Current MOOC Market

MOOC platforms	Head-Quarters	Found In	For-profit/ Non-profit	Description
Coursera	United States	2012	For-profit	Two Stanford professors launched Coursera, the biggest MOOC provider in the world with over 37 million students and $313.1 million raised in funding. It has over 160 university partners and more than 20 industry partners, offering 3,100 online courses.
edX	United States	2012	Non-profit	It's the second largest MOOC provider in the world founded by Harvard University and MIT, with more than 18 million students. EdX offers approximately 2,200 courses and claims 139 university partners.
FutureLearn	United Kingdom	2012	For-profit	Owned by Open University and Australia based SEEK Group with 10 million users. It's UK's biggest MOOC platform offering 15 degree programs also a bachelor's degree.
SWAYAM	India	2017	Non-profit	It offers over 2,150 courses taught by 1,300 instructors from over 135 Indian universities. It allows students in India to earn academic credit and has over 10 million learners.
XuetangX	China	2013	Non-profit	Founded by Tsinghua University with over 14 million registered users. It has a cloud learning management system currently used by more than 1.5 million Chinese students.

Udacity	United States	2012	For-profit	It was the first original MOOC platform to reach $1 billion. Udacity launched first MOOC-based degree, a completely online Masters in Computer Science degree.
Kadenze	United States	2015	For-profit	Kadenze is a platform that specializes in creative/arts education. Students can earn academic credits for Kadenze courses.
Canvas Network	United States	2008	For-profit	It offers number of free online courses in universities all around the world with some courses still offering free certificates.
Stanford Lagunita	United States		Non-profit	Stanford has been self-hosting courses for a long time now. It uses Open edX, the open source version of edX.
Miríada X	Spain			It is a regional platform that has 494 courses in Spanish and Portuguese. These courses are produced by its 91 university partners.
MéxicoX	Mexico			MéxicoX is a platform funded by Mexican government having 40 partner universities and 2.5 million registered learners.
France Université Numérique	France	2013		FUN has 93 partners among higher education institutions. FUN has 537 MOOCs courses and more than a million registered students.
EduOpen	Italy	2016		EduOpen is a network of 19 Italian universities funded by Italian government but it is also open to EU universities.
ThaiMOOC	Thailand	2017	Non-profit	The ThaiMOOC platform is the newest MOOC platform built on Open edX and currently lists around 50 courses.
Federica.eu	Italy			It is a platform created by the University of Naples Federico II. Currently it has over 60

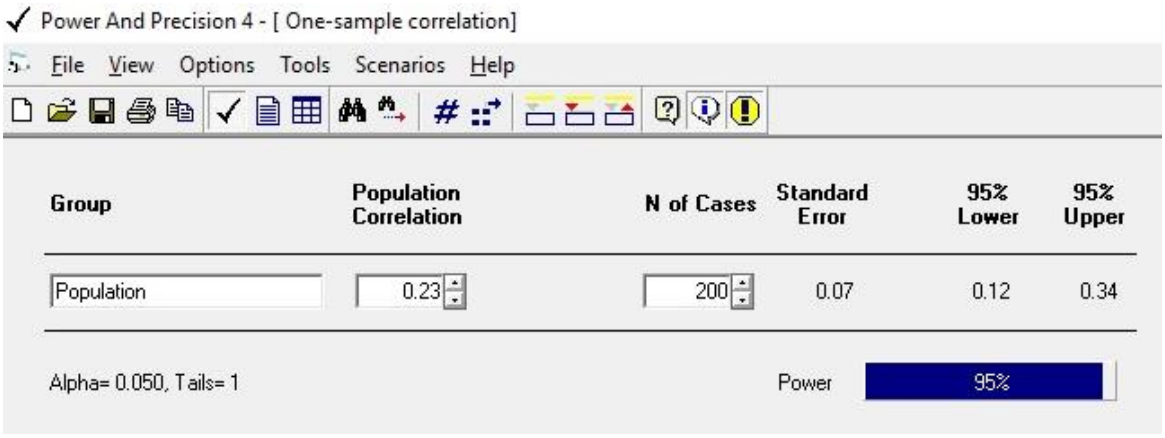
				free online courses listed.
NPTEL	India		Non-profit	It is a collaborative project of India's best institutions to deliver online courses covering engineering and science. NPTEL has now been integrated into SWAYAM.
Complexity Explorer	United States			It provides online courses and educational materials about complexity science.
Campus-Il	Israel			The national MOOC platform of Israel offers courses in Hebrew and Arabic.
CNMOOC	China			The official website of China's elite university Muji Union offered this platform. It hosts 1,138 courses from 109 universities.
Chinese MOOCS	China			The platform hosts 100+ courses from a few Chinese universities.
University of China MOOC	China			It is an online education platform launched by Higher Education Society. It hosts 3,124 courses from 444 Chinese universities.
ewant-education you want	Taiwan	2013		Founded by National Chiao Tung University. It hosts more than 1200 courses from 91 different universities.
Edraak (Arabic)	Jordan	2014	Non-profit	It is an Arabic MOOC platform which is affiliated with the Queen Rania Foundation. Edraak has more than two million learners.
Zhihuishu	China			Zhihuishu means "wisdom book." Learners can also earn credits.
OpenHPI	Germany	2012		It is a platform hosted by Hasso Plattner Institute (HPI) in Potsdam, Germany. It offers courses in English and German.
Gacco	Japan			Gacco partners with universities in Japan to offer online courses in Japenese. It has over 350k students enrolled on its platform.

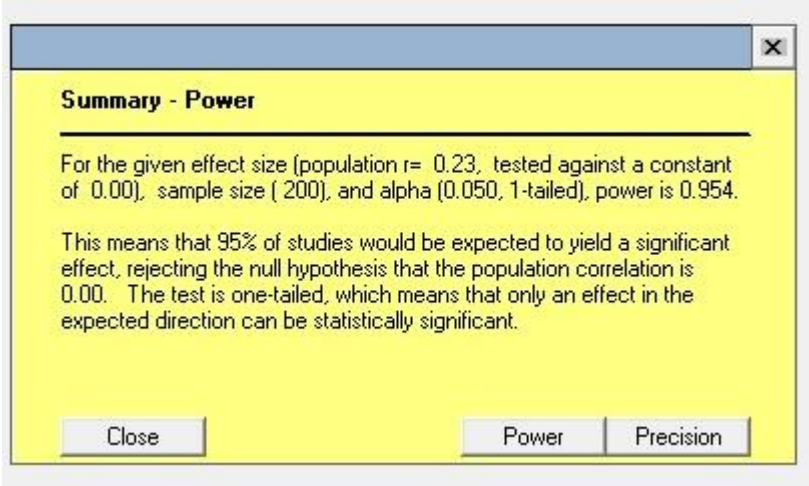
Fisdom	Japan	2018		This platform was launched by Fujitsu, a Japanese multinational company.
OpenLearning	Japan			It was launched by Net Learning Inc., an education service company based in Japan.
JMOOC	Japan		Non-profit	It's an association that promotes MOOC in Japan. The three Japanese MOOC providers listed above have courses that have been JMOOC certified. JMOOC currently offers 140 courses.
Open Education	Russia			This MOOC provider was created by leading universities and lists more than 350 courses.
Open Education	Taiwan			Openedu.tw is a MOOC provider that offers over 380 free online courses.
K-MOOC	Korea	2015		It was initiated by the Korean Ministry of Education and currently it lists 858 courses and around 100 participating institutions.
IndonesiaX	Indonesia	2015	Non-profit	The platform has courses made by universities and companies that currently offer 30 free online courses.
Prometheus	Ukraine	2014	Non-profit	It partners with universities and companies to launch free online courses. It has 113 courses and more than 250 thousand registered users.

Source: Adapted and modified in tabular form from Barbara Oakley Book: Mind shift; Break through Obstacles to Learning and Discover Your Hidden Potential (Oakley, 2017, p.243-245)

Appendix B: Sample Size Calculation; Power and Precision Report

Power and Precision v.4 tool was used for calculating the sample size of the questionnaire. Below attached is the report generated from the software.





Appendix C: Factor Loadings of the Items

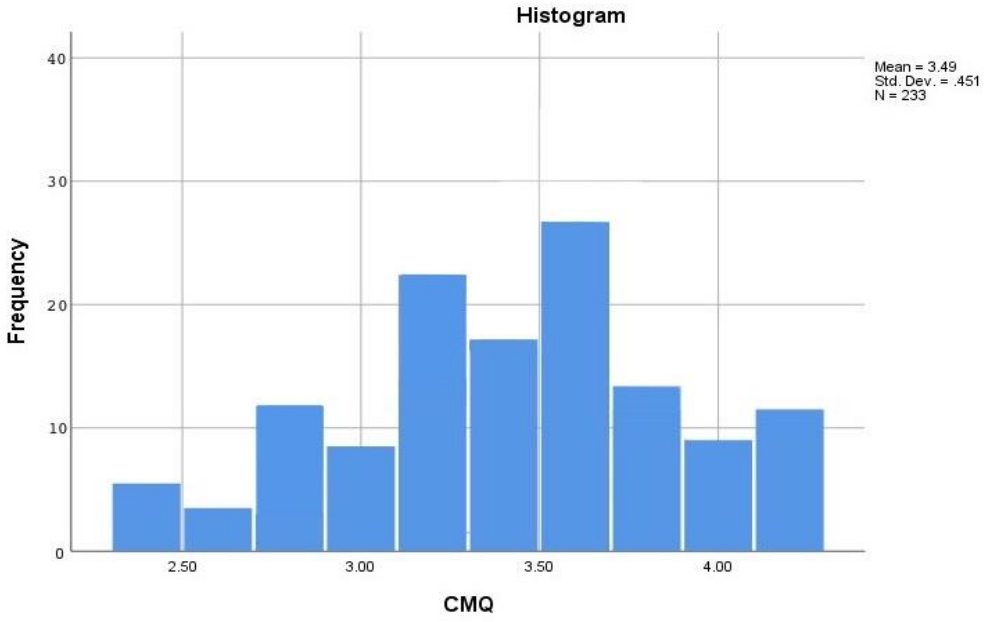
- Section A to be filled by students:

Variables	Items	Description	Factor Loading
MOOCs	MQS1	I can easily access course information.	0.648
	MQS2	I can easily complete my course on provided time slot.	0.7
	MQS3	I find MOOCs cost-effective.	0.726
	MQS4	MOOC help me to acquire work-place skills.	0.728
	MQS5	I prefer MOOCs over traditional learning process.	0.683
	MQS6	I feel MOOCs can disrupt traditional education.	0.771
Student's Skill Development	SSDQ1	MOOC provide me an in-depth knowledge of engineering discipline.	0.656
	SSDQ2	Participating in online class discussion develop my communication skills.	0.734
	SSDQ3	MOOC assignments build my analytical thinking.	0.65
	SSDQ4	Projects during course develop my creative thinking.	0.701
	SSDQ5	MOOC helps me analyzing quantitative problems.	0.761
	SSDQ6	Tasks during the course develop my technical writing skills.	0.824
	SSDQ7	Collaborative learning develops my team player skills.	0.736
Career Motivation	CMQ1	MOOC learning will help me get a good job.	0.738
	CMQ2	MOOC certifications will benefit me in my career.	0.705
	CMQ3	Knowing concepts will give me a career advantage.	0.803
	CMQ4	I will use MOOC problem-solving skills in my career.	0.683
	CMQ5	My career will involve MOOC skills.	0.715

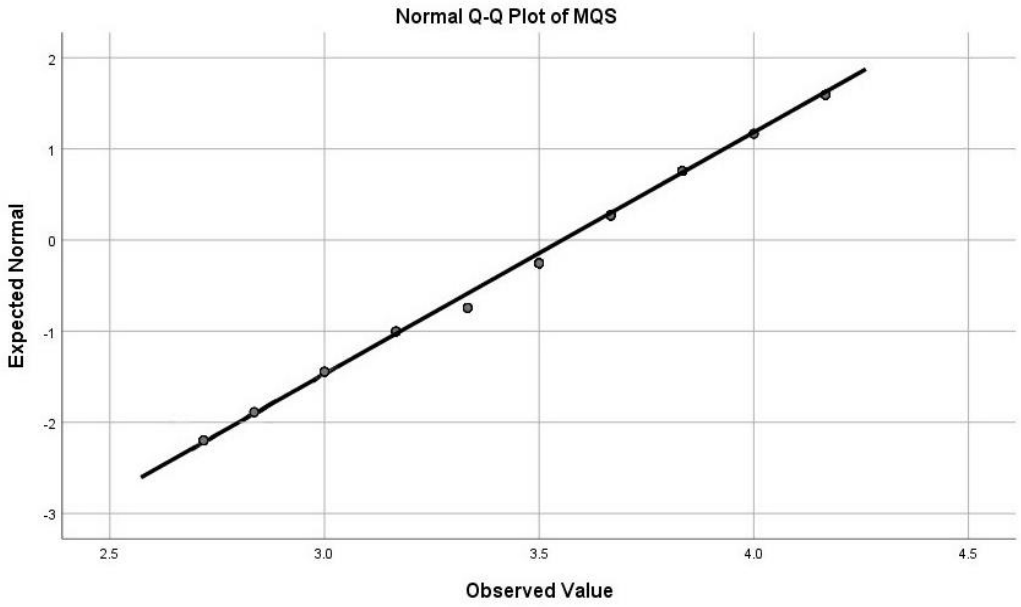
- Section B: To be filled by Employers:

Variables	Items	Description	Factor Loading
MOOCs	MQE1	I can easily access course information.	0.724
	MQE2	I can easily complete my course on provided time slot.	0.764
	MQE3	I find MOOCs cost-effective.	0.688
	MQE4	MOOC helps me to acquire work-place skills.	0.679
	MQE5	I prefer MOOCs over traditional learning process.	0.791
	MQE6	I feel MOOCs can disrupt traditional education.	0.833
Workplace Innovation	WIQ1	I have courage to make innovation and take risk.	0.658
	WIQ2	I actively lead the staff to grow and innovate.	0.691
	WIQ3	I have vision and insights to create new business opportunities.	0.854
	WIQ4	My company pays attentions to the uniqueness of employees.	0.833
	WIQ5	My company encourages the innovation from employees.	0.641
	WIQ6	My company is an ambitious and energetic organization.	0.696
Employability Propagation	EPQ1	I find new recruits proficient in technical domains.	0.671
	EPQ3	New recruits can handle work-place problems efficiently.	0.811
	EPQ4	I find new recruits performing high in their designated jobs.	0.644
	EPQ5	My company is giving preference to skills.	0.756
	EPQ6	My company is adapting MOOC platforms for employee training.	0.751

Appendix D: Normality Test of M1 Variables

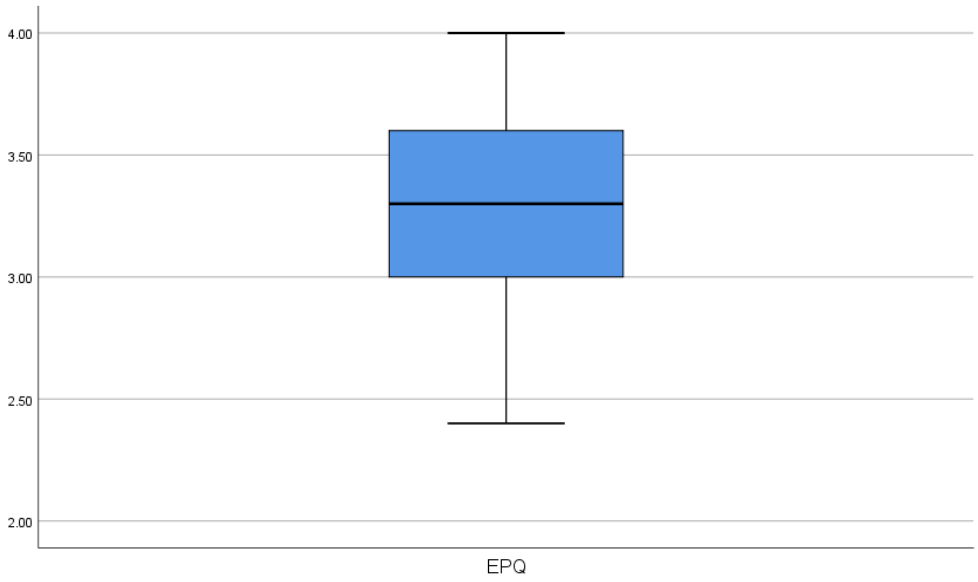


Histogram of Career Motivation

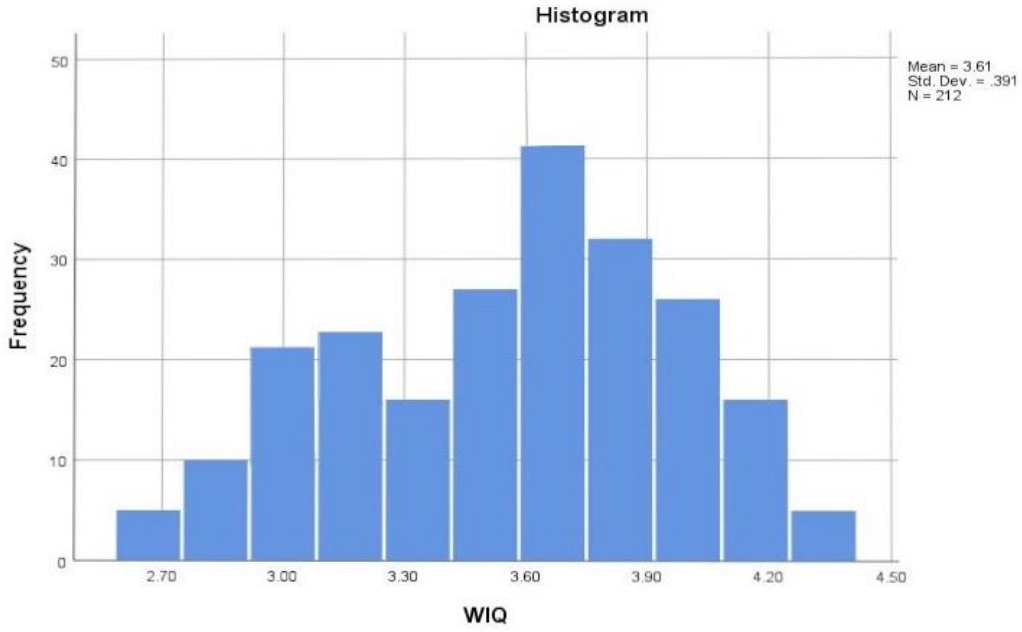


Normal Q-Q plot of MOOCs

Appendix E: Normality Test of M2 Variables



Boxplot of Employability Propagation



Histogram of Workplace Innovation

Appendix F: Complete Moderation Regression of M1

```
Run MATRIX procedure:

***************** PROCESS Procedure for SPSS Version 3.5
*****************

          Written by Andrew F. Hayes, Ph.D.       www.afhayes.com
    Documentation available in Hayes (2018). www.guilford.com/p/hayes3

**************************************************************************
*
Model  : 1
    Y  : SSDQ
    X  : MQS
    W  : CMQ

Sample
Size:  233

**************************************************************************
*
OUTCOME VARIABLE:
 SSDQ

Model Summary
          R       R-sq        MSE          F       df1       df2       p
      .6732      .4533      .1129    63.2817    3.0000   229.0000   .0000

Model
              coeff         se          t          p       LLCI     ULCI
ULCI
constant     3.5148      .0241   145.7930      .0000     3.4673     3.562
MQS           .3657      .0686     5.3312      .0000      .2305     .5008
CMQ           .4794      .0587     8.1679      .0000      .3638     .5951
Int_1         .3439      .1117     3.0796      .0023      .1239     .5640

Product terms key:
 Int_1    :        MQS      x        CMQ

Test(s) of highest order unconditional interaction(s):
       R2-chng          F        df1        df2          p
X*W      .0226     9.4842     1.0000   229.0000      .0023
----------
    Focal predict: MQS      (X)
          Mod var: CMQ      (W)

Conditional effects of the focal predictor at values of the moderator(s):

        CMQ     Effect         se          t          p     LLCI     ULCI
     -.4494      .2111      .0853     2.4753      .0140    .0431    .3792
      .0000      .3657      .0686     5.3312      .0000    .2305    .5008
      .4494      .5202      .0847     6.1430      .0000    .3534    .6871
```

```
Data for visualizing the conditional effect of the focal predictor:
Paste text below into a SPSS syntax window and execute to produce plot.

DATA LIST FREE/
   MQS        CMQ        SSDQ       .
BEGIN DATA.
     -.3770     -.4494     3.2197
      .0000     -.4494     3.2993
      .3770     -.4494     3.3789
     -.3770      .0000     3.3769
      .0000      .0000     3.5148
      .3770      .0000     3.6527
     -.3770      .4494     3.5341
      .0000      .4494     3.7302
      .3770      .4494     3.9264
END DATA.
GRAPH/SCATTERPLOT=
 MQS      WITH     SSDQ     BY       CMQ      .

************************ ANALYSIS NOTES AND ERRORS
************************

Level of confidence for all confidence intervals in output:
  95.0000

W values in conditional tables are the mean and +/- SD from the mean.

NOTE: The following variables were mean centered prior to analysis:
          CMQ      MQS

------ END MATRIX -----
```

