THE EFFECT OF TECHNOLOGY DISRUPTION ON ORGANISATIONAL HEALTH: MEDIATING EFFECT OF COMPETENCE ADEQUACY AND MODERATING EFFECT OF INNOVATION CAPACITY AND COMPETENCE BUILDING

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ABSTRACT

As a world's fastest growing telecommunication market, India is undergoing evolutionary changes in telecommunication technologies. Rapidly changing communication technology has been posing innumerable challenges to the telecommunication companies in India for adequate skill availability and at the same time significantly changing competence requirements. The recognition of competence adequacy as a key factor to sustain organizational health in an increasingly competitive telecommunication sector has opened up several possibilities of competence based research. The study examined the inverse effect of technology disruption on competence adequacy and subsequently on the organizational health. Further, the organization's intervention to competence building and innovation capacity was also put through the moderating tests as balancing factors. Knowledge Evolution Theory underpins this study framework to highlight the competence issues caused by technology disruption. This quantitative study was conducted in India among four leading Telecommunication firms. An online questionnaire was administered to managers from the firms who were selected using stratified random sampling. The eight hypotheses of this study were tested with Structural Equation Modelling using AMOS software. The results of the study found significant positive effects of competence adequacy, innovation capacity and competence building on organisational health. Secondly, technology disruption was found to have significant negative relationship with both competence adequacy and organisational health. In addition, the interaction of competence building and innovation capacity on the path of technology disruption and competence adequacy significantly moderated the relationship and finally, competence adequacy was found to have a significant mediating effect on the relationship between technology disruption and organisational health. The study provides new directions to the practising human resource professionals to improve the competence adequacy in high technology industries especially among telecommunication companies. The results of the study also highlights the widening technology skill gap present in telecommunication industry in India. The findings of this study also have pointed out the importance of innovation capacity as balancing factor in technology firms in the wake of evolutionary changes in telecommunication technology.

Keywords: organizational health, competence, innovation capacity, telecommunications.

ABSTRAK

Selaku pasaran telekomunikasi dunia yang paling pesat berkembang, India sedang melalui evolusi perubahan dalam teknologi komunikasi. Perubahan pantas teknologi komunikasi telah memberikan pelbagai cabaran kepada syarikat-syarikat telekomunikasi di India dari aspek ketersediaan kecukupan kemahiran dan pada masa yang sama mengubah keperluan kompetensi secara signifikan. Pengiktirafan kecukupan kompetensi sebagai faktor utama untuk mengekalkan kekukuhan organisasi dalam sektor telekomunikasi yang semakin kompetitif telah membuka beberapa kemungkinan kepada penyelidikan bersandarkan kompetensi. Kajian ini meneliti kesan pembalikan gangguan teknologi ke atas kecukupan kompetensi dan seterusnya ke atas kekukuhan organisasi. Selain itu, campurtangan organisasi dalam membina kompetensi dan keupayaan inovasi juga telah melalui ujian penyerderhana sebagai faktor-faktor pengimbang. Teori Evolusi Pengetahuan mendasari kerangka kajian ini untuk menengahkan isu-isu kompetensi yang disebabkan oleh gangguan teknologi. Kajian kuantitatif ini telah dijalankan di India di kalangan empat syarikat telekomunikasi yang besar. Soal selidik atas talian telah dilakukan ke atas pengurus-pengurus dari syarikat-syarikat tersebut yang telah dipilih melalui persampelan rawak berstrata. Lapan hipotesis kajian ini telah diuji dengan analisis Pemodelan Persamaan Struktur menggunakan perisian AMOS. Keputusan kajian ini mendapati kecukupan kompetensi, keupayaan inovasi dan pembinaan kompetensi mempunyai kesan positif yang signifikan ke atas kekukuhan organisasi. Selain itu, interaksi pembinaan kompetensi dan keupayaan inovasi ke atas hubungan di antara gangguan teknologi dan kecukupan kompetensi telah menyerderhana hubungan tersebut dan akhir sekali, kecukupan kompetensi didapati mempunyai kesan penengah yang signifikan ke atas hubungan di antara gangguan teknologi dan kekukuhan organisasi. Kajian ini telah memberikan hala tuju baru kepada pengamal-pengamal sumber manusia profesional untuk memperbaiki kecukupan kompetensi dalam industri berteknologi tinggi terutamanya di kalangan syarikat-syarikat telekomunikasi. Keputusan kajian ini juga telah menengahkan pelebaran dalam jurang kemahiran teknologi yang wujud dalam industri telekomunikasi di India. Dapatan kajian ini juga telah menegaskan kepentingan keupayaan inovasi sebagai faktor pengimbang dalam firma-firma teknologi dalam kebangkitan evolusi perubahan dalam teknologi telekomunikasi.