Appendix G: Complete Moderation Regression of M2

```
 Run MATRIX procedure:

***************** PROCESS Procedure for SPSS Version 3.5
*****************

          Written by Andrew F. Hayes, Ph.D.       www.afhayes.com
    Documentation available in Hayes (2018). www.guilford.com/p/hayes3

**************************************************************************
*
Model  : 1
    Y  : EPQ
    X  : MQE
    W  : WIQ

Sample
Size:  212

**************************************************************************
*
OUTCOME VARIABLE:
 EPQ

Model Summary
          R       R-sq        MSE          F        df1        df2   p
      .6231      .3882      .1822    43.9968     3.0000   208.0000 0.0000

Model
             coeff         se          t          p       LLCI     ULCI
ULCI
constant     3.5242      .0304   115.9450      .0000     3.4643    3.5481
MQE           .2227      .0527     4.2270      .0000      .1188     .3265
WIQ           .7061      .0781     9.0401      .0000      .5521     .8601
Int_1        -.3282      .1497    -2.1924      .0295     -.6234    -.0331

Product terms key:
 Int_1    :        MQE      x        WIQ

Covariance matrix of regression parameter estimates:
           constant        MQE        WIQ      Int_1
constant      .0009      .0000     -.0001     -.0012
MQE           .0000      .0028     -.0010     -.0008
WIQ          -.0001     -.0010      .0061      .0010
Int_1        -.0012     -.0008      .0010      .0224

Test(s) of highest order unconditional interaction(s):
       R2-chng          F        df1        df2          p
X*W      .0141     4.8064     1.0000   208.0000      .0295
----------
    Focal predict: MQE      (X)
          Mod var: WIQ      (W)

Conditional effects of the focal predictor at values of the moderator(s):
```

```
        WIQ     Effect         se          t          p     LLCI   ULCI
     -.3890      .3504      .0825     4.2474      .0000    .1877   .5130
      .0000      .2227      .0527     4.2270      .0000    .1188   .3265
      .3890      .0950      .0744     1.2775      .2029   -.0516   .2416

Data for visualizing the conditional effect of the focal predictor:
Paste text below into a SPSS syntax window and execute to produce plot.

DATA LIST FREE/
   MQE        WIQ        EPQ        .
BEGIN DATA.
     -.5777     -.3890     3.0471
      .0000     -.3890     3.2495
      .5777     -.3890     3.4519
     -.5777      .0000     3.3956
      .0000      .0000     3.5242
      .5777      .0000     3.6528
     -.5777      .3890     3.7440
      .0000      .3890     3.7989
      .5777      .3890     3.8537
END DATA.
GRAPH/SCATTERPLOT=
 MQE      WITH     EPQ      BY       WIQ      .

************************ ANALYSIS NOTES AND ERRORS
************************

Level of confidence for all confidence intervals in output:
  95.0000

W values in conditional tables are the mean and +/- SD from the mean.

NOTE: The following variables were mean centered prior to analysis:
          WIQ      MQE

------ END MATRIX -----
```

Thesis Report

by Shehzeen Bakhsh Malik

Submission date: 29-Sep-2020 12:57PM (UTC+0500)
Submission ID: 1400131726
File name: Shehzeen_Compiled_Thesis.docx (763.34K)
Word count: 21151
Character count: 120317

CHAPTER 1

INTRODUCTION

The first chapter of the research comprises of background of the study followed by description and justification. It also corroborates the critical concepts of the study including problem statement clarification, research questions and objectives. In the end stated are the limitations and outline structure of the research.

1.1 Background

In numerous parts of the world, the increasing costs of higher education (HE) makes it unaffordable for many apprentices. Due to excessive fee structures of private sector institutions; a big chunk of Pakistani students is deprived of quality higher education (Qureshi, 2016). Several question tertiary institutions capability to organize students for their professional careers. There lies a mismatch of skills students gain through higher education and perceptions of potential graduate employers. MOOCs act as a mean to reduce this skill gap (Calonge and Shah, 2016).

Massive open online courses (MOOCs) are recent advancement in online and distance learning phenomena (Qureshi, 2019). The term MOOCs was introduced first by Dave Cormier in 2008 to describe Siemens and Downes course called "Connectivism and Connective Knowledge". In 2011, Stanford professor named Sebastian Thrun and few of his colleagues provided worldwide access to the course that they were teaching at university, "Introduction to Artificial Intelligence". This course managed to attract 160,000 students from more than 190 countries. Almost 23,000 students completed AI course. Thrun was so overwhelmed with the response that he left Stanford and started his own

MOOC platform called Udacity with stated goal of democratizing education by offering courses to students at no cost. Two other Stanford professors named Daphne Koller and Andrew Ng co-founded Coursera. It started with partnership between top four universities-Stanford, the University of Pennsylvania, the University of Michigan and Princeton (Flynn, 2013). This proliferation of MOOCs began in 2012 has invigorated several elite institutions to place their courses online by setting up open learning platforms, including edX (MIT and Harvard Collaboration) (Yuan & Powell, 2013).

MOOCs are adapting the technologies and pedagogical approaches offered by online and open education resources (OER) but their novelty that attracted millions around the world is the concept of "free" availability of courses, material and content (Kalman, 2014). Though, most of them charge for certifications. The global access i.e. anyone can participate in a course for free is without demographic, economic and geographic constraints (Yuan and Powell, 2013). Assisted by other researchers, it is indicated that MOOCs platforms provide a democratic and cost effective alternative to traditional university education, based on their capability to scale educational content to large number of learners at minimal costs. MOOCs provide convenient education without any bound of time than in traditional education, thus regarded as flexible courses (Al-Imarah and Shields, 2018).

MOOCs promise is that they will provide free to access, highly advanced and innovative courses that will reduce university education expenses and potentially disrupt the existing models of higher education (Yuan and Powell, 2013). The disruption phenomena of MOOCs employ Disruptive Innovation Theory (Bower and Christensen, 1995). This theory describes new technologies that redefine an entire market and can improve product and services in unexpected ways (Al-Imarah and Shields, 2018). Following are the two features of disruption: "New market disruption" which involves creating a new market that meets the previous unmet demands, and "low-end disruption" which involve new technologies that exceed the performance of currently established business models (Christensen, Raynor and McDonald, 2015). Christensen and colleagues themselves describes disruption a process where a small company with less resource is able to successfully challenge established incumbents businesses with greater resources (Stepan, 2013). Entrants that

prove disruption, enter in market by targeting overlooked customer segments gaining advantage by delivering enhanced functionality at lower prices. Disruption is not one time activity; it's a process to evolve a product or a service to a point until the quality catches up to the main stream customer's standards. The authors stated that smart disrupters improve their products and hence drive upmarket" (Christensen, Raynor and McDonald, 2015).

Yuan and Powell identified that MOOCs contains the key characteristics of disruptive innovation i.e. a combination of new business models and an enabling technology (Yuan and Powell, 2013). Christensen supported that disrupters focus more on getting the business model right rather than just the product. Business model describes the essentials of an organization, how it creates and captures customer value and can be concisely represented by an interrelated set of elements that address the customer, value proposition, organizational architecture and economic dimensions (Fielt, 2013). Generally, the term business model is used to describe only the financial component of organizations but the three most commonly stated components of business model includes customers value proposition, organizations infrastructure and financial component. Customer value proposition are the way customer needs are met by the organization i.e. how organization creates value for customers for fulfilling their demands. Infrastructure comprises of resources and processes: physical resources such as lecture halls, campuses and human resources such as faculty and administrative staff. Financial aspect of the business model includes sources of income, profit margins and pricing. For success of any organization, a good fit between the three is required. MOOCs can open new business streams for higher education sector and contribute to universities business model by receiving governmental funding for MOOCs development and operation, charging for participant data to engage them with potential employer who desired specific skill-set, selling and adapting specified MOOCs material (Kalman, 2014).

The threat to engineering education is the societal perceptions that skills of university graduates are inadequate to meet lifetime work challenges. The gap between shared needs and actual performance of university graduates is increasing and online education is an important factor to reduce this gap (Casner-Lotto and Barrington, 2006; Kalman, 2014).

Learner's professional motivation is a driving factor towards MOOCs. Studies identified the factors including in MOOC participation are getting advantage of the various skills that the platform offered. Career shift, career enhancement, skills improvement and professionalism are counted among highest importance factors (Hew and Cheung, 2014). The 21st century demanding market requires graduates to be excelled not in just engineering specified skills but also in creative and analytical thinking, analyzing work-place problems, coming up with novel ideas and strategies to help nourish organization. An innovative culture in an organization itself supports creativity, give preference to employees having unique skill-set and thrive for betterment of its organization (Chang and Lin, 2007). MOOCs support employability and develop employability skills by adding to social capital (Suarta et al, 2017).

1.2 Justification and Relevance

Rapidly advancing technologies such as artificial intelligence, internet of things, big data analytics and robotics have created a situation in which most of the content learned from colleges and universities becomes outdated in a few short years. Indeed, soft skills such as critical thinking, communication skills and leadership do not go outdated but hard skills i.e. technical skills are changing as technology undulates through society. These demand employees to be up skilled for changing generations of technology. This combination of skills and knowledge demands more than just a degree. Google and other giant techs started its IT support course on Coursera to train its employees and to hire new as well. This sudden cultural shift from big-wigs induces employer's trend for not seeking un-skilled graduates; chances are this could soon become an industry norm (Kolowich, 2012).

Due to proliferation of MOOCs, big universities are shifting to MOOCs (Yuan and Powell, 2013). Small universities need to learn from them. Since MOOCs are using updated technology and free business models, they are attracting more learners. Quality content is another benefit that adds values to customers to meet their demands. If HEC fails to

identify the coming disrupter's disruption, chances are they will become obsolete in a course of time.

1.3 Problem Statement

Federal loans availability for higher education has created a student debt rumble that now tops one trillion dollars in the U.S., where the amount of tuition exceeds $50,000 per year in some private colleges and universities. Further, of this country's 37 million borrowers, 5.9 million students have fallen behind at least 12 months on their payments. One in six student borrowers are currently in default, representing $76 billion in non-preforming loans (Lewin, 2012b, p.1; Flynn, 2013). Student debt load for graduates of Boston University increased by nearly 50% between 1997 and 2016, to $25,625. American's have racked up a total of $1.5 trillion in student debt (Berkley & Letzing, 2019).

Students of Pakistan pay tuition fee approximately US$3,500 for undergraduate degree and US$1,140 per year for master's degree (Ed-Arabia Report, 2019).

Previous studies have identified that traditional universities are following old pedagogical approaches with continuous increase in annual fees. There lies a gap between employer's skill demands and graduate skill perceptions. MOOCs have a positive impact on graduates and employees skills development (Shah and Calonge, 2016).

Expensive and incompetent education is going to disrupt by MOOCs, thus effecting business model of universities. Will engineering universities cope with this situation?

1.4 Research Questions

Following will be the main research question of the study:

R1= Will students be switching to MOOCs because of their flexibility, affordability and development of employability skills?

R2= Do employers prefer MOOC skills among new recruits?

R3= Will MOOCs disrupt the existing business model of universities?

The study will discuss whether new technologies and freemium business models followed by MOOCs disrupt the traditional universities business models. Customer value proposition towards MOOCs can affect engineering universities either positively or negatively, thus measuring disruption.

1.5 Research Objectives

The dialogue around MOOCs includes predictions that a large proportion of universities will disappear, academic degrees will be replaced by MOOCs completion certificates which will be presented to potential employers. Moreover, institutes of higher education will graduate students whose transcripts comprise mainly of MOOCs and massive numbers of academic faculty will become redundant (Gregory, 2012; Yglesias, 2012; Kalman 2014).

The study aims to identify the impact of MOOCs on disruption of business model in engineering universities taking into account the customer satisfaction i.e. students and employers. The study will evaluate student's perceptions about MOOCs and their attitude in shifting from expensive to trendy education. It will explore the employer's behavior in recruiting individuals with MOOCs completion certificates. At the end, the study will give idea and suggestion about adaption of MOOCs certificates by traditional universities to benefit graduates in job market and fulfilling employer's demands.

1.6 Limitations of Research

Given below are the limitations of this research:

- Only the mentioned variables will be considered for the study, any other variable beyond that will not be considered.
- Due to limited resources, students and managers having familiarity with MOOCs is considered as a valid response for consideration.

- Only organizations/institutions accessible to researcher (Government, semi-government, private) will be considered for the research.
- Due to limitation of time, responses received after 45 days of sending the survey will not be considered as part of the data.

1.7 Outline of the Research

The thesis comprises of five chapters. Chapter one is of introduction that contains the relevance and justification, problem statement, research questions, research objectives and limitations of the study. Chapter two will be the literature review in which the researcher will study the significant and existing literature relevant to the topic. The third chapter will be the methodology where researcher will sort the data for achieving the required objectives with use of appropriate methods. In the fourth chapter the researcher will analyze the data collected for the study and reach conclusive findings. In the last chapter the researcher will discuss and conclude the findings of the overall study and suggest future work as well.

CHAPTER 2

LITERATURE REVIEW

It is mandatory to take certain steps with a goal to find the answers of the research questions. These steps include the review of the relevant theories established on the concepts of disruptive innovation, MOOCs, prevailing business models and its elements. This chapter is developed for the achievement of this purpose and includes the findings of previously established theories on the relationship between the variables used for the research.

2.1 MOOCs (Massive Open Online Courses)

MOOCs provide a reasonable and flexible way to learn different skills, advance professional career and deliver quality educational experiences at scales. It helps in career development, changing career and lifelong learning. It provides global, open access through video based instructional content and discussion forums to higher number of participants; aiming to take a course. It has potential to open up higher education by providing free or low cost easily accessible, flexible, affordable and fast-track completion of courses to its learners (Shelley and Srivastava, 2016). In principle, a MOOC is denoted by (Gore, 2014):

- Massive: They can be offered to unlimited participants (sometimes enrollments exceeds hundred thousand);
- Open: As one can take advantage of widely available open education resources (OER) and their content with open registration (though some MOOCs platforms have pre-requisites, especially for degree programs);

- Online: Generally with no criterion for face-to-face attendance and delivered worldwide via the internet;
- Course: The concept of a pedagogically designed learning expedition.

Since their widespread appearance in 2012, massive open online courses (MOOCs) have become a common setup for individuals interested in learning without being constrained by time, location, or academic enrollment (Liu et al, 2019).

Some possible reasons for investing money in MOOCs in such a short time by (Stepan, 2013):

- MOOCs provide a live workroom for studying how people learn, how the mind works and how to improve education both face-to-face and online.
- MOOCs can be used to help understand why people forget things so that strategies can be created to prevent it.
- Study which teaching methods and tools are most successful.
- Tool for identifying top talent to charge recruitment fee and act as a career placement center e.g. Udacity.
- Large and diverse meeting place and forum for ideas and for networking. MOOC provide a large space for learners without personal interaction (Stepan, 2013).

2.1.1 Key Characteristics of MOOCs

MOOCs characteristics comprise of novelty aspects compared to earlier distance and online learning initiatives, MOOCs motivation and benefits for learners. It also includes two economic specificities of MOOCs based on supply and demand.

2.1.1.1 Novelty

The unique characteristics of MOOCs include free registration, open access to learning and a large and varied learner body. Learners; who not only have different backgrounds but also wide ranging motivations for enrolling in a course are shaping the

learning progression (Shelley and Srivastava, 2016). The Novelty of MOOCs lies in the first acronym "O" which defines openness. Learners can learn at a zero to very low costs for degree programs. There is no registration fee, entry barrier or any form of selection to take part in the open courses (Belleflamme and Jacqmin, 2015). The aim of MOOCs is to open up education and provide free access to tertiary level education for as many students as possible. In disparity to traditional university online courses, MOOCs have two key features identified by (Yuan and Powell, 2013):

- Open access - anyone can participate for free in an online course
- Scalability - courses are intended to facilitate an indefinite amount of participants

Completion and professional certificates of MOOCs demonstrates mandatory level of knowledge required for the understanding of the course and helps learners to utilize their skills based on certifications (Belleflamme and Jacqmin, 2015).

2.1.1.2 Engagement and Motivation for Learners

Learner's motivation towards MOOCs is a significant area of interest for many venture capitalists and higher education stakeholders. With invent of industry 4.0 and dynamic market demands, technology is taking shifts rapidly. What is in demand currently might not be the case in next two to three years, so learners craved for opportunities to enhance their skills based on demands (Lasi et al, 2014). Economic benefits, personal and professional identity development, challenges and achievements, enjoyment and fun are some of the major factors that influence learner's motivation to participate in MOOCs (Yuan and Powell, 2013). A lot of research has been done to find out the response of students on their motivation in MOOCs and participation in particular course revealed following four reasons (Hew and Cheung, 2014; Liu, 2014; Shapiro et al, 2017; Li 2019):

1. To gain a lifelong experience and understanding in learning a new topic or to extend current knowledge.
2. For fun, entertainment, curiosity, social experience and intellectual incentive.
3. Convenience, to attain relaxation with barriers to traditional education options.

4. A desire to personal challenge and to obtain completion certificates.

All above reasons benefit learners in their own domain depending on the type of experience they are seeking. Age, gender and highest degree and number of courses previously taken also determine course taken by the participants (Li, 2019).

2013 was the year MOOCs were still in their infancy, students were more curious about knowing the details and offerings of the platform. Meanwhile, a portion of learners are focusing on their skill building and career development (Christensen et al, 2013). Christensen and colleagues surveyed learner's motivation in University of Pennsylvania's 32 MOOC courses from both developing and developed countries. From the 34,779 participants both from developing and developed countries, the reason for MOOC motivations vary. 13.2% students were doing MOOCs to gain knowledge to get degree in which developing countries lead with 20.6%. 43.9% wants to gain specific skill to do job better, 17% desired to gain specific skill to get an new job while 50.05% were doing MOOC courses for curiosity and fun factor. In 2013, the ratio of learners doing MOOCs fell heavily in the entertainment side (Christensen et.al, 2013).

Liu and colleagues analyzed learner's motivation in taking MOOCs courses offered through the Knight Center for Journalism in the Americas in the College of Communication at the University of Texas at Austin from spring to summer 2017. The results showed different learners motivations. Among 846 participants from 94 countries from the five continents, 70.8% were interested generally in the topic, 70% were doing MOOC course for personal growth and enrichment, and 66.8 % learners claim that the specific MOOC course was related to their job. In 2019, fun curiosity factor went down to 27.9%. 22.8 % wanted to earn a certificate to boost their career while 22.5% were interested in their career change. The unique percentage of students comes forward whose participation relies solely due to prestigious university professor teaching and they contribute to 26.4% of the total ratio (Liu et al, 2019).

With MOOCs proliferation, learners interested in different courses mainly comprises of working professionals to enhance their skill in specified technology for getting benefits in the job market and improve their expertise (Christensen et al. 2013; Liu et al. 2019).

2.1.1.3 Learning Strategies

Apart from flexibility and accessibility, following are some of the features identified that add value to MOOCs compared to traditional face-to-face approach in higher education sector (Belleflamme and Jacqmin, 2015). These are as follows:

1. **Retrieval based learning:** It provides continuous feedback to the students using automatically graded tests and quizzes. Retrieval learning is a strategy that involves recalling information repeatedly through multiple studies, and it isn't time consuming as well. Retrieval does produce meaningful and long-term learning despite of rote and transient learning. Many researchers have found a positive and significant relationship between the exercise of retrieval and learning outcomes (Roediger and Karpicke, 2008).
2. **Student-centered learning experience:** Internet markets make the pricing low of adopting the content provided to the students and ability to utilize the data available on the platforms, classes can be watched, re-watched and stopped at any time depending on student's attention capacity (Levin, 2013). This implementation enhances multitasking skills of the younger generation, which can take more advantage of the stated learning (carrier et al. 2009).
3. **Evidence-based education practices:** MOOC platforms offer a great environment for random trial experiments. Obligations to the massive amount of data concerning the learning process and the outcomes available at a very low cost, the internet gives a perfect setting for this type of experiments. By separating the control groups from the new technology, controlled trial experiments allow analysts to draw the conclusion how control groups responded learning outcomes differently. This give room for improvements on the MOOC platforms which can be adapted by higher education as well (Levin, 2013).

2.1.1.4 Economic Specificities

The two important specificities of MOOCs include supply and demand of the innovation. MOOCs differ from traditional courses both on the supply and on the demand

side, with prospective effects on the market structure of higher education. While the choice of organizational mode i.e. for or non-profit likely to have a larger impact on MOOC platforms than on traditional higher education institutions (Belleflamme and Jacqmin, 2015).

a) **Supply vs. Demand:** Depending on the supply side, the cost structure of MOOCs comprise largely of fixed costs, as they concern the development of the platform, the investment in a sufficiently large quantity, and the online adaptation of the course. The cost of the person providing the course is also larger depending on the platforms as Udacity professors charge for per course while Coursera and edX professors do not, they are still on payroll of the host university. In contrast, variable costs are much smaller as interactions between students and professors are now replaced by interactions with the platform to grade quizzes and by interactions among peers (Hollands and Tirthali, 2014). On demand side, MOOCs improve the accessibility of higher education: classes can be trailed at any time with no boundaries; there is no transportation cost and no need to move in to live near a campus or to shuttle. They are generally free of charge. Students can also decide the courses that they want to follow without having to stick to a specific course outline and the content (Belleflamme and Jacqmin, 2015).

b) **For-profit/ Non-profit:** The two modes of structure are prevailing among current MOOC platforms i.e. non-profit and for-profit platforms. Both are categorized in tabular form as:

Table 2.1: *For-profit vs. Non-profit Organizations*

For-profit	Non-profit
Incentives are distributed to the owners of the platforms and among peers.	These institutions are excluded from distributing their profits to their owners.
Surplus budget equally divides among the owners and venture capitalists.	Surplus budget reinvested into the institution.
Joint ventures among institutions for monetizing and other benefits.	Lack of collateral in start-up phase makes it difficult to access flexible capital.
Fund raising and donations, investments by venture capitalists and access to equity market.	Difficulty to access additional capital and to raise it via debt financing.
Professors are paid by the platforms to build network effects.	Lack of indirect network effects among students and professors
Monetized, customers attraction enhanced by offering certificates, industry-academia linkage.	Freemium model attracts customers, charge only for certifications.
Donations used for achieving certain objectives for foundations.	All donations invested on quality of education.

Source: Adapted and presented in tabular form from An Economic Appraisal of MOOC Platforms: Business Models and Impacts on Higher Education (Belleflamme and Jacqmin, 2015, p.155)

2.1.2 MOOCs Types

"Connectivism and Connective Knowledge" course was offered by Stephen Downes and George Siemens in 2008, set up a class of 25 tuition paying students at University of Manitoba, Canada. The course was also offered as an open version for free in which two thousand and three hundred students participated. This type of MOOC is coined cMOOC. xMOOC are different, they are affiliated with elite institutions and all are started back in 2012 (Stepan, 2013).

The research focuses on xMOOC; it is important first to understand the difference between the two types of MOOCs. The information contained in the table below has been adapted from research by Kesim and Altinpulluk (2015) and presented in tabular form for reader's facility.

Table 2.2: *cMOOCs vs. xMOOCs*

cMOOCs	xMOOCs
Referred as Canadian MOOCs, started in 2008 at University of Manitoba, Canada by George Siemens, Stephen Downes and Dave Cormier.	The well-financed providers, associated with top universities established in 2012 - Udacity, Coursera, edX.
Medium of knowledge transfer - Based on theory of connectivism (The learning process takes place as the learner gains their knowledge through making connections, mostly with the collective knowledge of the community i.e. network based learning).	Medium of knowledge transfer – Based on Behaviorist pedagogy (The traditional behaviorist model is primarily based on the transfer of information from the teacher to the student).
Focus on knowledge creation - content, biological/neural, conceptual and social/external context, people interaction in web environment (open learning and online network practices).	Focus on knowledge duplication – information transmission through video presentations, computer marked assignments and quizzes, peer assessments. Received learning information reduced their creative and cognitive development.
Emphasis on autonomy, creativity and social networking learning. Each learner structures and manages their own learning network. They are considered as extensions of personal learning environment (PLE).	Emphasis on traditional theoretical learning, lecture video and multiple- choice tests (video-taped lectures appear online). It is very beneficial for those who don't have access to quality learning materials at their institutions.
Instructor led - Learners are free to determine their own learning goals	Instructor facilitated - Lectures are provided by instructors but few platforms support

throughout the learning process.	open content by learners.
Monetary gains are quite difficult due to open nature of courses.	Infrastructure and financial support required to offer such courses are mostly provided by large corporations and foundation donations.
Tools utilized - RSS, LinkedIn, Flickr etc. (users inhabit their own space)	Tools - Learning Management System (LMS)

Source: Adapted and presented in tabular format from A Theoretical Analysis of MOOCs Types from a Perspective of Learning Theories (Kesim and Altinpulluk, 2015, p. 15-19)

The xMOOC are further divided into two models: for-profit platforms and non-profit platforms to serve different purposes as discussed in section 2.1.2.4. xMOOCs have been criticized for lacking any innovation in what pedagogy is concerned. However, it gains a huge success amongst students, possibly because of the effervescent nature of their discussion forums and their available learning tools and virtual laboratories (Meinel, Totschnig and Willems, 2013).

2.1.3 MOOCs Providers and Platforms

MOOCs initiative started with online lectures from Khan Academy in 2004 by Salman khan when one of his cousins and other relatives requested a help in mathematics, he started uploading tutorials on YouTube. In a short period videos got 200 millions of views and their popularity exploded. In 2006, Khan Academy was backed by Bill Gates Foundation and Google, it now have more than 3,300 video lectures on different subjects. The ability to gather significant financial support drew venture capitalists attention and one of the first MOOC was create. It did not take long for innovators in higher education and venture capitalists looking forward for business ventures to see MOOCs potential (Flynn, 2014).

In 2011, Stanford professors launched three free online courses open to public; these courses went massive and gather so much public attention that the courses cross over 100,000 enrollments. More than 900 universities around the world have launched free online courses since then. By 2018, more than 100 million students signed at least one MOOC course. Many national governments around the world have launched their own country specific MOOC platforms. The table in Appendix A contains 34 larger MOOC platforms performing worldwide and at national levels by (Dhawal Shah, 2019):

The current value propositions for its customers by institutions to engage with MOOCs are identified as experimentation, education access, branding and developing new revenue streams. MOOCs serves as a way to enter the higher education market for many commercial organizations, as they do so by providing a MOOC platform and developing partnerships with existing institutions and to explore new delivery models in higher education. For example, Udacity partners with Georgia Tech to launch Nano-degrees, a low-cost project, to engage students with technology related jobs (Dhawal Shah, 2019) For those organizations, MOOCs have a practical role in the selection and recruitment process of talented employees (Yuan and Powell, 2013). The costs to initially produce a MOOC based on assumption that it requires around 100 hours of work to generate the content at an average cost of $15,000 to $50,000; the costs for running for a single MOOC are within the range of $25,000-$60,000 (Burd, Smith and Reisman, 2014).

2.2 MOOCs Disruption and Innovation in Engineering Education

The term “disruptive innovation” refers to innovations that deliver a product or a service to consumers in an explicit way as to go beyond market expectations. This raises a question for higher education about online teaching innovation such as MOOCs, as it’s causing a change in their business models that poses a threat to their existing prototypes of degree courses provision (Yuan and Powell, 2013).

Literature shows that MOOCs are disruptive and a threat to traditional bricks and mortar, face-to-face instructional medium (Stepan 2013; Yuan and Powell, 2013; Burd et al, 2014; Venkatesh, 2014; Flynn, 2014; Calonge and Shah, 2016; Qureshi, 2019).

2.2.1 Disruptive Innovation Theory

The theory of disruptive innovation (Bower and Christensen, 1995) explains as to why some of the innovations disrupt existing markets by the disbursement of incumbent players (Yuan and Powell, 2013). A disruptive innovation creates an entirely new market generally by lowering down the price or targeting a new market designed for a different set of consumers or for diverse needs of existing customers (Stepan, 2013).

Disruption describes a process in which a minor company is able to successfully challenge already established incumbent businesses with scarce resources. Explicitly, as incumbents focus on improving their offered products and services for their most demanding and profitable customers, they exceed the needs of some customer segments and ignores the needs of other segments. Entrants that prove to be disruptive begin by successfully targeting those overlooked customer segments and gaining a foothold by delivering services at a lower price (Christensen, Raynor and McDonald, 2015).

> *"Disruption drives prices down in a market"*
>
> (Christensen, Raynor and McDonald, 2015, p. 47)

Disruption has occurred when incumbents failed to serve low-profile customers and put their focus entirely on profitability from high-demanding segments, entrants move up-market with a continuous progress. They deliver the performance that mainstream customers required, while focusing on the benefits that deliver their early success. With passage of time, incumbent's consumers begin to adopt entrant's offerings in bulk (Christensen, Raynor and McDonald, 2015).

The two markets for disruptors as identified by (Christensen, Raynor and McDonald, 2015):

1. Disruptive innovations mostly initiate in low-end or new-market footholds.
2. Disruptive innovations do not chase onto mainstream customers, until quality catches up to their high-end standards.

Based on Christensen's theory of disruptive innovation (1995), MOOCs do fit the disruptive model. Following the theory, conclusions by (Stepan, 2013):

- Serving non-consumers - MOOCs are open to everyone anywhere, therefore they do not target mainstream face-to-face learners of incumbents higher education.
- MOOCs are moving up-market – First MOOC has been started since 2008 but now the technology has improved and captures a significant presence.
- Disruptive innovations improve quality standards - MOOCs are serving mainstream customers with its cost effectiveness leading people to question traditional education models.
- Separate autonomous business entity set-up by established firms (Christensen and Bower, 1995). Harvard and MIT did exactly that by creating their own MOOCs, edX, as a separate business unit (Harvard Gazette, 2012, p.3). Platforms such as Coursera and Udacity have adopted MOOCs as disruptive innovation with a main focus on developing new business models and new markets as well to serve different needs of apprentices (Yuan and Powell, 2013).

2.2.1.1 Disruptive vs. Sustaining Innovation

Christensen has identified two types of innovations which affect organizations and businesses, namely sustaining and disruptive innovations. Christensen and Overdorf provide the following definitions:

> *"Sustaining technologies are innovations which make a product or service performs better in ways that customers in the mainstream market already value. They are nearly always developed and introduced by established industry leaders. Disruptive innovations create an entirely new market over the introduction of a new kind of product or service, one that is actually worse, initially, as judged by the performance metrics that mainstream customer's value."*
>
> (Christensen & Overdorf, 2000, p. 6)

The differences between sustaining and disruptive innovation can be identified based on value networks which refers to how an organization delivers its value proposition. Value networks requirements surrounds customer preferences, cost structures, business models for making profits, culture and strategic direction. For example, the customer preferences and relevant cost structures may differ significantly from one network to another network (Stepan, 2013). Some of the characteristics between the disruptive innovation and mainstream value networks are described in the following table:

Table 2.3: *Sustaining vs. Disruptive Innovation*

Mainstream/ Sustaining Innovation	**Disruptive Innovation**
Sustaining innovations object specific high-end customers, those demand better product or a service performance and they are prepared to pay even more for it.	Disrupts the mainstream trajectory by offering a service or a product that is not good enough as the main stream company's products. Disrupters started by appealing to low-end or un-served consumers, and then migrate to the mainstream market.
First mover is not always important.	First mover always gain advantage.
Moves upmarket.	Moves upmarket.
High margin product focus – Always focus on higher ends and even overshoot the performance requirement.	Low margin focus - Focus on developing products and performances that generate lower margins.
Upstream focus - Try to beat the competition by looking at competitors.	Downstream focus - Ignore the incumbents business and target non-served customers.
Pursue large markets with established higher served consumers.	Pursue two types of small markets- Low-end footholds (less-demanding customers) and New-market footholds (entirely new market of non-consumers).
Incumbents listen to their customers try to provide their most demanding, profitable	Looking for new and low-end customers.

and high-end customers with ever-improving products and services.	
Incumbents accelerate their innovations to succeed the market or acquire the entrants to stop disruption.	Strategic choices guided by disruption theory when new technology arrives, either captured by mainstream incumbents.
Higher cost ends products and services	Products are simpler, usually offered at lower prices than mainstream incumbents.
Mainstream customers have their own value network and initially do not respond to disruptors as success is uncertain and project may fail.	It should be set up as a separate business entity, serving new customers and not included as part of the mainstream value network.
Strategy followed is to increase the profit margins. Failure is not acceptable.	Strategy is trial and error. Every disruption does not succeed.

Source: Adapted from Clayton Christensen's book: The Innovator's Dilemma and is presented in tabular form. (Christensen C. M., The Innovator's Dilemma, 1997)

2.2.2 Disruptive Innovation Elements

> *"Disruptive innovation is the process by which a segment that has previously serviced only a limited few, because its products and services were complicated, expensive and inaccessible, is transformed into one whose products and services are simple, affordable and convenient and serves many no matter where the wealth or expertise."*
>
> (Christensen, Horn, Caldera, & Soares, 2011, p. 2)

With disruptive innovation, the product or service doesn't have to perform better than the mainstream technology; it only has to satisfy a need that is currently not being served. Students who want to take their courses online or participate in courses that are more interactive to make better use of online instructional mediums, university need to facilitate their demands; otherwise the students will search for other platforms, MOOCs in this case (Stepan, 2013).

According to Christensen, MOOCs contains two elements or key characteristics of a disruptive innovation. They are: a technology enabler and business model innovation (Christensen C. M., Future of State Universities Conference, 2011).

2.2.2.1 Technology Enabler

According to Christensen, a disruptive product is always at the bottom of the market, and is not usually as demanding as what the leaders are producing i.e. traditional university face-to-face courses, but the products are embraced by the least served customers in the market (Christensen C. M., The Innovator's Dilemma, 1997)

10

> *"Disruption occurs in industries where there is an enabling technology that can scale upward and allow the disruptive entrants to take their low-cost business models up-market."*
>
> (Christensen, Horn, Caldera, & Soares, 2011, p. 27)

The diagram below, adapted from the HBR article by Christensen, Raynor and McDonald shows how Christensen's disruptive innovation model works.

Figure 2.1 *Disruptive Innovation Progress*

Source: Diagram adapted from HBR article of (Christensen, Raynor and McDonald, 2015)

The diagram identifies that gradient of any disruptive trajectory shows how quickly the enabling technology improves. Universities in higher education, replicate the existing models in order to move up-market, replicating the cost structures and formats of the institutions they were trying to match. This is not disruptive. Today, online learning is an enabling technology that does not have to replicate and therefore changes the higher education market (Christensen, 2003). Online learning has the potential to take business model of low-end universities upmarket (Christensen, Horn, Caldera, & Soares, 2011). Considering the rise in the number of students taking online courses, Christensen stated: "in 2003, roughly 10% of students took at least one online course. By 2008, that fraction grew to 25%, was nearly 30% in the fall of 2009 and is projected to rise to 50% by 2014" (Christensen, Horn, Caldera, & Soares, 2011, p. 3).

2.2.2.2 Business Model Innovation

> *"Disrupters tend to focus more on getting the business model, rather than simply the product, just right. When they succeed, their movement from the fringe to the mainstream erodes first the incumbents' market share and then their profitability"*
>
> (Christensen, Raynor, McDonald, 2015, p.48)

Disrupters often build business models different than those of incumbent's players. An example of using an innovative business model to effect a disruption is Apple's iPhone that use innovative business model offered feature of Internet access through mobile back in 2007, thus disrupting laptop as primary access point to internet. This was achieved through the introduction of a new business model, not through product improvements (Christensen, Raynor and McDonald, 2015).

Universities currently try to do everything for everybody with multiple value propositions – research, teaching and preparing students for life and careers and meeting employers high end skill demands (Stepan, 2013). The table below highlights value propositions offered by traditional universities:

Table 2.4: *Multiple Business Models and Value Proposition*

Business Model	Value Proposition	Fee
Solution Shops	Knowledge Creation (Skill)	For service
Value-added Processes	Knowledge Proliferation (Academia)	For outcome measure
Facilitated User Networks	Preparation for life and careers	For membership

Source: Adapted from Disrupting College (Christensen, Horn, Caldera, & Soares, 2011, p. 3 & 33)

Offering all three value propositions results in a costly and extremely complex organizational structure (Stepan, 2013). According to Christensen, in the absence of donations, universities could not exist. Students rarely get to see the research until they reached the PhD level. The significant overhead costs are at the expense of research and teaching. If teaching were separated from research then the overhead costs would be reduced. (Christensen C. M., Future of State Universities Conference, 2011)

Disruptive innovations develop a new model that allows incumbent companies to offer customers increased simplicity and convenience at an affordable cost. Using online mechanism in a new business model based entirely on learning and focused on programs such as skill enhancement, careers development has given a significant cost advantage by several organizations. Further, combining disruptive innovation to an existing business model will not result in a transformation of the model (Christensen, Horn, Caldera, & Soares, 2011).

To follow a disruptive path, there exist a novel technology or business model that allows the new entrants to move upmarket without surpassing the incumbent's high costs structures. The answer to this enabling innovation is online learning, which is becoming broadly available. Costs for online courses are gradually falling and accessibility and quality are improving continuously. Innovators are making their ways into the mainstream market at a stunning pace (Christensen, Raynor and McDonald, 2015)

2.2.3 Are MOOCs a Threat?

The enhanced rate of technological advances has enabled the easy entrance of MOOCs within a very short period of time. This impact will lead to improvements in teaching and will encourage institutions to develop distinguishing missions. MOOCs may lead universities to embrace uniqueness and be less copied (Stepan, 2013).