Keywords: kekukuhan organisasi, kompetensi, keupayaan inovasi, telekomunikasi.

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With my mother's blessings.

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LIST OF ABBREVIATIONS

2G/3G/4G	2nd, 3rd & 4th Generation Telecommunication
AMOS	Analysis of Moment Structures
AVE	Average Variance Extracted
BSC	Balanced Score Card
CA	Competence Adequacy
CB	Competence Building
CLC	Corporate Leadership Council
CR	Composite Reliability
GSM	Global Standard for Mobile communication
IC	Innovation Capacity
ICT	Information and Communication Technology
IOI	Inventory of Organisational Innovation
KET	Knowledge Evolution Theory
KSAO	Knowledge, Skill, Attributes & Other characteristics
LTE	Long Term Evolution
OH	Organisational Health
R&D	Research & Development
RBT	Resource Based Theory
RBV	Resource Based View
RIM	Research In Motion
ROI	Return on Investment
TD	Technology Disruption

UMTS	Universal Mobile Telecommunication Standards
VRIN	Valuable, Rare, In-imitable & Non-substitutable

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CHAPTER ONE

INTRODUCTION

1.1 Introduction

This chapter sets the foundation for this research study. The research is framed in the context of the technology companies, where environmental disruption is inevitable and frequent, particularly to the telecommunication sector. Through the section 1.2 and the subsections, this chapter provides the background and rationale of the study from the global perspective and further focussed to Indian telecommunication context. The section is followed by statement of the research problem, research questions and research objectives. Corresponding variables applied in the theoretical framework are briefly touched upon in this chapter. Theoretical, methodological and practical significance of the study is elaborated in section 1.6. Further, the scope and limitations of the research is covered in subsequent section followed by an overview of how the overall thesis is structured. Finally the summary section gives a quick overview of what had been covered in this chapter.

1.2 Background

The increasing rapidity of change in business environments and disruptive technologies are common to the Telecommunication industry today. These disruptive changes continuously affect the performance of these firms and sometimes influence their very existence itself (Esposito & Mastroianni, 2002). Technology disruption has caused an abysmal reduction of product prices and at the same time, the demand from consumers for superior product performance has increased (Munir, 2003; Real, Barbosa, & Vargas, 2006). Rapid progress in communication technologies has put telecommunication companies across the world in great peer pressure to develop newer and refreshed products in accordance to the changing demands from the customers. Such environmental changes coupled with the mounting demands from the market, pose enormous challenges for organisations to continuously improve people capabilities and competence (Kessler, Bierly, & Gopalakrishnan, 2000; Filson, 2002; Mahmoud, Midler, & Garel, 2004).

As the advancing technology crosses continental boundaries in great speed, the global competition is equally fierce and insurmountable for telecommunication companies in Asia as well. In these challenging times, it is imperative that companies create, develop and reconfigure the technical and core competencies as sources of competitive advantage. Such timely competence building efforts will help improve revenue and profitability (Granstand, 1998; Teece, Pisano, & Shuen, 1998; Javidan, 1998; Coates & McDermott, 2002; Grunert & Hildebrandt, 2004; Wang, Lo, & Yang, 2004). Owing to the huge investment required to set up telecom infrastructure and the long gestation period to reach the profit level, it is essential for the telecommunication companies to understand the reasons behind the declining organizational performance so that they can take timely corrective action.