2.2.4 Limitations of Disruptive theory

Some disruptive innovations succeed while some don't. The theory doesn't say much about how to win in the new market or give any surety about that, the only way is to play the odds and avoid face-to-face competition with better resourced incumbents. A technology might be disruptive to one industry but sustaining to other, for example Uber, is a disruptive innovation to black car business and sustaining to Taxi drivers (Christensen, Raynor, McDonald, 2015).

2.3 Business Model Definition

25 A business model is defined as the value logic of an organization. It tells how it creates and captures customer value and is concisely represented by an interrelated set of elements which address the customer, value proposition, organizational architecture and economics dimensions (Fielt, 2013).

6 *"A business model describes the rationale of how an organization creates, delivers and captures value"*

(Osterwalder and Pigneur, 2010, p. 14)

"A business model defines how the enterprise creates and delivers value to customers, and then converts payments received to profits"

(Teece, 2010, p. 173)

Most of the authors are not very obvious about what they mean with value, but other definitions seem to refer to customer value i.e. value for the customer (Osterwalder and Pigneur, 2010; Teece, 2010). The same technology or idea when taken to the market through two different business models will seem to produce two different economic outcomes (Chesbrough, 2010). Business models are essential because of the market economies features where there is consumer choice, diversity amongst consumers, transaction costs and producers and competition (Fielt, 2013). Business models have gathered significant attention from various disciplines, such as e-business, entrepreneurship, innovation, information systems management, strategy and financial side. (Bouwman and Fielt, 2008; Morris, Schindehutte and Allen, 2005; Teece, 2010; Zott and Amit, 2013). Identifying the compositional elements of a business model makes the business model concept more precise and makes it even appropriate for different purposes and contexts for example, business, strategy and innovation (Fielt, 2013).

2.3.1 Components of Business Model

Compositional elements are closely related to the business model definitions describing the made-off of a business model. The elements are also referred to as, for example, building blocks, components or functions (Osterwalder & Pigneur, 2010). Business model frameworks not only define the elements, they also define the relationships between them (e.g., Gordijn et al., 2005).

The most well-known and widely used framework is the Business Model Canvas (Osterwalder & Pigneur, 2010). The Business Model Canvas is presented as a landscape for depicting changes in the business models. In this framework, the elements are grouped into four categories: customer interface (segments, relationships and channels), product (value proposition), infrastructure management (activities, resources, and partners) and financial aspects (revenues and costs) (Fielt, 2013). The Four-Box Business Model and the Business Model Canvas have so many similarities. In latter framework, the elements included are: customer value proposition (Job-to-be-done, offering), profit formula (revenue model, cost structure, target unit and resource velocity), Key resources and key processes (behaviors

and success metrics) (Johnson, 2010). The main difference between the Business Model Canvas and the Four-Box Business Model is that the first has a customer pillar while the second does not have a separate customer box, but covers customer aspects to some extent in the value proposition box. The framework overview shows that there are significant similarities in terms of the elements that can be used to represent how an organization creates and captures customer value (Fielt, 2013).

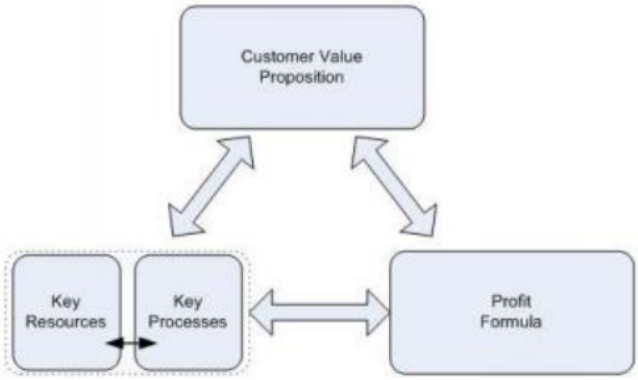


Figure: 2.2 *Four-Box Business Model Framework*

Source: Diagram adopted from Business Model Innovation: Review of The Concept, Importance, Classifications, and Elements (Alibage and Ahn, 2018, p. 21)

The term "business" in the business model was developed in the context of for-profit businesses. Now it is applied to any type of organization, be it a for-profit, a non-profit, a governmental or any other organization. There are many frameworks of business models, a simple business model that comprises of three components which appear in almost every version are described (Kalman, 2014).

Table 2.5: *Generalized Business Model Components*

Business Model Component	Description	Examples taken from Institutes of Higher Education
Customer Value Proposition	The characteristics and needs of the organization's customers, and the way these needs are met	The needs of full-time students are met differently at traditional universities than the needs of part-time students at open universities.
Infrastructure	The resources and processes of the organization	Physical resources are lecture halls and laboratories, human resources include faculty and administrative staff. Processes include student enrolment, quality assurance and fund raising.
Financial	The financial principles according to which the organization operates	Fixed and variable costs, sources of income (tuition, external funding, contributions), profit margins and pricing.

Source: Reproduced from A race to the bottom: MOOCs and higher education business models (Yoram M. Kalman, 2014, p.7)

2.3.1.1 Customer Value proposition

The main task is of how to create and capture value in the face of a changing business environment. Different frames emphasize different aspects of the same problem i.e. value creation and proposition. Generating revenues and managing relationships depend deeply in creating value in the unsettled Digital Economy (Fielt, 2013).

The first and most important component is the customer value proposition which includes the characteristics of the organization's customers and their needs, and the way these need i.e. how the organization creates value for the customer (Kalman, 2014).

A comparison between the customer value propositions of traditional universities with that of open universities provides an inner insight. Traditional universities in Western countries typically offer their students a program that enables them to complete the bachelor's degree in three to four years in an environment that facilitates social activities, opportunities, societal involvement and part-time employment etc. In contrast, the value proposition at an open university is more in line with students who wish to combine full-time employment and higher education by a variety of other types of students who are not well served by the traditional institutions (Kalman, 2014).

2.3.1.2 Infrastructure

The second component of the business model is the organization's infrastructure. Infrastructure is divided into resources and processes. A university's resources include the building structure, lecture halls and classrooms, research laboratories, offices, faculty, administrators, IT infrastructure etc. Resources are not necessarily physical, for example, a university's reputation is one of its most important resources. Processes at a university could include student registration and enrolment, research funding, budget control, quality control, course approval, hiring and promotion, and hundreds of other processes (Kalman, 2014). The commodity Internet and programming assets create the infrastructure for MOOCs (Baker and Passmore, 2016).

2.3.1.3 Financial Analysis

The third component of the business model is the financial component which describes profit margins and revenues generated. This can include pricing, fixed and variable costs, income sources etc. (Kalman, 2014). Variable costs depend on an organizations product or a service delivery i.e. customers serve. For example, variable costs include components such as the cost of bandwidth and processing power consumption of MOOC participants. Other is fixed costs, which comprises of the initial costs required by the organization for installment of new business model or strategy. For example, in the case

of MOOCs, the fixed costs include cost of time dedicated by academic and technical staff to develop and to maintain the course. VCM describes a situation where in the variable costs are minimal to almost zero, thus called variable costs minimization (VCM) because the difference between serving a small or a large number of customers is negligible (Belleflamme and Jacqmin, 2015).

Revenue streams for MOOCs evolve as organizations offer information about how MOOCs add value to fulfill investor's requirements and student's educational needs for financial returns (Baker and Passmore, 2016).

2.3.2 MOOCs Business Model

MOOCs, commonly advertised as free to students, there is no such thing that is completely free, actually they are subsidized heavily by universities and venture capitalists. The disruptive nature of MOOCs could threaten the very roots of the business model that directs most higher education institutions. MOOCs business model comprises of five possible value propositions with pricing strategies associated with these value propositions (Baker and Passmore, 2016).

2.3.2.1 Value Propositions for MOOCs

A business model starts with a value proposition that offer a supposition of benefits that will result from a good or service purchased. The following five value propositions provided by MOOCs are presented in tabular form for reader's facility.

Table 2.6: *Value Propositions for MOOCs*

Value Propositions for MOOCs	Description
Headhunting	MOOCs offer services to employers that provide information about skills of MOOC students. Both students and employers might have an incentive to pay for this service. For example, Coursera announced an employee-matching service, called Coursera Career Services in 2012.
Certification	A number of MOOCs providers offer certificates of completion for MOOC courses. In 2014, Penn universities offered academic credit for MOOC completion.
Premium Learning Services	Face-to-face courses might attract MOOC participants who want opportunities to supplement their MOOC experience with interaction with an instructor. MOOC participants might want matchmaking services that create networks among like-minded or geographically co-located MOOC participants.
External Services	MOOC developers could license MOOC technology to alter and brand MOOCs for their own good. Another possibility is the mining of information from MOOC operations for use in other markets. Branding rights could be a strong value proposition that MOOCs could offer.
MOOC data use for Marketing	A common thinking among many university MOOC providers and designers is the application of MOOCs to market higher education institutions.

Source: Adapted and produced in tabular form from Value and Pricing of MOOCs (Baker and Passmore, 2016, p.5)

2.3.2.2 Pricing Strategies for MOOCs

Following are the pricing strategies coupled with value propositions of MOOCs.

Table 2.7: *Pricing Strategies for MOOCs*

Pricing Strategies for MOOCs	Description
Cross-subsidy	This strategy follows reallocation of funds. For instance, funds earned through a university's revenue generating academic program or other services are primarily used to establish and operate a university MOOC.
Third-Party	Neither MOOC operators nor MOOC participants have any or all costs but a third party covers some or all costs. For example, AT&T provided subsidy to Georgia Institute to team-up with Udacity in 2013 to deliver an online master's degree in computer science.
Freemium	In this approach, one product is provided at no price to customer while the other product, one that complements the free product, is sold at a price. For example, MOOC enrollment is free but to receive premium services i.e. face-to-face classes, to contact with an instructor, the participant must pay.
Non-monetary	MOOC participation is without any monetary return expected. As, Red Cross might offer a MOOC for free that teaches principles of first aid. The Red Cross would not benefit directly but Red Cross would pay the costs of MOOC operation and recipient parties derive benefits, not the Red Cross.

Source: Adapted and produced in tabular form for user facility from Value and Pricing of MOOCs (Baker and Passmore, 2016, p.6-7)

2.4 MOOCs, HEC, Graduate skills and Employability

Nowadays college graduates face a dynamic and demanding job market; in which they encounter an evolving skill needs, reduced hiring, and increasing competition among workers. Higher education can be looked upon for development of knowledge, skills, and expertise. Possession of these attributes can replace what today's college graduates might

have with one that greets and utilizes them fully (Eisner, 2010). Rapid and drastic changes are creating higher demands for employability skills in the workforce nowadays in this era of economic and technological growth. Labor market is becoming more and more competitive and depends on quality of knowledge and skills as the globalization come across in all industries. The employers generally have high expectations with fresh engineering graduates to perform well in their organization as soon as they are hired. Engineering employability skills are therefore necessary worldwide to remain competitive in the global market (Zaharim et al, 2009).

Employers expect graduates to have the technical competences from their degrees, but lso require graduates to demonstrate a range of broader skills and attributes that include team-working, communication, leadership, creative thinking, critical thinking, problem solving and often managerial abilities or potential. Above all, the literature has highlighted the importance of internships, placements and work-based learning opportunities as an effective way of providing university students with relevant employment skills. Knowledge and awareness of employer culture is also required. Apart from numerous initiatives among employers and higher education to promote employability skills, there are still barriers and issues particularly in terms of differences in mindset, expectations and priorities. There lies some frustration from employers about courses not meeting their needs. However, there's no clear evidence why higher education and employers cannot reach a consensus on educational measures that promote employability (Lowden et al, 2011).

Personal growth and enrichment, relevance to job, and career change were the top reasons for working professionals to enroll in MOOCs (Liu et al, 2019). With the proliferation of MOOCs since 2012, there emerges some interest among companies to examine whether MOOCs could help reduce the gap in skills of their newly recruited university graduate employees. Further, they have attracted the attention of educators and have raised hopes of change in higher education. MOOCs, through their accessible and flexible foundation have the potential to bridge the graduate skills gap as they offer on demand affordable education (Christensen & Alcorn, 2013). Calonge and Shah (2016) have found that MOOCs have a positive impact on graduates' and employees skills development. MOOCs are becoming

clear worldwide stakeholders in enhancing opportunities, both for new seekers of employment, as well as corporations seeking skilled personnel's (Calonge and Shah, 2016).

HEC is revamping education to ensure that students get a useful, meaningful, and practical education, which increases the likelihood of their success. The objective of revamping is to provide Competence-Based Education (CBE), which comprises the following four measurable aspects as stated by (HEC report, 2020, p.2-3):

- Knowledge, based on facts and principles of a particular field.
- Skills, which is the ability to perform physical or mental activities in a particular profession; as well as to think critically and creatively.
- Behavioral attributes, which include characteristics like adaptability, curiosity, honesty and punctuality.
- Interpersonal qualities that include self-confidence, empathy, leadership, and collaboration.

The revamping aims at preparing students to apply the acquired knowledge and skills to life's challenges, rather than just acquiring theoretical knowledge. It emphasizes exploration, curiosity, discovery, and creativity amongst students (HEC report, 2020, p.2-3)

HEC worked tirelessly in the Covid-19 pandemic to minimize academic disruption, develop and guide universities to acquire online readiness, provide supplementary resources of Rs.1.20 billion to institutions, deploy live dashboard to monitor quality of online delivery, build free online academic content and resources, motivate students to continue learning and usage of platforms such as virtual think tanks to carve out imaginative solutions. Efforts are being put up by HEC to resolve connectivity issues faced by students (HEC 36th Online Commission Meeting, 2020, p.4).

2.5 Relation between Variables

Using Four-Box business model, the following are the requirements for the customer value proposition as identified by (Alibage and Ahn, 2018):

- Target Costumer: Specify who the customers of the company are; what their wants, needs, desires, are etc. The customers included are Managerial Employees and Students.
- Offering: What is fulfilling the need? It involves quality of the product i.e. skill required by the customers to enhance their value.
- Job to be done: To solve an important problem for the target customer. It makes sure the availability of the required product by the firm.

Christensen mentioned multiple business models namely solution shops, processes and user networks as presented in Table 5 of section 2.2.2.2. The research utilizes Christensen's "Solution-Shop" model, the basic purpose of which is knowledge creation and proliferation for convenience to customers. In case of university, those customers are the ones that are directly benefit from them i.e. Students and Employers. MOOCs platforms formulate such strategies that attract students and prepare them with knowledge based education to boost career and to be able to compete in the working environment. Derived are the variables from Christensen's business model named solution shop value propositions from Disrupting College (Christensen, Horn, Caldera, & Soares, 2011, p. 3 & 33) and what is Disrupting Innovation? (Christensen, Raynor and McDonald, 2015, p. 48).

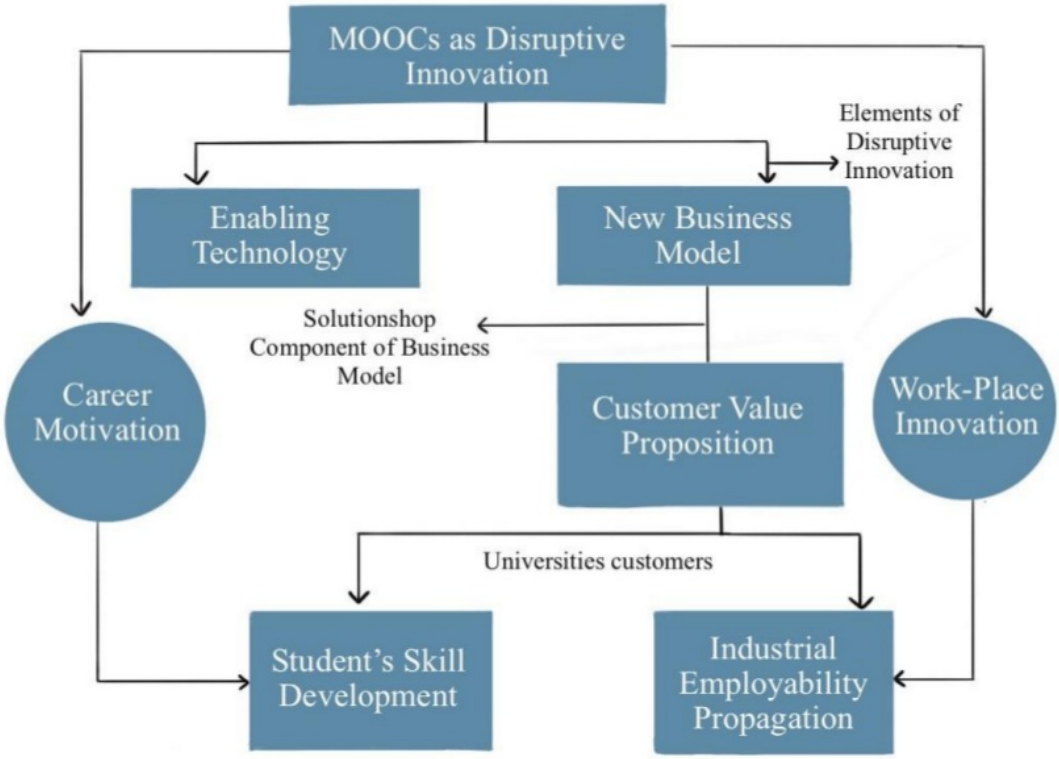


Figure: 2.3 *Schematic Diagram of MOOCs Impact on Business Model in Engineering Universities*

2.5.1 Relationship between MOOCs, Career Motivation and Skill Development

Many researchers have studied student's motivation in enrollment to MOOCs programs. The varied motivations to enroll in MOOCs include interest in knowledge, curiosity, entertainment, recognition, and professional relevance (Chen et al, 2019). Apart from curiosity and gaining basic knowledge, majority of enrollments in MOOCs counter for career building, career planning, career change, professional development, relevant to job, gaining new skills, gaining skills related to job, relevance to current role and relevance to future career (Hew and Cheung, 2014; Kizilcec and Schneider, 2015; Loizzo et al, 2017;

Milligan and Littlejohn, 2017). Some of the motivational characteristics of MOOC learners are explained (Barak, Watted and Haick, 2015).

- Problem-solvers: They are individuals motivated by the desire to solve real scientific and engineering problems that they have encountered at the work place.
- Networkers: Their motivation is to be a part of community of people with similar interests, desires and expertise in order to collaborate with them to share ideas and gain valued suggestions and knowledge.
- Benefactors: They are the well-wishers of the society and the country whose motivation is to bring advancement through knowledge gain.
- Innovation-seekers: These are the ones who always looked forward for learning something new, to innovate and create novel things and to be informed about the latest trends prevailing in the market regarding technology and innovation.
- Complementary-learners: Mostly students are motivated by the desire to deepen their knowledge in curriculum and build up new skills.

Professional career development by learning new skills lies among the main reasons for student's devotion towards MOOCs (Christensen et al, 2013). MOOCs made some contribution to the capabilities of students to write clearly, analyze quantitative problems and think critically. Among professional development the main focus lies on learning technical skills, speaking skills may not lie among the specialty of MOOCs but they do contribute in bringing up writing skills. Future preparation is the career motivation that includes impressing the potential employers to secure positions in the well renowned organizations (Zheng et al, 2015).

Figure: 2.4 *Theoretical Framework 1 (Student's Value Proposition)*

H1= MOOCs have a positive relation with Student's Skill Development.

H2= Career Motivation will strengthen the relationship between MOOCs and Student's Skill Development.