1.2.1 Technology and global telecommunication sector

The rapidity of change and increasing complexity of technologies are the basic characteristics of telecommunications industry today. The speed and frequency with which the new generation mobile technologies are emerging may incur substantial investment and service disruptions, which may result into an imminent adverse impact on the business and financial performance. Additionally, development of applications related to new technologies will take enormous cost and risk, putting firms through unexpected hardships in developing newer competencies. Disruption in communication technologies forced companies to scrap investments already made in the older generation technologies each time and incur massive costs and engineering efforts worth billions to rebuild the resource and infrastructure (Bernhard, Michae, Biljana, & Valerio, 2014). The endless succession of new generation technologies disrupts the whole ecosystem of related competence. For example, upgrade in Universal Mobile Telecommunication Standards (UMTS) changes the communication protocols, emergence of new generation network technology (Eg. 2G,3G,LTE) etc. demand a wide range of new applications and network infrastructure. It also causes redundancy of related software, mobile-based applications, and value added services.

In a study conducted by Pradhan, Arvin, and Bahmani (2014) across a combination of 40 developed and developing countries, it was found that there is a close relationship between technological changes in telecommunication infrastructure and the economic growth and labor productivity of the country. The telecommunication industry is a crucial element of world economic development. According to a statistical report for the telecommunications services sector in the European Union (EU), as covered by NACE Rev. 2, Division 61, the total revenue earned from this industry is 3 percent of the gross world products and is aiming at attaining more revenues. In the European Union, alone the expenses on Telecommunications accounted for 2.8 % of gross domestic product (GDP) in 2010, compared with 3.3 % in the United States and 3.5 % in Japan (both 2008). Figure 1.1 shows the total revenue in billion Euros earned from the telecommunication services by different regions. The figure also shows a statistical forecast of their revenue until 2018. It shows that the Asia Pacific region accounts for the largest chunk of the revenue with

363 billion Euros in 2014 accounting for almost 33% of the global telecommunication revenue. The revenue is estimated to grow further with largest revenue figures clocking in 2017 (437 bn Euros for Asia Pacific).

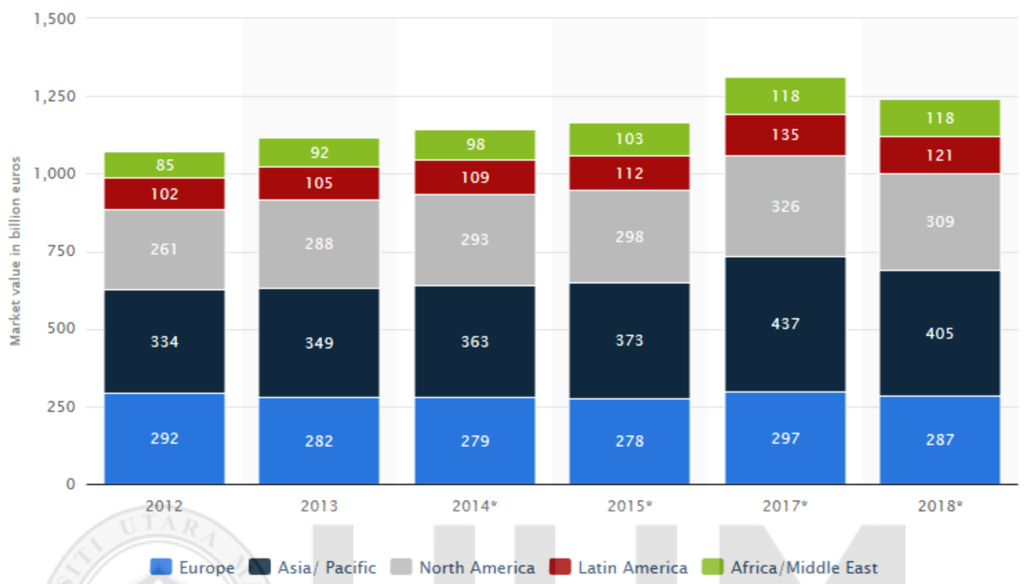

Figure 1.1
Global Telecom service revenue and forecast by region (in billion euros)
Source: Report by Statisticia Inc., July 2015

Figure 1.1 suggests that every region is set for an exponential revenue growth in telecommunication sector until it reaches maturity in 2017. Out of the total revenue from telecommunication sector worldwide reported for 2014 (1142 billion Euros), the top 10 companies from the world accounted for 55% of the total revenue (656 billion Euros) as per Figure 1.2. With a whopping 41.2 billion Euros in telecommunications revenue, India contributed more than 10% of the total revenue in Asia Pacific region in 2014.