2.5.2 Relationship between MOOCs, Work-Place Innovation and Employability Propagation

Innovativeness is a cultural trait that can be characterized by the flexibility placements in the model of organization, with a focus on creativity, dynamic behavior, entrepreneurship and adaptability. An innovative organization is open to uniqueness among its employees and supports all innovative traits. The company that emphasizes innovativeness supports a fully creative and dynamic environment (Chang and Lin, 2007). For an organization to improve its innovation capacity should encourage higher level of creativeness. Creativeness help firms to solve their problems related to knowledge creation and absorptive capacity. Creativity involves generation of novel ideas, products and more. Research suggested for an organization to become innovative should emphasize on variables such as quality of ideas, technology strategies, acquisition and manipulation (Skerlavaj, Song and Lee, 2010).

Many learners are using MOOCs for employment can be categorized into following by (Dillahunt et al, 2016):

- Those learners who are looking for a refresher in their current job or area of work;
- Learners looking to be promoted and get benefit in their current field or job;
- Learners that are looking for new positions in their current fields or jobs to have a career plan;
- And those transitioning to new fields.

Many learners use MOOCs for employment for the following benefits as indicated by (Dillahunt et al, 2016):

- Easy to access resources;
- Improve their expertise and skills in their current lines of work;
- Enhance their credibility;
- To better understand the processes and operations of their existing workplace.

MOOCs provide some support for social capital, career identity and personal adaptability. MOOCs medium of knowledge emphasis its learners to learn new traits in their specified domains, built their critical and analytical thinking. The workforce in the 21st century demands graduates to be equipped with a number of skills and attributes along with high academic qualifications as represented by the subject and degree class. The employer's demand indicates that only occupation-specific skills are not just sufficient for graduates, rather they prefer to hire graduates who can manage change and bring creativity. They preferred flexible and adaptable workers who are quick to learn and fit in changing circumstances. Now-a-days graduates' attributes are labeled as more important than the graduates 'degree subjects. Some important attributes of employability skills include communication skills, problem-solving and decision-making skills and collaborative or teamwork skills. In addition, graduates are also expected to have a number of personal attributes which includes: self-confidence, self-awareness, emotional intelligence, flexibility and adaptability, creativity and implementation, willingness to learn, positive response, stress tolerance, lifelong learning, independence and professional behavior (Suarta et al, 2017).

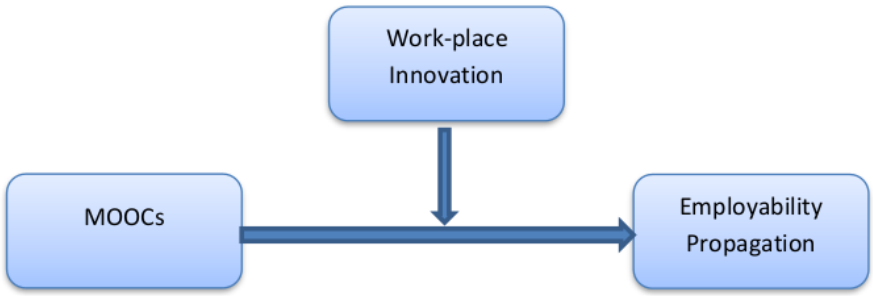


Figure: 2.5 *Theoretical Framework 2 (Industrial Value Proposition)*

H3= MOOCs have a positive relation with Employability Propagation.

H4= Work-place Innovation will strengthen the relationship between MOOCs and Employability Propagation.

CHAPTER 3

METHODOLOGY

In previous chapter, literature review associated with MOOCs, business model and theory of disruptive innovation has been studied. This chapter is concerned with derivation of current patterns in the study with the help of methods, design and approach used for data collection and following data analysis. The selected population and sample size of the study is also mentioned in this chapter.

3.1 Research Philosophy

The term research philosophy refers to a system of views and assumptions about developing knowledge in a particular field (Saunders, Lewis and Thornhill, 2009). For the study, the approach of "positivism" is utilized. Positivism constitutes scientific methods, observable and measurable facts, law-like generalizations, underlying explanation and prediction as contribution (Saunders, 2009). A methodology that needs to be adopted in case of positivism philosophy should be highly structured involving hypotheses testing and statistical tools i.e. a quantitative method.

3.2 Research Approach

If research starts with a theory that often developed from reading the academic literature, and research strategy is designed to test the theory then it is called a deductive approach (Saunders, 2009). Deductive reasoning occurs when the conclusion is derived logically from a set of premises, the conclusion needs to be true when all the premises are

true (Ketokivi and Mantere 2010). The study is based on deductive approach as it utilized Theory of Disruptive Innovation (Bowell and Christensen, 1995).

3.3 Research Duration

It's a cross-sectional descriptive study. The practicality of things is determined in descriptive research. This study decision was made because of the fact that this study involves observations as a mean of collecting data to test hypotheses. The duration of the study was six months from 15th February to 15th August, 2020.

3.4 Data Collection

Data is collected by the following techniques:

3.4.1 Research Design

The research design explains how data will be collected and among which population. A descriptive and quantitative approach will be used for answering research questions. Data collection tool i.e. questionnaire will be used for collecting primary data for the research questions.

3.4.2 Research Area

The research was conducted in firms with IT/Engineering departments and Engineering universities of Federal Capital of Pakistan and Punjab Province.

3.4.3 Research Population

The questionnaire was distributed to managers of IT/Engineering departments of different companies involved in the hiring process of graduates, and students of engineering universities enrolled in any engineering discipline. A descriptive note was written on the

front of the questionnaire that describes research purpose, its aims and objectives and significance. Written consent was also there for confidentially of the respondents.

3.4.4 Sample Size

Sample size was measured with the help of Power and Precision v4 tool. The correlation r among reference research found to be 0.23 (1-tailed) (Chang and Lin, 2007). At alpha=0.05, with 95% power, the number of cases calculated are N= 200 (Appendix B).

3.4.5 Sampling Technique

Random sampling technique was used for collecting data from managers and students. Questionnaire was developed on the Microsoft forms and link was shared through e-mail and social media apps to respective population with a deadline of one month. Reminders were sent thrice for collecting the calculated sample size.

3.4.6 Inclusion and Exclusion Criteria

3.4.6.1 Inclusion Criteria

- Managers/ Team Leads involved in hiring or formulating job design for employee recruitment.
- Students must have done internship in any industry to have an idea of work-place skills.
- Managers and Students who are familiar with MOOCs.

3.4.6.2 Exclusion Criteria

- Managers who were not part of the employee recruitment.

- Students who did not have done any internship or have any experience of work-place.
- Managers and Students who are not familiar with MOOCs.

3.4.7 Variables of the Study

Following are the variables included in the research:

Table 3.1: *Independent, Dependent and Moderating Variables*

Independent Variable	Dependent Variable	Moderating Variable
MOOCs	Employability Propagation	Work-place Innovation
	Students Skill Development	Career Motivation

Independent variable is MOOCs while dependent variables are derived from business model component i.e. customer value proposition, which will measure MOOCs impact on university business model. Work-place Innovation act as a moderating variable among MOOCs and Employability propagation, whose basic purpose is to strengthen the relationship between independent and dependent variable. Career Motivation is a moderating variable for MOOCs and Students Skills Development; it has a direct effect on both the variables of Model 1. It also describes the strength of association among the predictor and outcome variable.

3.4.8 Data Collection Tool

The instrument used for collecting data was a structured questionnaire comprised of close ended questions. The survey questionnaire consists of series of questions based on respective variables, adapted from surveys for gathering information from respondents.

Following are the research instruments used for this study:

- Science Motivation Questionnaire II (Glynn et al, 2011). This questionnaire was used for having Career Motivation Questions (CMQ). Career motivation act as a moderator among MOOCs and Students skill development. This questionnaire has five variables to measure student's motivation in science, namely intrinsic motivation, career motivation, self-determination, self-efficacy and grade motivation. The variable deal with the study was career motivation. It has 5 items with factor loadings 0.84, 0.84, 0.82, 0.76 and 0.57 respectively. The items were modified according to the research topic. It has more influence in measuring student's motivation towards career than any other motivational survey.
- Exploring Organizational Culture Questionnaire (Chang and Lin, 2007). Work-place Innovation Questions (WIQ) was derived from this survey questionnaire. It has 4 factors namely cooperativeness, innovativeness, consistency and effectiveness. Innovativeness described the work-place culture and its impact on hiring process was comprised of 6 items with alpha value of 0.892. Items were adopted with a slight change in wording to fit the research model. Work-place Innovation worked as a moderator among MOOCs and Employability Propagation.
- MOOC Analysis Survey (Venkatesh, 2014). The independent variable MOOCs Questions (MQ) was derived from this survey. The questionnaire has 11 questions among which 6 questions were adapted. The rest of the questions were removed because of difficulty in understanding among respondent and outdated content with advancement in the phenomena.
- Student Engagement in Online Learning Survey (Robinson and Hullinger, 2010). Model 1 dependent variable namely Students Skill Development Questions (SSDQ) was adapted from this survey. The survey measures student's engagement in online learning with the help of four factors namely level of academic challenge, student-faculty interaction, collaborative and active learning and enriching educational experience. The academic challenge factor measures mental activities and skills development. Total 7 items were modified according to advancement in online learning to gauge the impact of MOOCs in development of skills among students.

- Graduate Recruitment Survey (Carless, 2007). Model 2 dependent variable Employability Propagation Questions (EPQ) was obtained from graduate recruitment survey. The survey was done for assessing the recruiting strengths. The survey was conducted in Australia with total of 13 strengths, 6 matches with the research content. Upon testing validity further 1 item was dropped from the variable. So 5 items used to measure the current phenomena of hiring going on in the industry.

3.4.8.1 Instrument Design

The adapted questionnaire was separated into two parts.

- Section A: This portion of the questionnaire includes Model 1 items. It has total of 23 questions with 5 demographics questions (Gender, Age, Qualification, Institution and Engineering Branch) and 18 variables questions (MQ, CMQ, SSDQ). Engineering students were directed to fill this section (Appendix C).
- Section B: This part of questionnaire was distributed to Engineering Managers and has items of Model 2. This portion has total of 23 items among which 5 are demographic questions (Gender, Age. Qualification, Nature of Company and Company Background) and the remaining 18 measure the relationship between the variables (MQ, WIQ, EPQ) (Appendix C).

3.4.8.2 Measurement of Questionnaire

The questionnaire was then tested for validity and reliability.

A. Reliability

Reliability indicates the consistency of a measure in the dataset. For measuring the instrument reliability, Cronbach's Alpha of every variable is calculated. It tells how strongly correlated are the items of a variable. The acceptable Cronbach's Alpha value is 0.7-0.9 (Andy Field, 2009).

Table 3.2: *Measurement of Reliability*

Variables	Cronbach's Alpha	Number of Items
MOOCs (TFW1)	.744	6
MOOCs (TFW2)	.741	6
Student's Skill Development (SSD)	.801	7
Employability Propagation (EP)	.814	6
Career Motivation (CM)	.726	5
Work-place Innovation (WI)	.768	6

The items of MOOCs have a Cronbach's Alpha value of 0.744 among its 6 items. There were 7 items of Students Skill Development with an alpha value of 0.801 which shows that the items used for measuring the variable are highly reliable. The alpha value for Employability was calculated to be 0.814 showing highly correlated items. Career Motivation has 5 items with 0.726 alpha values and Work-place Innovation has 6 items with an Alpha value of 0.768 showing good reliability among items of the respective variable.

B. Validity

Validity defines whether the instrument measures the variables accurately for what they are intended to measure. Exploratory Factor Analysis (EFA) was done for finding the validity of the questionnaire. KMO test was performed for assessing the sample size adequacy and Bartlett's test signifies the strength of relationship between the variables i.e. variables are related to one another for performing a significant EFA. If the KMO values lies above 0.5, the sample size is considered appropriate. 0.5-0.7 KMO value is considered moderate, 0.7-0.8 good, and above 0.9 shows that the sample size is excellent. Bartlett test provide a chi-square value that should be significant i.e. the value is not more than 0.05 (Chan and Idris, 2017).

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Table 3.3: *Results of KMO and Bartlett's Test*

Variable	Kaiser-Meyer-Olkin Measure of Sampling Adequacy	Bartlett's Test of Sphericity		
		Chi-Square	Df	Sig.
MOOCs (MQS)	0.688	242.69	15	0.000
MOOCs (MQE)	0.698	269.37	15	0.000
Skill Development	0.675	378.34	21	0.000
Employability Propagation	0.690	318.42	10	0.000
Career Motivation	0.745	176.52	10	0.000
Workplace Innovation	0.752	198.48	15	0.000

The KMO value for independent variable MOOCs and dependent variables Students Skill Development and Employability propagation are close to 0.7 while the moderator values lie above 0.7 which means that the sample size is good.

Principle Component Analysis (PCA) is the extraction technique most commonly used which considered all the available variances. Researchers need to start with this technique and then follow up with Principle Axis Factoring (PAF). The factor loadings from PCA and PAF are almost the same, importance is of rotation performed regardless of the extraction technique or factoring method (Yong and Pearce, 2013; Tabachnick and Fidell, 2007).

Rotation clearly differentiate factor loadings which facilitate interpretation, the type of rotation applied is orthogonal rotation. Orthogonal rotation assumes that the variables are not correlated. Factor loading of each item was calculated and it was greater than 0.5. There found a problem in EPQ2 factor loading as shown in table below.

Table 3.4: *Rotated Component Matrix[a] of Employability Propagation*

	Component	
	1	2
EPQ1	.594	.195
EPQ2	-.015	.874
EPQ3	.765	-.146
EPQ4	.619	.365
EPQ5	.704	.362
EPQ6	.844	.206

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 3 iterations.

Item EPQ2 was then removed to obtain the corrected factor loadings.

Table 3.5: *Corrected Loading of Employability Propagation*

Component Matrix[a]	
	Component
	1
EPQ1	.671
EPQ3	.811
EPQ4	.644
EPQ5	.756
EPQ6	.751

Extraction Method: Principal Component Analysis.
a. 1 component extracted.

The factor loading for each item is given in Appendix C. Factor loading from above table shows a strong correlation among the items of particular variables. Communalities are the variable's variances that are extracted from the factors given in table 3.6.

Table 3.6: *Communalities of Variables*

	Initial	Extraction
MOOCs (MQS)	1.000	.661
Student's Skill Development	1.000	.753
Career Motivation	1.000	.717
MOOCs (MQE)	1.000	.672
Employability Propagation	1.000	.770
Workplace Innovation	1.000	.671

Extraction Method: Principal Component Analysis

In PCA, communalities are the sum of the squared factor loadings. Average Variance Extracted (AVE) was also calculated for the variables that are above the value of 0.5 thresholds which are acceptable. The factor loadings and AVE values proves the convergent validity which states how closely indicators are related to their respective variables (Chan and Idris, 2017).

Discriminant validity states how much variables are different and uncorrelated from each other. The square root of average should be greater than the inter-construct correlations. One of the methods is to examine the factor correlation matrix. Correlation between factors should not exceed 0.7 i.e. 49% shared variance (Gaskin, 2016). The observed values in factor correlation matrix were less than the threshold of 0.7. The factors load only on their specific variable and no cross loadings observed. This proves evidence about the discriminant validity as well.

Face validity is quite simple which states that the variables which are similar in nature load together on the same factor (Gaskin, 2016). One can generally look into the factors and if they do make sense and their nature matches with the other variables of the same factor, then it confirms that the questionnaire measures the variables for which it is designed.

All the above validities namely, convergent, divergent and face validity proves the construct validity. Hence the questionnaire used for the research is a valid tool.

3.5 Data Analysis

After three reminders, the total responses obtained in a month were 272 for employers and 304 for students. Based on exclusion criteria, those who were not aware of MOOCs were eliminated from both managers and students sections. Among 272 manager responses, 60 were found unaware of the MOOC learning and their impact on employee's performance. Upon excluding those, 212 responses was left, which will be further analyzed for finding the results.

304 responses were collected from engineering students. Among them, 48 students were not familiar with MOOCs, 12 students were not having any internship or work experience and 11 were neither familiar with MOOCs nor have done internship. Eliminating these responses 233 responses were left which will be used for finding the impact of MOOCs on student's value proposition.

3.5.1 Data Analysis Plan

- After checking the validity and reliability of the questionnaire, IBM SPSS version 26 has been used for carrying out results and obtains diagrams.
- In the first step, input data will be explored for any missing values and outliers, and then calculate demographics descriptions.
- Frequency tables and bar graphs will estimate MOOCs impact on Employability propagation and Students Skill Development.
- Correlation and Regression tests will analyze the relation among variables and influence of interaction term on predictor and outcome variables respectively.

3.6 Ethical Consideration

- Consent of participants (where required) is obtained before sending them survey to answer the mentioned questions.

- All queries of respondents were resolved throughout the period of data collection, responded to their emails, and will share results with those who demanded.
- Professional decency was maintained with assurance of societal norms.

CHAPTER 4

RESULTS

In the previous chapter, the data was collected from Engineering/IT managers and Engineering students from various organizations and institutions of Federal Capital territory and Punjab Province. This data is analyzed by eliminating the false and forged responses. SPSS version 26 is then used for obtaining the results for the hypotheses.

4.1 Theoretical Framework 1 (Student's Value Proposition):

This TFW was designed for analyzing the impact of MOOCs on Student's Skill Development. Career motivation acts as a moderator among the independent and dependent variables.

4.1.1 Exploring Data

In the first step, data is explored for any missing values, outliers and for finding normality.

4.1.1.1 Missing Values

Frequency distribution is checked for finding missing values in the data. Total valid entries come out to be 233 and Missing values 0. This provides evidence that there are no missing values in the data set.

4.1.1.2 Outliers

Normality test is executed to check how much data is spread out and if there are any outliers present in the data. Outliers are very different scores than the rest as they bias the mean and increase the standard deviation. There are possible two-ways to check outliers i.e. draw boxplots or find z-scores (Andy Field, 2009). Each variable is explored; boxplot shows the exact location for the outliers. In SSDQ, case 31, 136 and 174 have some outliers; in MQS a case holds double entry. Upon finding all above, the data will further be explored for normality after descriptive analysis.

4.1.2 Descriptive Analysis

Descriptive test is performed first on the data, mean and standard deviation of demographics and variable items is calculated. Frequency of occurrence and percentage is also analyzed.

4.1.2.1 Descriptive Statistics

Below are the values for the demographics, dependent, independent and moderating variables descriptive statistics, mean calculates the average value of data occurrence, median calculates the mid-value and mode is repetition of data i.e. the highest value, standard deviation shows model fit i.e. how much the data deviates from the mean value.

Table 4.1: *TFW1 Descriptive Statistics*

	N	Minimum	Maximum	Mean	Std. Deviation
Gender	233	1	2	1.45	.498
Age	233	1	3	2.16	.564
Qualification	233	2	4	2.61	.538
Institution	233	1	4	2.15	.998
Engineering Branch	233	1	10	4.55	2.684
MQS	233	2.67	4.17	3.5544	.37702
CMQ	233	2.40	4.40	3.5227	.44937
SSDQ	233	2.57	4.43	3.5451	.45147
Valid N (listwise)	233				

The mean shows observed age of respondent lies in between 20-40 years. Most respondents are enrolled in BS and MS degree programs in different institutions with specific engineering domains. The main variables mean and descriptive statistics are also mentioned in the above table.

A. Gender

Frequency statistics of gender of the students are given in the table below:

Table 4.2: *TWF1 Frequency Table of Gender*

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	129	55.4	55.4	55.4
	Female	104	44.6	44.6	100.0
	Total	233	100.0	100.0	

Among 233 respondents, more than half i.e. 129 (55.4 %) are male students and 104 (44.6%) are female students.

B. Age

Frequency statistics of age of the students are given in the table below:

Table 4.3: *TFW1 Frequency Table of Age*

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	less than 20	21	9.0	9.0	9.0
	20-29	153	65.7	65.7	74.7
	30-39	59	25.3	25.3	100.0
	Total	233	100.0	100.0	

In the research a large number of students found to be in between age 20-29 years with frequency of 153 (65.7 %). Rest 80 (34.3%) is either below 20 or more than 30 years of age. No student is observed above 40 years of age in the data set.

C. Degree Enrolled

Statistics show that students belong to different degree programs responded to the questionnaire. The table below shows their frequency:

Table 4.4: *TFW1Frequency Table of Qualification*

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	BS	96	41.2	41.2	41.2
	MS	131	56.2	56.2	97.4
	PhD	6	2.6	2.6	100.0
	Total	233	100.0	100.0	

Demographics show that highest numbers of respondents are master's level students with total of 131 (56.2%) students in the data set. BS students constitute the second majority of 96 (41.2 %). Only 6 (2.6%) belongs to PhD program.

D. Institution

Frequency statistics finds that students were enrolled in different types of institutions as shown below:

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***Table 4.5**: TFW1 Frequency Table of Institution*

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Public	88	37.8	37.8	37.8
	Semi-Public	36	15.5	15.5	53.2
	Local Private	96	41.2	41.2	94.4
	Local Foreign Private	13	5.6	5.6	100.0
	Total	233	100.0	100.0	

The table shows the institution of the students they are currently enrolled. 96 (41.2%) of students are from private institutions that respond to the survey. 88 (37.8%) belong to public sector institutions while the rest 49 (21.1%) are from semi-public and local foreign private organizations.

E. Branch of Engineering

Responded students belong to several different branches of engineering as given below:

Table 4.6: *TFW1 Frequency Table of Engineering Branch*

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Electrical	43	18.5	18.5	18.5
	Mechanical	25	10.7	10.7	29.2
	Civil	9	3.9	3.9	33.0
	Software	43	18.5	18.5	51.5
	Computer	36	15.5	15.5	67.0
	Electronics	21	9.0	9.0	76.0
	Telecom	27	11.6	11.6	87.6
	Mechatronics	8	3.4	3.4	91.0
	Other	21	9.0	9.0	100.0
	Total	233	100.0	100.0	

A large majority of students i.e. 43 (18.5%) are from Electrical and Software background. 25 (10.7%) from Mechanical, 9 (3.9%) from Civil, 36 (15.5%) from Computer, rest 77 (33%) are from Electronics, Telecom, Mechatronics and other background.

4.1.3 Inferential Analysis

After descriptive analysis, inferential analysis is performed to find correlation and regression among the variables. The normality tests are performed on variables to find that the data is normally distributed.

4.1.3.1 Normality Test

Normality of variables is necessary to observe before testing the variables relation. The above found outliers are transformed to obtain normal statistics. Normality statistics of the study are shown in the table. It contains the mean and the standard deviation of the study variables. The mean is the average value i.e. average response from the respondents shown in the table, while standard deviation is the difference form the mean value. The table shows that students are slightly satisfied with their skills development through MOOCs. Career motivation is also high among students.

Table 4.7: *TFW1 Normality Statistics*

	N	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
MQS	233	3.5544	.37702	-.463	.159	-.006	.318
CMQ	233	3.5227	.44937	-.535	.159	.254	.318
SSDQ	233	3.5451	.45147	-.108	.159	-.547	.318
Valid N (listwise)	233						

The last two columns of the table show the value of skewness and kurtosis for the data set. According to Andy fields, the value of z-score should not be greater than 1.96 (positively and negatively) for data less than 200, and for data greater than 200, the z-score should be less than 2.58 (Andy Field, 2009). The z-score is obtained by dividing the statistical value with the standard error. The obtained z-scores from the above table for different variables of the model are 0.02, 0.79 and 1.72. All the scores lies within range, hence the data is normally distributed. We can further analyzed normality by drawing histograms, normal Q-Q plots and boxplots (also known as box whisker plots).

Histograms are a good approach to spot the problems in the data. The histogram bar shows how many times a certain value occurred in a data set (Andy Field, 2009). Figure shows the histogram for Students Skill Development.

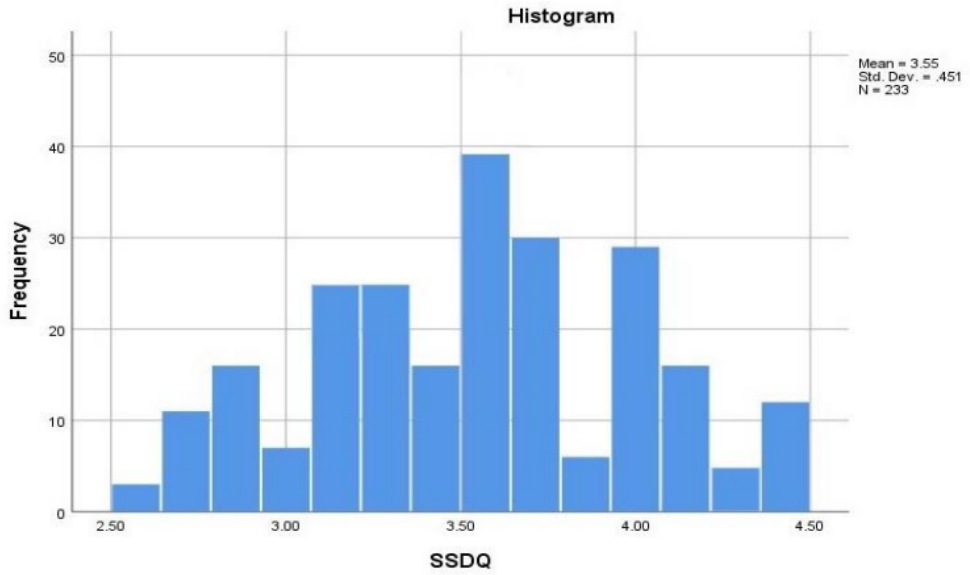

Figure 4.1 *Histogram of Student's Skill Development*

The normal Q–Q chart plots the values observed in the data set on expected values. The expected values are a straight diagonal line while the observed values are plotted as points on the straight line. If the data is normally distributed, then the observed values fall exactly on the straight line in the graph. Any deviation in these dots points a deviation in normality (Andy Field, 2009). The figure shows that the data is near or on the line, hence normally distributed.

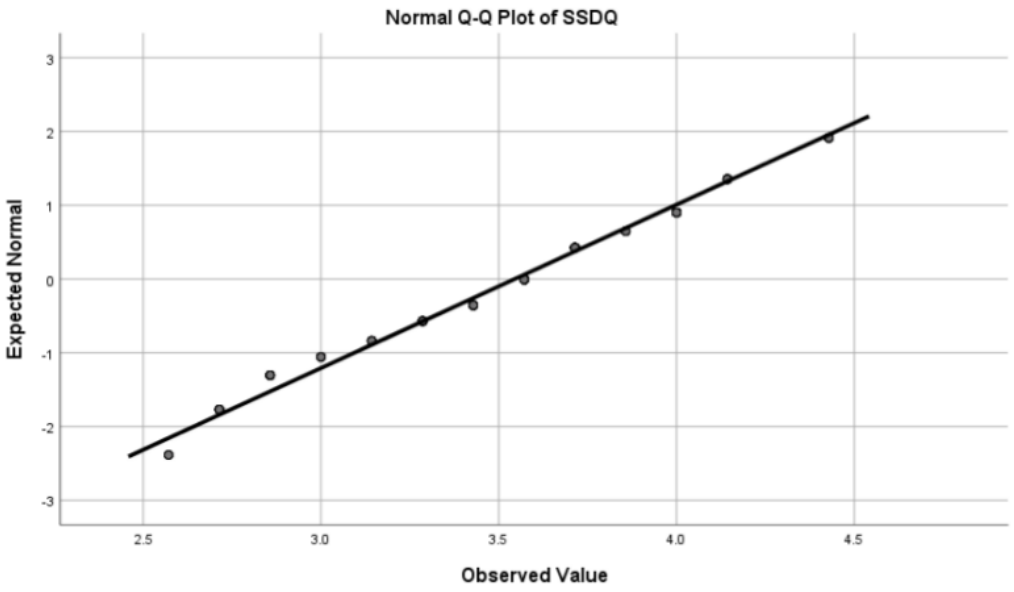

Figure 4.2 *Normal Q-Q plot of Student's Skill Development*

Boxplots or box-whisker diagrams show the distribution of the data. Like histograms, boxplots also tell us whether the distribution of data is symmetrical or skewed. The center line is the median value, above and below is the upper and lower quartiles respectively that show the equal distribution of observations among the data (Andy Field, 2009). Boxplots are used to show the outliers with steric and the number of the case. If the whiskers or quartiles are not equal than the data is asymmetrical, the figure below shows that the data is equally distributed around its mean.

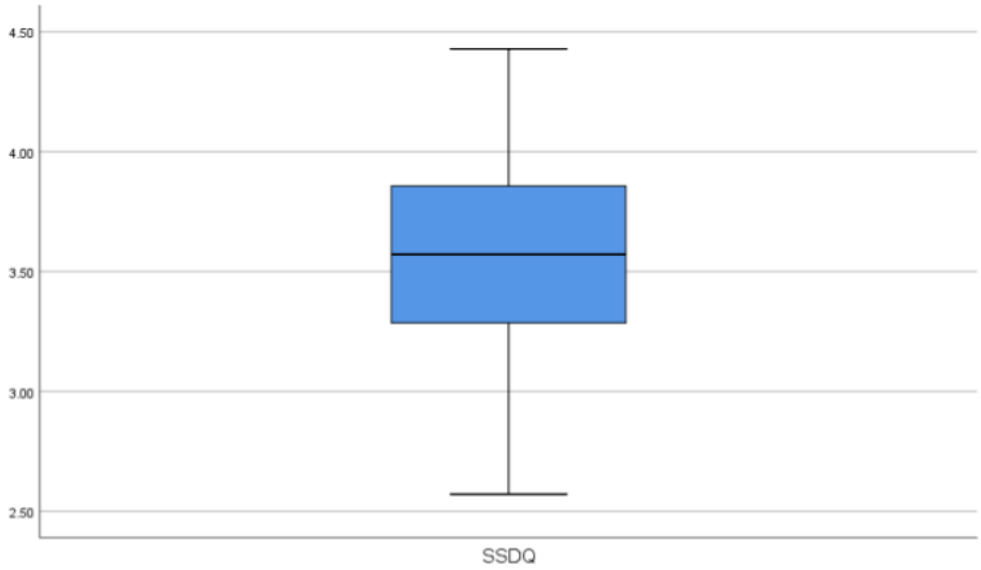

Figure 4.3 *Box plot of Student's Skill Development*

In normality test, the histograms, normal Q-Q plots and boxplots of all independent, dependent and moderator values are observed. Removal of outliers results in normal distribution of the data set. The normality plots of the remaining two variables are attached in Appendix D.

4.1.3.2 Correlation

A correlation describes the measure of association between the variables. A bivariate correlation is used to check the relationship between two variables. The correlation coefficient values ranges from +1 to -1. A value of +1 indicates that the variables are perfectly positively correlated i.e. increase in one variable will result a proportionate increase in the other variable while a value of -1 indicates a perfect negative correlation i.e. if one variable increases, the other decreases (Andy Field, 2009). A value of zero shows that no correlation exists between the variables. If the correlation coefficient value lies between values 0 to 0.2, there is a weak correlation or small effect among the variables. 0.3-0.4 shows a moderate correlation and a strong correlation exists if the values

are above 0.5 (Andy Field, 2009). The table below shows the correlation among the variables of the TFW 1.

Table 4.8: *TFW1 Correlations*

	Mean	Std. Deviation	MOOCs	Career Motivation	Student's Skill Development
MOOCs	3.5544	.37702	*.744*		
Career Motivation	3.5227	.44937	.522**	*.726*	
Student's Skill Development	3.5451	.45147	.537**	.602**	*.801*

**. *Correlation is significant at the 0.01 level (1-tailed).*
Cronbach's Alpha is reported on diagonal in italic.

The correlation between the variables is obtained from Pearson's Correlation. It is find from the table that a moderate correlation is present between MOOCs and Career Motivation ($\gamma = 0.522$; $\rho < 0.01$). Relationship between MOOCs and Students Skill Development is also moderate ($\gamma = 0.537$; $\rho < 0.01$) while a strong correlation exists between Career Motivation and Students Skill Development ($\gamma = 0.602$; $\rho < 0.01$).
The positive correlation ($\gamma = 0.537$; $\rho < 0.01$) between MOOCs (Independent variable) and Students Skill Development (Dependent variable) proves hypothesis H1 that is; MOOCs has a significant relation with Student's Skill Development. The positive coefficient shows that a direct correlation exists between the dependent and independent variables.

4.1.3.3 Linear Regression

Simple linear regression is a way of predicting an outcome variable from a predictor variable (Andy Field, 2009). It is basically done to find the influence of independent variable on dependent variable. The value of adjusted R square explained the percentage of variance in the dependent variable caused by the independent variable. Coefficient B

represents the change in outcome variable resulting from a unit change in the predictor variable.

Table 4.9: *Linear Regression Model Summary of TFW1*

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.537[a]	.289	.286	.38161

a. Predictors: (Constant), MQS

Table 4.10: *TFW1 Linear Regression Table of ANOVA[a]*

	Model	Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	13.648	1	13.648	93.717	.000[b]
	Residual	33.639	231	.146		
	Total	47.287	232			

a. Dependent Variable: SSDQ
b. Predictors: (Constant), MQS

Table 4.11: *TFW1 Linear Regression of Coefficients[a]*

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	T	Sig.
1	(Constant)	1.259	.238		5.299	.000
	MQS	.643	.066	.537	9.681	.000

a. Dependent Variable: SSDQ

Table 4.9 show the value of adjusted R square as 0.286, which means that 28.6% variance in dependent variable is explained by independent variable. This means that 28.6% of skills developed among students is due to MOOCs. The value of Coefficient is 0.643 which tells

us that for every 1 unit change in MOOCs, there is a 0.643 unit change in the Skill Development. It represents the change in the outcome variable associated with a unit change in the predictor variable. If unit of measurement is taken on thousand steps, then the theoretical framework 1 predicts for 1000 students enrolled in MOOCs, 643 students will have their skills developed by MOOCs. This states the influence of MOOCs on student's skill development, as increase in MOOCs enrollment will result in higher skills development among students. The ρ value is less than 0.05 so MOOCs has a statistically significant and positive impact on Student's Skill Development, it supports H1.

4.1.3.4 Moderation Regression

A moderator is a variable that specifies the impact of predictor on outcome variable under its influence. Moderation induces an interaction effect which changes the direction or magnitude of a relationship between the two variables. In order to correctly analyze the impact of the moderating variable, the researcher has chosen to adopt the Hayes process. The Process v3.5 syntax file was integrated with SPSS v26 to scrutinize the impact of moderation and to see whether the interaction effect is significant and helps explain the variation in the outcome variable. The results of the moderation are shown in the tables below:

```
OUTCOME VARIABLE:
 SSDQ

Model Summary
        R       R-sq        MSE          F        df1         df2      p
   .6732      .4533      .1129    63.2817     3.0000   229.0000 .0000
```

The value of R shows the correlation among the variables. The value of R square shows that 45.33% variance in the outcome is due to MOOCs and career motivation.

Table 4.12: *Moderation Regression Results of TFW1*

Predictors	B	Se	T	P
Constant	3.5148	0.0241	145.791	0.0000
	[3.47, 3.56]			
MOOCs (centered)	0.3657	0.0686	5.331	0.0000
	[0.23, 0.50]			
Career Motivation (centered)	0.4795	0.0587	8.168	0.0000
	[0.36, 0.60]			
MOOCs x Career Motivation	0.3439	0.1117	3.080	0.0023
	[0.12, 0.56]			

Dependent Variable: Student's Skill Development

The table above shows the effect of MOOCs and Career Motivation on Student's Skill Development. The effect of MOOCs on student's skill development is positive and significant (b= 0.3657, se= 0.0686, p= 0.000) while the effect of career motivation on student's skill development is also positive and significant (b= 0.4795, se= 0.0587, p= 0.000). The interaction term is significant which shows that moderation has occurred. The interaction effect is positive which shows that as career motivation increases, the effect of MOOCs on student's skill development also increases.