AT&T, Verizon and China Mobile continue to be the three largest telecommunication service providers in the world (Figure 1.2), followed by the national companies from Japan, Germany and UK. Spain and Mexico are also major global providers in Telecommunication services.

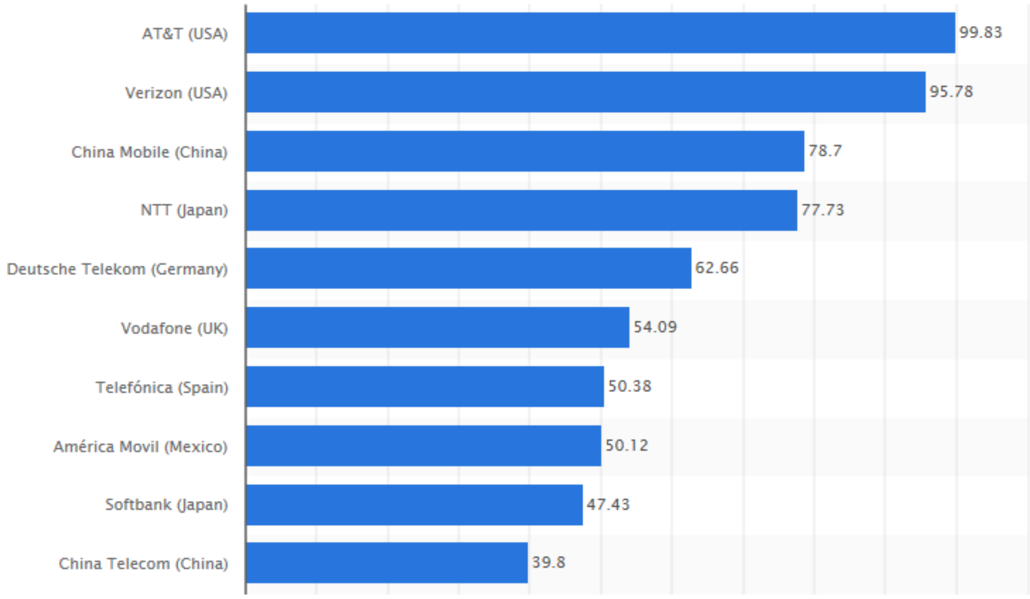

Figure 1.2
Top 10 Global Telecom service providers (revenue in billion euros)
Source: Statisticia Inc. 2015

A survey conducted across 40 telecommunication companies worldwide from developed and emerging markets by Ernst & Young in 2015 analysed the significant challenges facing the industry. According to this survey 73% of the respondents opined that disruptive competition (technology, products and price) is one of the most significant challenges (Figure 1.3). Apart from this, lack of organisational agility (organizational health), shortening technology cycles (technology disruption) and poor rates of innovation (innovation capacity) also were cited as significant challenges to telecommunication industry.

The pace of technology advancement has pushed telecommunication companies to regenerate skills and knowledge in ever-increasing momentum. The requirement of knowledge, skills, and function based other characteristics (KSO) requirements for telecommunication sector is complex and ever growing. Telecommunication sector, being part of the knowledge industry, needs such competence as the only input, which turns out to be the key driving force behind the performance. Analysts cite absence of Competence Adequacy (CA) as one of the major reasons for the recent decline of Nokia, Blackberry, Motorola, AT&T and Verizon. These cases prove the serious impact of competence and its consequences on firms and nations.

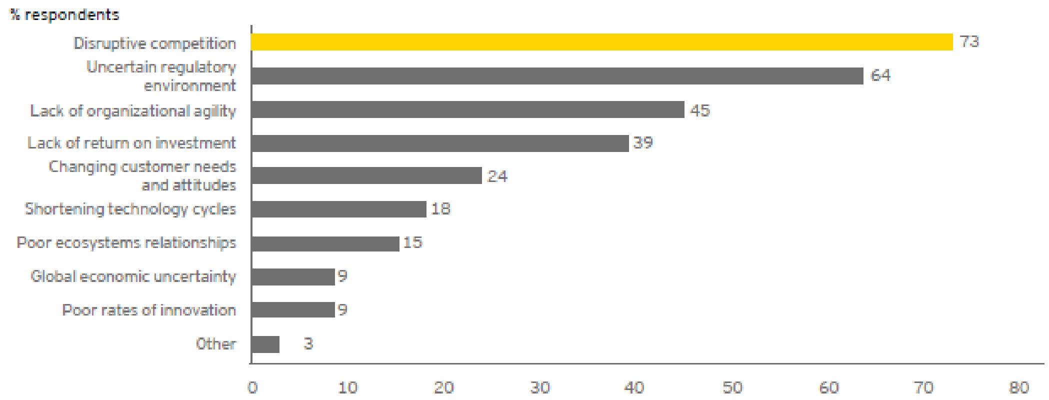

Figure 1.3
Significant challenges faced by telecommunication companies
Source: Global Telecommunication Study, E&Y, 2015