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```
Test(s) of highest order unconditional interaction(s):
       R2-chng          F        df1         df2          p
X*W      .0226     9.4842     1.0000   229.0000      .0023
```

The interaction term between MOOCs and career motivation was accounted for a significant proportion of variance in students skill development, as $\Delta R2 = .02$, $\Delta F(1, 229) = 9.48$, $p = .0023$, $b = 0.344$, $t(229) = 3.08$, $p < .05$.

The conditional effect of focal predictor at moderator values will provide a clear picture of the moderation result in strengthening of relation between the predictor and the outcome variable.

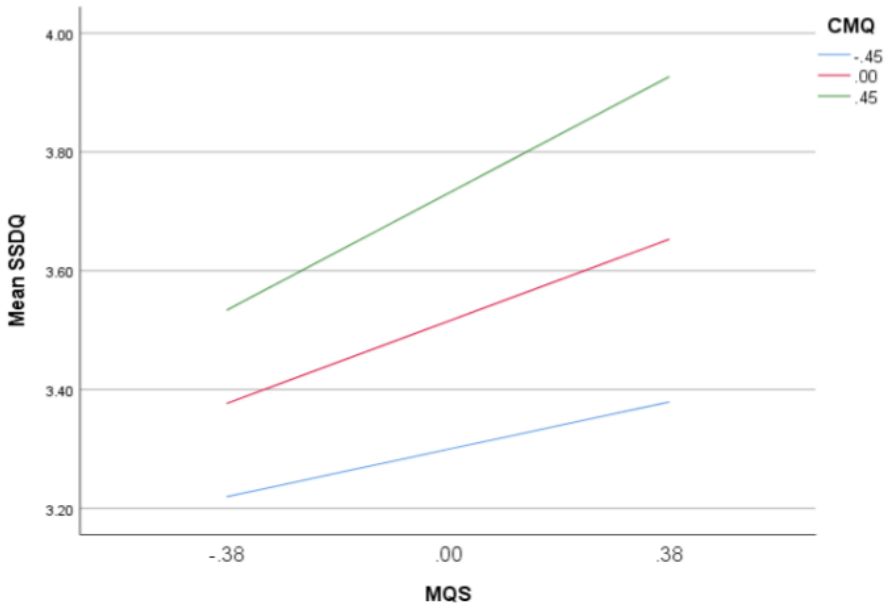

Figure 4.4 *Multiple Line Plot of TFW1 Moderation Effect*

Examination of plot shows an enhancing effect of MOOCs and Career Motivation on Students Skill Development. The lines represent the slopes of MOOCs at below SD, Mean and above SD on career motivation. The blue line represents below standard deviation effect, as with low career motivation, the effect of MOOCs in development of skills among students is relatively lower, as can be seen in the graph as a lower steep slope. Taking the mean 0 as an average, the red line represents that at an average career motivation, the effect of MOOCs in student's skill development is moderate. The green line represents above standard deviation effect of career motivation. It shows that at higher career motivation, increasing MOOCs demand will result in highest development of skills among students. This proves hypothesis H2, that is Career Motivation strengthen the relation between MOOCs and Student's Skill Development. A complete Process matrix result is given in Appendix F.

4.2 Theoretical Framework 2 (Industrial Value Proposition):

The TFW 2 of the research is designed for analyzing the impact of MOOCs on industries employability propagation. Work-place innovation acts as a moderator among the independent and dependent variables.

4.2.1 Exploring Data

In the first step, data is explored for any missing values, outliers and for finding normality.

4.2.1.1 Missing Values

As done previously, data is explored for missing values in the data set. Frequency distribution is checked for the data and total valid entries come out to be 212 and no missing value is present in the data. This provides evidence that the data is carefully placed without any error.

4.2.1.2 Outliers

In the given data set, each variable is explored; boxplot shows the exact location for the outliers. In MQE, case 19, 58, 123 and 204 have some outliers; there also some outliers in EPQ and WIQ. Upon removing/replacing all above, the data will further be explored for normality after descriptive analysis.

4.2.2 Descriptive Analysis

Descriptive test is performed first on the data, mean and standard deviation of demographics and variable items is calculated. Frequency of occurrence and percentage is also analyzed.

4.2.2.1 Descriptive Statistics

Below are the values for the demographics descriptive statistics, mean calculates the average value of data occurrence, median calculates the mid-value and mode is repetition of data i.e. the highest value, standard deviation shows model fit i.e. how much the data deviates from the mean value.

Table 4.13: *TFW2 Descriptive Statistics*

	N	Minimum	Maximum	Mean	Std. Deviation
Gender	212	1	2	1.39	.488
Age	212	2	5	2.69	.614
Qualification	212	2	4	2.60	.536
Company Nature	212	1	4	2.66	.933
Company Background	212	1	10	4.46	2.676
MQE	212	2.67	4.83	3.6958	.52686
WIQ	212	2.67	4.33	3.6077	.39053
EPQ	212	2.00	4.40	3.4830	.55885
Valid N (listwise)	212				

The mean statistics shows that the large majority of respondents are male employees with age between 30 years and qualification of majorly master's level. Most of the managers belong to private companies and serving in different departments. The mean and standard deviation values for different variables are also mentioned in the above table.

A. Gender

Frequency statistics of gender of managers are given in the table below:

Table 4.14: *TFW2 Frequency Table of Gender*

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	130	61.3	61.3	61.3
	Female	82	38.7	38.7	100.0
	Total	212	100.0	100.0	

Results show that 130 (61.3%) male and 82 (38.7%) female responded to the survey.

B. Age

Frequency statistics of age range of managers responded is given in below table:

Table 4.15: *TFW2 Frequency Table of Age*

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20-29	82	38.7	38.7	38.7
	30-39	115	54.2	54.2	92.9
	40-49	14	6.6	6.6	99.5
	50-59	1	.5	.5	100.0
	Total	212	100.0	100.0	

Table shows that a large number of managers are between the age range 30-39, as they constitute the highest 115 (54.2%) of the response rate. Second majority is from 20-29 age group and they are 82 (38.7%) in total. 14 (6.6%) are above 40 years and only 1 (0.5%) is above 50 years.

C. Qualification

Managers having different qualification backgrounds responded to the questionnaire. Their frequency statistics are mentioned below:

Table 4.16: *TFW2 Frequency Table of Qualification*

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	BS	89	42.0	42.0	42.0
	MS	118	55.7	55.7	97.6
	PhD	5	2.4	2.4	100.0
	Total	212	100.0	100.0	

The above table describes the qualification of the managers. 118 (55.7%) have done MS, 89 (42%) have done BS and only 5 (2.4%) have done PhD.

D. Nature of Company

Different managers work in different sectors of organizations. Below table shows their statistics:

Table 4.17: *TFW2 Frequency Table of Company Nature*

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Government	36	17.0	17.0	17.0
	Semi-Government	32	15.1	15.1	32.1
	Private	112	52.8	52.8	84.9
	Multinational	32	15.1	15.1	100.0
	Total	212	100.0	100.0	

A large majority of managers responded belong to private companies as they constitute 112 (52.8%) of the total responses. 36 (17%) belongs to government organizations and 64 (30.2%) are semi-government or multinational employees.

E. Background of Company

Statistics below describes the different departments, the managers are working in.

Table 4.18: *TFW2 Frequency Table of Company Background*

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	IT/Software	45	21.2	21.2	21.2
	Manufacturing	18	8.5	8.5	29.7
	Transportation	5	2.4	2.4	32.1
	Telecommunication	50	23.6	23.6	55.7
	Education	31	14.6	14.6	70.3
	Medical Services	11	5.2	5.2	75.5
	Retail	16	7.5	7.5	83.0
	Banking/Insurance	21	9.9	9.9	92.9
	Military	2	.9	.9	93.9
	Other	13	6.1	6.1	100.0
	Total	212	100.0	100.0	

45 (21.2%) managers belong to Software department, 50 (23.6%) from Telecom industry, 31 (14.6%) from education sector, 21 (9.9%) from banking and the rest 65 (30.6%) belonged to manufacturing, transportation, medical, retail, military and other organizations.

4.2.3 Inferential Analysis

After descriptive analysis, inferential analysis is performed to find correlation and regression among the variables. The normality tests are performed on variables to find that the data is normally distributed.

4.2.3.1 Normality Test

Normality test is performed before correlation and regression tests. The above found outliers are then transformed to obtain normality curve of variables. Normality statistics of the study are shown in the table. It contains the mean and the standard deviation of the study variables. The mean is the average value i.e. average response from the respondents shown in the table, while standard deviation is the difference form the mean value (Andy Field, 2009). The table shows that employers are inclined towards skills in their demands for employees and are in favor of MOOCs. Work-place innovation plays an important role in defining the mindset for the employers.

Table 4.19: *TFW2 Normality Statistics*

	N	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
MQE	212	3.6958	.52686	.077	.167	-.865	.333
WIQ	212	3.6077	.39053	-.493	.167	-.270	.333
EPQ	212	3.4830	.55885	-.476	.167	-.737	.333
Valid N (listwise)	212						

The last two columns of the table show the value of skewness and kurtosis for the data set. As mentioned earlier, for sample size less than 200 z-score should not be more than 1.96 and for sample above 200 z-score should not be more than 2.58 (Andy Field, 2009). The z-score is obtained by dividing the statistical value with the standard error. The obtained z-scores from the above table for different variables of the model are 2.58, 0.81 and 2.21. All the scores lies within range, hence the data is normally distributed. We can further analyzed normality by drawing histogram, normal Q-Q plots and boxplots (also known as box whisker plots).

Histograms are a good approach to spot the problems in the data. The histogram bar shows how many times a certain value occurred in a data set (Andy Field, 2009). Figure shows the histogram for MOOCs score obtained as a response from managers.

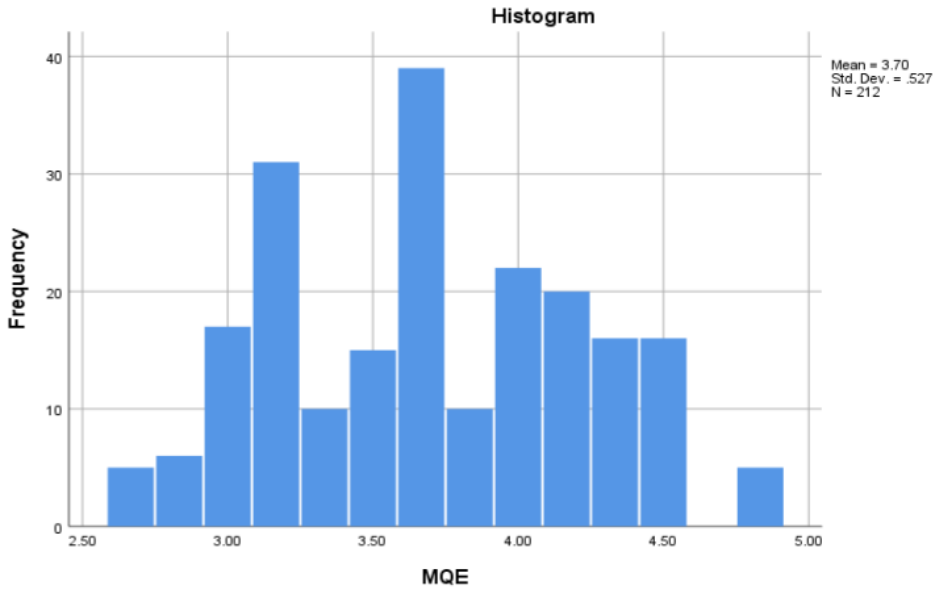

Figure 4.5*Histogram of MOOCs*

As described before, the normal Q–Q chart plots the values observed in the data set on expected values. The expected values are a clear straight diagonal line while the observed values are plotted as points on the straight line. If the data is normally distributed then the observed values fall exactly on the straight line. Any deviation in these dots points a deviation in normality (Andy Field, 2009). The figure shows that the data is near or on the line, hence normally distributed.

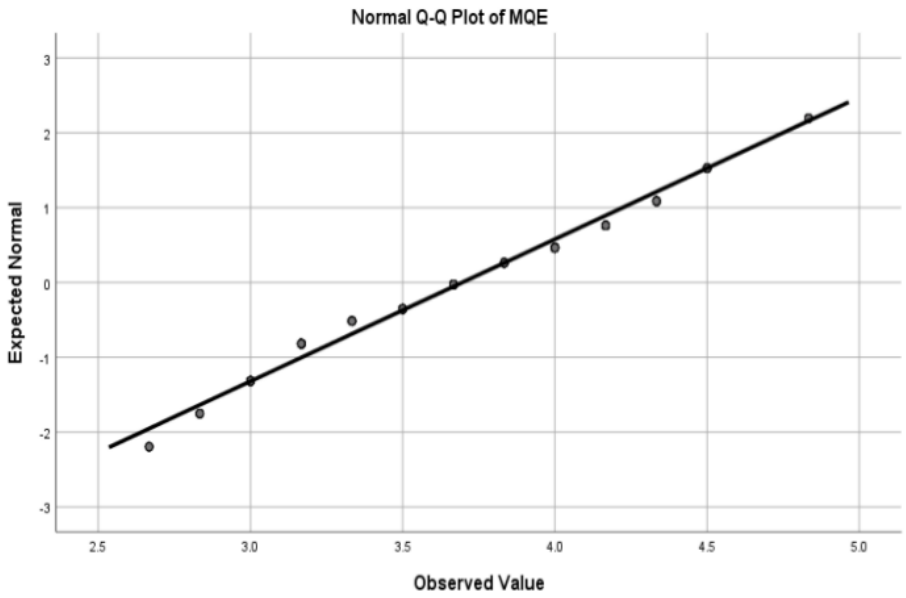

Figure 4.6 *Normal Q-Q plot of MOOCs*

Boxplots or box-whisker diagrams show the distribution of the data. Like histograms, boxplots also tell us whether the distribution of data is symmetrical or skewed. The center line is the median value, above and below is the upper and lower quartiles respectively that show the equal distribution of observations among the data (Andy Fields, 2009). Boxplots are used to show the outliers with steric and the number of the case. If the whiskers or quartiles are not equal than the data is asymmetrical, the figure below shows that the data is equally distributed around its mean.

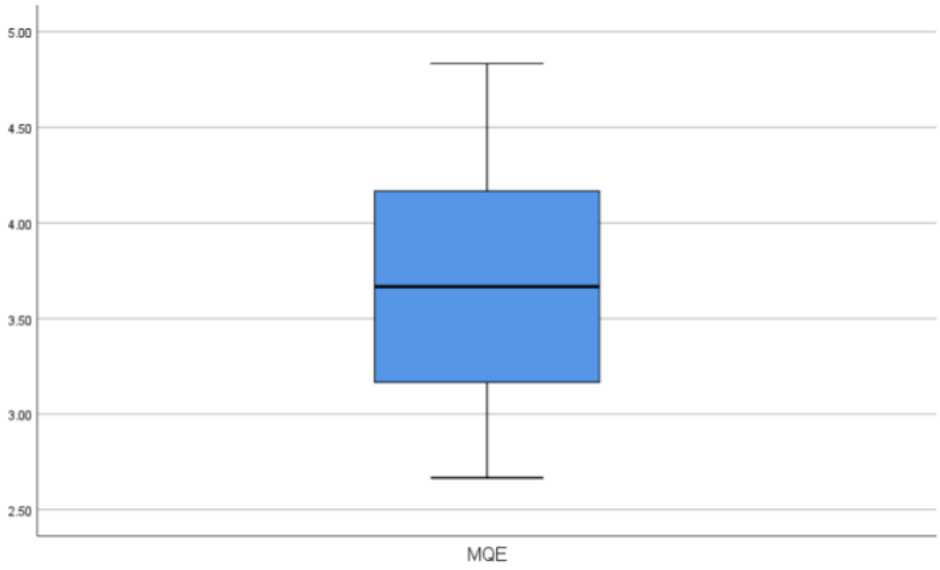

Figure 4.7 *Box plot of MOOCs*

In normality test, the histograms, normal Q-Q plots and boxplots of all independent, dependent and moderator values are observed. Removal of outliers results in normal distribution of the data set. The normality plots of the remaining two variables are attached in Appendix E.

4.2.3.2 Correlation

A correlation describes the measure of association between the variables. A bivariate correlation is used to check the relationship between two variables. The correlation coefficient values ranges from +1 to -1. A value of +1 indicates that the variables are perfectly positively correlated i.e. increase in one variable will result a proportionate increase in the other variable while a value of -1 indicates a perfect negative correlation i.e. if one variable increases, the other decreases (Andy Field, 2009). A value of zero shows that no correlation exists between the variables. If the correlation coefficient value lies between values 0 to 0.2, there is a weak correlation among the variables. 0.3-0.4 shows a moderate correlation and a strong correlation exists if the values are above 0.5

(Andy Field, 2009). The table below shows the correlation among the variables of the TFW 2.

Table 4.20: *TFW2 Correlations*

	Mean	Std. Deviation	MOOCs	Work-place Innovation	Employability Propagation
MOOCs	3.6958	.52686	*.741*		
Work-place Innovation	3.6077	.39053	.223**	*.768*	
Employability Propagation	3.4830	.55885	.359**	.605**	*.814*

**. *Correlation is significant at the 0.01 level (1-tailed).*
Cronbach's Alpha is reported on diagonal in italic.

The correlation between the variables is obtained from Pearson's Correlation. The table shows that all variables are in significant relationship with each other. It is found from the table that a relatively weak correlation is present between MOOCs and Wok-place Innovation ($\gamma = 0.223$; $\rho < 0.01$). Relationship between MOOCs and Employability Propagation is moderate ($\gamma = 0.359$; $\rho < 0.01$) while a relatively strong correlation exists between Work-place Innovation and Employability Propagation ($\gamma = 0.605$; $\rho < 0.01$).
The significant positive correlation ($\gamma = 0.359$; $\rho < 0.01$) between MOOCs (Independent variable) and Employability Propagation (Dependent variable) proves hypothesis H3 that is; MOOCs has a significant relation with Employability Propagation. The positive coefficient shows that a direct correlation exists between the dependent and independent variables.

4.2.3.3 Linear Regression

Simple linear regression is a way of predicting an outcome variable from a predictor variable (Andy Field, 2009). It is basically done to find the influence of independent variable on dependent variable. The value of adjusted R square explained the percentage of variance in the dependent variable caused by the independent variable. Coefficient B

represents the change in outcome variable resulting from a unit change in the predictor variable.

Table 4.21: *Linear Regression Model Summary of TFW2*

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.359[a]	.219	.215	.52289

a. Predictors: (Constant), MQE

Table 4.22: *TFW2 Linear Regression Table of ANOVA[a]*

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	8.481	1	8.481	31.020	.000[b]
	Residual	57.418	210	.273		
	Total	65.899	211			

a. Dependent Variable: EPQ

b. Predictors: (Constant), MQE

Table 4.23: *TFW2 Linear Regression Table of Coefficients[a]*

		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	T	Sig.
1	(Constant)	2.077	.255		8.142	.000
	MQE	.381	.068	.359	5.570	.000

a. Dependent Variable: EPQ

Table 21 shows the value of adjusted R square as 0.215, which means that 21.5% variance in dependent variable is explained by independent variable. This means that 21.5% of employability is due to MOOCs. The value of Coefficient is 0.381 which tells us that for every 1 unit change in MOOCs, there is a 0.381 unit change in the Employability

Propagation. It represents the change in the outcome variable associated with a unit change in the predictor variable. If unit of measurement is taken on thousand steps, then the model 2 predicts for 1000 employees having certifications in MOOCs, 381 employees will have the chance to be hired by the managers. From the results, we can state that increasing MOOCs demand will result in higher employability propagation. The p value is less than 0.05 so MOOCs has a statistically significant and positive impact on Employability Propagation, it supports H3.

4.2.3.4 Moderation Regression

A moderator is a variable that specifies the impact of predictor on outcome variable under its influence. Moderation induces an interaction effect which changes the direction or magnitude of a relationship between the two variables. In order to correctly analyze the impact of the moderating variable, the researcher has chosen to adopt the Hayes process. The Process v3.5 syntax file was integrated with SPSS v26 to scrutinize the impact of moderation and to see whether the interaction effect is significant and helps explain the variation in the outcome variable. The results of the moderation are shown in the tables below:

```
OUTCOME VARIABLE:
 EPQ

Model Summary
        R       R-sq        MSE          F        df1        df2        p
   .6231      .3882      .1822    43.9968     3.0000   208.0000  .0000
```

The value of R shows the correlation between the variables, the value of R square shows 38.82% variance in the employability is due to MOOCs and workplace innovation.

Table 4.24: *Moderation Regression Results of TFW2*

Predictors	B	se	T	P
Constant	3.5242	0.0304	115.945	0.0000
	[3.46, 3.58]			
MOOCs (centered)	0.2227	0.0527	4.227	0.0000
	[0.12, 0.33]			
Workplace Innovation (Centered)	0.7061	0.0781	9.040	0.0000
	[0.55, 0.86]			
MOOCs x Workplace Innovation	-0.3282	0.1497	-2.192	0.0295
	[-0.62, -0.03]			

Dependent Variable: Employability Propagation

The table above shows the effect of MOOCs and Workplace Innovation on Employability Propagation. The effect of MOOCs on employability is positive and significant (b= 0.2227, se= 0.0527, p= 0.000) while the effect of workplace innovation on employability propagation is also positive and significant (b= 0.7061, se= 0.0781, p= 0.000). The interaction term is statistically significant which shows that moderation has occurred. However, the interaction effect is negative which shows if workplace innovation increases then effect of MOOCs on Employability propagation decreases. Alternatively, if workplace innovation decreases then MOOCs will result in more employability.