According to a published global telecommunication study by Ernst & Young in 2015, Global Standards for Mobility (GSM) technology is poised for a series of growth in network infrastructure. This will pave the way to increased bandwidth, reduced power consumption, and improvement in spectral efficiency. The LTE (Long Term Evolution) technology under the 4th Generation (4G) GSM itself is transforming into four different versions (Figure 1.4). By the turn of 2020 world will witness enormous changes in communications through 5th Generation technology.

Figure 1.4
Evolution of GSM technology
Source: Global Telecommunication Study, E&Y, 2015

The deficiency in required competence may be aggravated by the depletion created by emerging technology coupled with collective competence depletion. A report published in 2010 by Merryll Lynch shows that despite having increase in net additions of customer base, telecommunication companies globally are witnessing a decline in revenue (Figure 1.5). From the resource-based view, such decline in performance could be attributed to the internal competence capability of the organisation (Nair, Kumar, & Ramalu, 2014). Through the period 2005-10, the industry has seen tremendous technology progress through the 3G and subsequently the 4G through 2010-15. With the technology progress, the data shows a steady decline in service revenue from 2004 onwards even though there is an increase is net customer additions over the years.

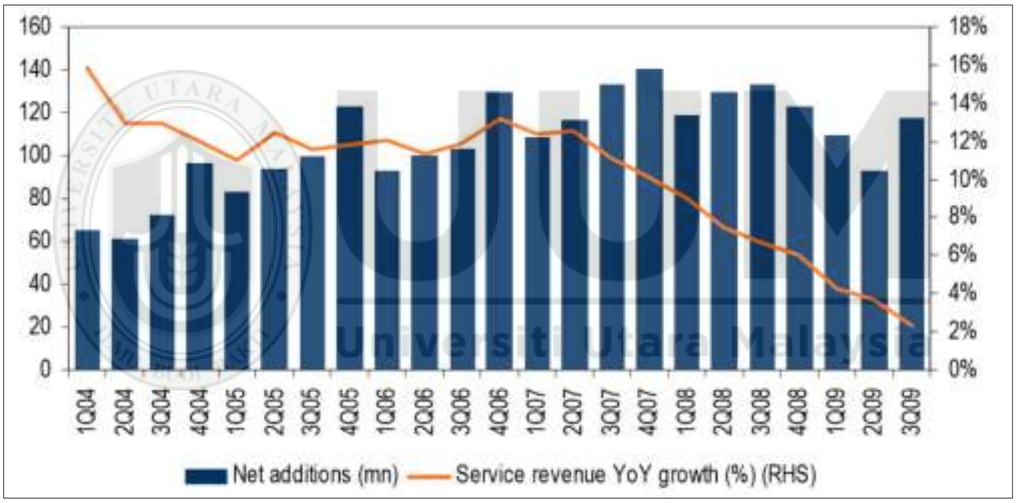

Figure 1.5
Global Telecom service revenue growth trend
Source: BofA Merrill Lynch Global Research estimates 2010

European commission estimated that by the year 2015, European Union (EU) would have a shortage of 700,000 skilled workers in the telecommunication sector. Subsequent to this report, the commission had predicted that the telecommunication skill shortage in the EU will further deteriorate to 900,000 by 2020 (Balanskat, Blamire, & Kefala, 2009). According to John Higgins, director general of Digital Europe, the labour shortage in the telecommunication sector should not be taken lightly as the situation becomes vulnerable with larger number of countries joining the bandwagon to seek labour.