```
18
Test(s) of highest order unconditional interaction(s):
      R2-chng          F        df1         df2          p
X*W     .0141     4.8064     1.0000   208.0000      .0295
```

The interaction term between MOOCs and workplace innovation is accounted for a significant proportion of variance in employability propagation, as ΔR2= .014, ΔF (1, 208) = 4.81, p = .0295, b = -0.3282, t (208) = -2.192, p < .05.

The conditional effect of focal predictor at moderator values will provide a clear picture of the moderation result in strengthening or weakening of relation between the predictor and the outcome variable.

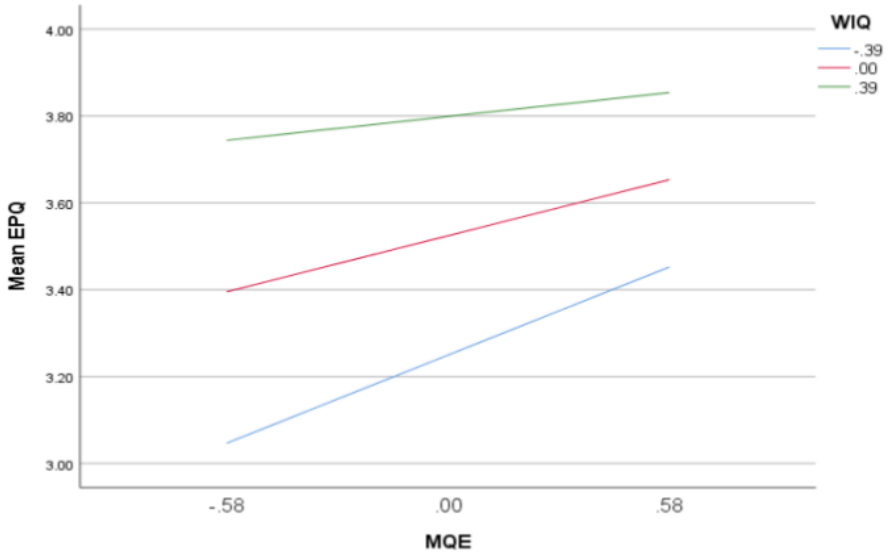

Figure 4.8 *Multiple Line Plot of TFW2 Moderation Effect*

Examination of plot shows an enhanced picture of effect of MOOCs and Workplace Innovation on Employability Propagation. The direction of slopes represents an inverse relation between the variables. The lines represent the slopes of MOOCs at below SD, Mean and above SD on workplace innovation. The blue line represents below standard deviation effect, as higher MOOCs demand causes a rapid decrease in employability at lower workplace innovation. Taking the mean 0 as an average, the red line represents a relatively moderate decrease in employability caused by MOOCs with an average level of workplace innovation. The green line represents above standard deviation effect of workplace innovation on relation of MOOCs and employability propagation. It shows that at higher workplace innovation, increasing MOOCs will result in relatively lower shift in employability propagation, though the effect is slightly lower as compared to lower workplace innovation, but it shows a decrease in employability with increase in MOOCs at higher workplace innovation. This rejects hypothesis H4, that is Workplace Innovation strengthen the relation between MOOCs and Employability Propagation. The above results show that increasing innovation trickle down the relation between MOOCs and Employability Propagation. A complete Process matrix result is given in Appendix G.

CHAPTER 5

DISCUSSION

The present study was cross-sectional study that involved 233 engineering students and 212 engineering managers from reputed organizations. As now a day, online courses emerge as a new trend in education sector. A large majority of students, graduates, employees and professionals are enrolling in these courses to earn badges, certificates and professional training. These certificates not only enhance their skills but also provide them leverage in their current degrees, jobs and professional careers. The name coined for providing such courses is Massive Open Online Courses (MOOCs). There are several platforms working under the name as Cousera, edX, Udacity, Udemy, FutureLearn etc. Theses platforms are formed from the collaboration of elite universities across the globe whose basic purpose is to provide education to every single being without any financial, demographical and geographical constraints. As the offered courses are free to register and can be available to anyone interested, these courses not only terminate the class divide in the traditional education sector but also provide accessibility, flexibility and cost-effective alternative to unprivileged and un-served. So the main purpose of conducting the study was to investigate the impact of MOOCs on current models of education prevailing in institutions and their pros and cons in engineering students and professional managers that are the true customers of universities offerings and outputs. Since they contribute to the business model of universities, this study has investigated their awareness, perceptions and trends in adapting the new platforms for knowledge gain. This gave an idea about the challenges universities have to face in order to manage their prevailing business model, so that it won't get destroyed in a course of time.

According to the study, 23.35% students and 22.06% managers weren't aware of MOOCs. Among the rest 76.65% students, who were aware of MOOCs, only 31.75% students have done any MOOCs courses or certifications. In case of mangers, 77.94% who were aware of MOOCs, only 14.15% have done any professional certification. Though the awareness level among both populations regarding the courses and certifications and their benefits found to be quiet high but their adaption rate is very low. MOOCs are still in its infancy among students and managers.

Form theoretical framework 1, we found that 55.4% of male students responded to the survey than the 44.6% female students. 65.7% of students responded belong to the age group of 20-29 which shows that a large portion of young students are heading towards MOOCs for gaining skills. 56.2% of students were enrolled in MS and 41.2% were enrolled in BS while only 2.6% were doing PhD. A farsightedness can state that students after completing their graduate degree hunt for skills to boost their professional career ended up in taking part in such courses. Students belonging to different fields and from various institutions responded. A generalized observation based on the statistics is most students with IT/software and electrical background is inclined towards MOOCs with both 18.5% response rates as compared to students belonging to other engineering domains.

From descriptive statistics, researcher find that MOOCs provide all sorts of leverages they claim i.e. accessibility, flexibility, affordability and quality. Students are attracting towards the offerings they made, majorly as a boost in their career, and are optimistic in their response of different skills they gain through the platforms. Findings also suggest that students prefer these platforms to have career advantage since they offered latest trends and quality education; sooner or later this will affect the way traditional universities are doing their businesses as their customer's demands are changing. They need to review their course content and offerings they made to their customers to stay competitive in the fast moving era of technology.

The correlation analysis from the items shows that MOOCs and career motivation are moderately correlated with $\gamma = .522$, MOOCs and students skill development are also moderately correlated with $\gamma = .537$, while career motivation and student's skill development are highly correlated with $\gamma = .602$. As students are motivated to build their

career, they opt for MOOCs for developing skills that will benefit them in their career, and boost their professional skills. H1 proved that MOOCs have a significant relation with student's skill development.

The linear regression analysis shows the direction of influence, MOOCs have 28.7% variance in student's skill development that directs positive influence of MOOCs on student's skill development which proves that greater students enrollment in MOOCs will result in higher development of skills among them.

Moderation regression was done to evaluate the impact of MOOCs on student's skill development under the influence of career motivation. 45.33% variance in students skill development were found by MOOCs, career motivation and interaction term. The interaction term was statistically significant and $\Delta R2 = .0226$ proves that moderation has occurred. The interaction term was positive as $b = 0.3439$ which means as Career motivation increases, the effect of MOOCs on student's skill development also increases. Alternatively if career motivation decreases, the effect of MOOCs on student's skill development also decreases. The graphical representation of MOOCs slopes on career motivation also provides evidence that with low career motivation, the effect of MOOCs on student's skill development was also low, as there observes a slight increase in skills with increase in MOOCs. With an average career motivation at 0 mean, the effect of MOOCs on student's skill development is moderate. Higher career motivation resulted in an increased effect of MOOCs on student's skill development. This provides evidence that career motivation strengthens the relation between MOOCs and student's skill development and thus proved H2.

The evaluation of descriptive and inferential statistics describes student's behavior towards MOOCs. Students find MOOCs cost-effective and burden relaxant as more than half of the student's majority agrees with the statements. They believe in development of technical, communication, analytical, creative, problem-solving, technical writing and team player skills among them. Students prefer MOOCs over traditional education and showed warm response towards such courses. Career motivation drives students to enroll in MOOCs and get hands-on to skills prevailing in the market. Increasing enrollments in MOOCs resulted

in higher development of skills are moderated by career motivation. This answers our second research question R1 that students are switching to MOOCs because of their flexibility, accessibility, affordability and to develop their skills and build their career.

From theoretical framework 2, we found that 61.3% male and 38.7% female students responded to the survey with mostly (54.2%) in age group of 30-39 years, 38.7% belongs to 20-29 age group while the rest 7.1% were above 40 years of age. 42% managers did BS, 55.7% had MS degree while only 2.4% were PhD's. 52.8% managers responded were from private companies, 15.1% were from semi-government and multinational leads while 17% belonged to government organizations. 21.2% belonged to software departments, 23.6% belonged to telecom industries while the rest were from several different technical departments in different organizations.

From the survey, manager's familiarity with MOOCs found to be higher than those of students, yet fewer have earned certifications. Almost half the majority prefers MOOCs in gaining skills over traditional education and they thought that sooner or later it will disrupt the traditional education model while the rest denies and remain neutral as well in the phenomena to occur. Workplace innovation is the key factor in leading organizations towards success. An innovative culture supports its employees and motivates them to acquire new skills, cherish their creativity and appreciate uniqueness in them. An innovative organization always looks forward for an enthusiastic blood who will lead their organization to new roads. Workplace innovation plays an important role in defining the behavior and attitude of the employees in responding to innovation and their consideration in hiring new skills. From descriptive mean of workplace innovation, researcher concluded that mangers themselves are very enthusiast in hiring and supporting innovative staff but most of them found their companies to be less encouraging. Few of them found their organizations to be innovative, ambitious and creative; they believe in themselves and have vision to lead their organizations to new heights.

After securing tertiary level education, graduates hunt for job increases. The survey first identified mangers response towards MOOCs, that found to be proportionate, and then asked about innovativeness among them and the organization with in, the organizational culture predicts how employers are performing and what they seek in new recruits. The

responses on employability propagation identify that employers find new recruits professional yet they have ambiguity in their performance, half of the managers are satisfied while the rest are either in denial or neutral for the actual work performance of the employees. Many identified that their company prefers innovation and skills among new recruits and few of the companies are taking advantage from the platforms to train their employees as well.

The correlation analysis provides evidence that MOOCs and employability are correlated with $\gamma = .359$, the results show a moderate relation, though employers are in favor of MOOCs, most of the companies are concerned with skills, either by MOOC platforms or from tertiary institutes. MOOCs help in increasing skills among recruits, as students prefer MOOC courses to gain skills, a moderate correlation supports the argument that MOOCs help them further in getting employed. This relation further strengthens or weakens depending on the organization culture. There exists a weak correlation, $\gamma = .223$ between MOOCs and workplace innovation which means that an innovative organization that value skills among students, not necessarily give preference to MOOCs courses or skills. A strong correlation, $\gamma = .605$ exists between workplace innovation and employability propagation which shows that an innovative organization responds highly of creativity, always welcome innovation. MOOCs itself regard as disruptive innovation. So such organizations that value innovation tends to hire recruits more with diverse skills, as they believe in all sorts of skills the platform is providing and the students doing MOOC certifications have rich knowledge of latest trends in technology. This proved hypothesis H3 that MOOCs have a positive relation with employability propagation

The linear regression analysis among MOOCs and employability propagation show that MOOCs have 21.5% variance in employability propagation. Though the influence is not so high but it did show some variance in employability propagation. So we can describe the relation among MOOCs and employability propagation, as higher MOOCs demand will result in enhanced employability propagation.

Moderation regression was done to analyze the impact of MOOCs on employability propagation under the influence of work place innovation. The predictors accounts for 38.82% variance in employability. MOOCs and workplace innovation tends to have

positive influence on employability individually. The interaction term was statistically significant with ΔR2=0.014 which showed that moderation has occurred. The interaction effect was negative, which means an inverse relation is present, with an increase in workplace innovation, the effect of MOOCs in employability propagation decreases. Alternatively, if workplace innovation decreases, the effect of MOOCs in employability propagation will increase. Multiple line plots confirmed the results, as lower SD i.e. low workplace innovation results in steep MOOC slope which means the effect of MOOCs in employability propagation enhanced at lower work place innovation. At mean 0 i.e. at an average workplace innovation, the effect of MOOCs in employability propagation is moderate and at above SD i.e. at higher workplace innovation, the slope is very low, which shows the effect of MOOCs in employability propagation is low at higher workplace innovation. We can say that as innovation increases in an organization, they will not tend to hire recruits mainly with MOOCs certifications only. However, with organizations having lower level of innovation have even drastic decline in hiring MOOC graduates. Based on results, H4 rejected which states that workplace innovation strengthens the relation between MOOC and employability. Though workplace innovation is highly correlated with employability and employers seemed to give preference to skills among new recruits, yet these skills are not necessarily to be obtained from the MOOC certifications. The results showed that workplace innovation weakens the relation between MOOCs and employability propagation. Highly innovative organizations seemed to be less reluctant to MOOCs compared to less innovative organizations. Employers show their interest in skills from reputable institutions.

The descriptive and inferential statistics describes industries behavior towards MOOCs and new recruits. Most of the employers find new recruits efficient and professional in their job designation. Many managers claimed that their company is giving preference to skills among new recruits, and some say that their company is adapting MOOC platforms also. Workplace innovation plays vital role in defining manager's mindset towards their staff growth and development. Innovative organizations always search for innovation among its employees and new recruits. Managers found to be cooperative and prefer innovation and uniqueness among recruits. Managers somehow fancy MOOCs platform for skills

development and tending to give preference to recruits having skills, still organizations with innovative culture are reluctant to rely fully on individuals having MOOC courses. Innovative culture open paths and ways for employability among graduates and applicants with skills are trending among these organizations, as they have higher knowledge of the latest technology. This answers our third research question R3 that employers prefer skills among new recruits. But there exists a limitation that these skills are not entirely MOOC based, as results show that innovative organizations are insecure towards MOOCs courses in employability campaigns.

From the results, it is stated that MOOCs fulfill development of skills among students and employers demand of skills for graduates and new recruits. This provide evidence that both the customers i.e. students and industries are satisfied with their value proposition through MOOCs. However, workplace innovation decreases the effect of MOOCs in employability propagation. Career motivation on the other hand strengthens the relationship among MOOCs and student's skill development. Providing the best to customers and meet their needs and desires is the new business model trend that MOOC platforms are adapting. MOOCs platforms introduce new business model in which they provide value to their customers at lower prices by fulfilling their needs and demands, so they are the disruptors in the incumbent higher education market. Industries that are claiming to be innovative and preferring skill among new recruits are yet to embrace the diversity of MOOCs. The diverse attributes of MOOCs poses a threat to traditional universities business model, who are sticking to the same money-making business model since decades as students with higher career motivations are attracting to these platforms for skills development. MOOCs are providing them with what is missing in traditional education, i.e. skills at lower prices. Thus serving the lower-end market customers, and slightly moving upmarket with improving quality of their offered products. These quality skills help them in getting employed. With all the facts, still it's a whole lot process of change in which higher education personnel and industrialists begin to value the diverse forms of education, whose only purpose is to serve its consumers. These findings answer our first research question R1 that MOOCs will disrupt the existing business model of universities eventually with its new business models yet it will take time for industries and higher education in Pakistan to

accept different mediums of education and to focus more on every sort of skills rather than just earning degrees.

5.1 Conclusion

MOOCs are challenging higher education by providing accessible, flexible and affordable education to its consumers. They emerge as disruptors in higher education by bridging the mismatch in skills among graduates and potential employers. Career motivation is driving students towards MOOCs for development of skills that industries demand. Innovative industries are encouraging their employers for bringing uniqueness and creativity. For capturing new business opportunities employers are looking for skills among new recruits that leads their organization to have higher market ends meet. To entertain both students and employer's needs, MOOCs introduce new business model of providing value proposition to its customers. Quality content with skillful learning in feasible environment gain popularity among students and employers tend to hire those with suitable skills. They believe in employees skills more than the medium for obtaining the desired set of skills. Companies are collaborating with MOOC platforms to refine their employee's skills, yet a majority of innovative workplaces lag behind in embracing MOOC skills. Increasing MOOCs demand among students and employers pose a threat to existing costly business model of universities. If not addressed properly, universities will face disruption in a course of time. Higher education need to revise their course content and cost structures to stay competitive in the fast growing MOOCs trend.

5.2 Recommendations

Following are the few recommendations derived from the conclusions:

- Online learning is becoming global phenomena as more and more elite universities are collaborating to facilitate students. As seen in COVID-19, universities were not prepared which lend them in serious situation, and made them do temporary arrangements for taking online classes unofficially. While virtual universities

continue to provide online classes properly. This is the threat which higher education is neglecting from decades. World is changing rapidly and technologies advances, authorities need to take swift action on this. Worldwide collaboration of universities is producing quality content, our higher education need to follow them and adapt the latest content and ways of learning. This is important to stay competitive and keep their students engaged so they cannot move to other platforms in search of quality education.

- Online education apart from flexibility is a big relief for those who can't afford expensive elite institutions. At any geographical location, with a good internet and medium knowledge they can get benefit from MOOC platforms, which are open to everyone. Higher education needs to pay special attention on cost-structure. Following MOOCs platform, they can introduce hybrid or flip-flops classrooms. In offering online education, they can save costs for complex infrastructures, which can further be invested in upbringing of latest technology in education departments like video conferencing, video lectures etc.
- Higher education should make policies to link graduate with relative employers to reduce un-employability among new graduates.
- Higher education should start accrediting MOOC credits, transfer of credits and faster completion of degrees after obtaining the specified credits.
- Higher education needs to collaborate with information and technology ministry to introduce technological changes within education sector. Providing internet facilities and encouraging citizens to get skillful education should be done on immediate measures.
- New business models based on customers, value proposition, finance and infrastructure should be adopted to provide leverage to students and industries.

5.3 Limitations and Future Research

There exist few limitations which need to be addressed in future. Following research can be done in future:

- Researcher found lack of awareness among students regarding the professional and skilled courses. A research on awareness of such courses and certifications should be conducted in future.
- Students were found to be unaware of their skills and the market demands. A future study should be conducted related to Industry-Academia linkage, to explore the impact of MOOCs on Pakistani academia and their efforts in training their students to meet potential employer's demands.
- Due to unavailability of MOOC platforms in Pakistan or any collaboration among universities, a future research should be done to explore the financial component of the business model to estimate offering of such courses and building these platforms to entertain students.
- Due to time and resource constraints, researcher restricted to Capital Territory and Punjab Province only, a similar research can be conducted in other provinces of Pakistan for exploring the opportunities and challenges students will face in adapting such platforms. As some areas of Pakistan are still deprived of electricity and internet facilities. Medium of instructions can also be discovered in future research.

Thesis Report

ORIGINALITY REPORT

13%	%	%	13%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Submitted to Queensland University of Technology Student Paper	1%
2	Submitted to Liverpool Hope Student Paper	1%
3	Submitted to uva Student Paper	1%
4	Submitted to University of Greenwich Student Paper	1%
5	Submitted to Leeds Beckett University Student Paper	1%
6	Submitted to uvt Student Paper	<1%
7	Submitted to 97324 Student Paper	<1%
8	Submitted to Higher Education Commission Pakistan Student Paper	<1%

9	Submitted to Arkansas State University, Jonesboro Student Paper	<1%
10	Submitted to Bolton Institute of Higher Education Student Paper	<1%
11	Submitted to International Institute of Social Studies - Erasmus University Rotterdam Student Paper	<1%
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19	Submitted to Colorado Technical University Online Student Paper	<1%
20	Submitted to University of Essex Student Paper	<1%
21	Submitted to St. Xavier's College Student Paper	<1%
22	Submitted to CSU, Los Angeles Student Paper	<1%
23	Submitted to University of Wolverhampton Student Paper	<1%
24	Submitted to University of Huddersfield Student Paper	<1%
25	Submitted to Massey University Student Paper	<1%
26	Submitted to University of Sunderland Student Paper	<1%
27	Submitted to University of Witwatersrand Student Paper	<1%
28	Submitted to University of Maryland, University College Student Paper	<1%
29	Submitted to University of Wales central institutions	<1%

Student Paper

30	Submitted to Macquarie University Student Paper	<1%
31	Submitted to Vaasan yliopisto Student Paper	<1%
32	Submitted to South Dakota Board of Regents Student Paper	<1%
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35	Submitted to Polytechnic University of the Philippines - Sta. Mesa Student Paper	<1%
36	Submitted to University of Northumbria at Newcastle Student Paper	<1%
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39	Submitted to Sheffield Hallam University Student Paper	<1%
40	Submitted to Universiti Pendidikan Sultan Idris	

	Student Paper	<1%
41	Submitted to Fachhochschule fuer Wirtschaft Berlin Student Paper	<1%
42	Submitted to University of Johannsburg Student Paper	<1%
43	Submitted to Federation University Student Paper	<1%
44	Submitted to Singapore Management University Student Paper	<1%
45	Submitted to CSU, Long Beach Student Paper	<1%
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