Anticipating the future competence needs to reshape the product lines in accordance to the changing environment is the key to success for technology companies (Schiemann, 2014). Highly skilled and agile competence is required for telecommunication companies to bring out the best of the product and services to the customers (Park, Shin, & Park, 2006). Development of unique and core competencies in tune with the changing requirements in technology is the only strategy which can give sustenance to these companies.

The firms can only contain such aggressive changes if they correctly anticipate the impending competence requirements and enhance the internal innovation capacity. While discussing about fast occurring changes, Hurmelinna, and Olander (2014) emphasized the importance of adapting to change by individuals and companies. They further reiterate that failure to adapt changes through the challenging environments will result in companies turning into warehouse of obsolete competence, and large numbers of employees turn redundant due to the lack of skills to compete in the changed business scenario.

The speed and efficiency which organizations respond to change and the sincere efforts put towards encouraging innovation will determine the success rate of the organization in the market. Changes in technology influence organizational systems including products and process. For example, phenomenal changes in computer hardware design and chip manufacturing has resulted in significant innovation in information technology related products and processes. Innovation can create, shape, and re-shape markets and industrial sectors (Wang & Chiu, 2014). What most firms fail to attempt is to translate the internal power of innovation into a core competence, which characterizes the innate ability of the firm to define product lines based on the potential requirement of current customers and redefine the markets.

1.2.2 Indian telecommunication sector

India is the fastest growing telecommunications field in the world, with a projected telephone penetration of one billion telephones by 2015 (Deloitte, 2013). Pradhan, Arvin, Bahmani, and Norman (2014) find an existence of unidirectional causality between gross domestic product (GDP) and telecommunication infrastructure growth in G20 countries including India. The Indian Telecommunication Services Performance Indicator Report published by Telecom Regulatory Authority of India (TRAI) in January 2015 shows that the gross revenue from Telecommunication services in 2014 was USD 45.41 billion, as against the GDP of the nation for the same year accounting for USD 2066 billion, recording 2.2% contribution to GDP by the telecommunication sector. The same report suggests that India is ranked second in the world telecommunication market only after China.

At the turn of this decade, India had 18 companies holding spectrum and license to operate telecommunication services. Out of this, 16 companies have already launched their services with a significant number of customer acquisitions. Such a long list of telecom operators are unusual in any country compared to the number in other countries. In comparison to a large segment of developed and developing countries, India holds ground for breakneck competition in telecommunications. There are only few countries, which have more than four telecommunication operators (Bank of America Merrill Lynch, April 2011). However, by the end of 2013, four companies were unable to sustain the market pressure forcing them to close down the business and nine of them showing steady decline of customer base.

Table 1.1 shows that only Airtel, Vodafone, Idea Cellular and Aircel were the only companies, which showed a positive trend in customer acquisition in 2014 in comparison to the base of 2013. Though the state owned Bharat Sanchar Nigam Limited (BSNL) and the private giant Reliance managed to grow through 2011 until 2013, their customer base declined substantially in 2014. It is worthwhile to note that full spectrum of 3rd generation Global Standards for Mobile (GSM) technology was launched in India in 2014 and many companies mentioned in Table 1.1 were unable to meet the expectations of customers in line with what the technology has promised to bring about. With a total customer base of 554 million, the above-mentioned four companies held 63% of the overall telecommunication customer share.

The competition in the sector intensifies with the new entrants into the market. In 2013, there were as many as 15 telecom operators, of which over 90 percent of the market seven major incumbents hold share (in terms of customer base and revenue). Dubai based telecom major Etisalat and Saudi based S-Tel could not survive in the Indian market for more than two years. Norwegian operator Telenor was also unsuccessful in continuing with the operations. Including the state owned BSNL & MTNL; most of the telecom operators are showing a steady decline in customer base over the years. Aircel with 6.93 percent market share is the fastest growing telecommunication company in India. Vodafone, Idea Cellular an Airtel are the other players, which are still showing revenue improvement and profits. As per a report published by the Confederation of Indian Industries, there is a pressing need to develop substantial telecommunication skills to enable the sector to move up the value ladder (Nigam, Thakur, Sethi, & Singh, 2012). To encourage and attract investments into the country, it is essential to have highly skilled technology talent.

Table 1.1

Performance (customer base in million) and organizational health status of Indian Telecom sector

Sl. No.	Operator	2011	2012	2013	2014	Trend
1	BPL					
2	Uninor (Telenor)	18.51	36.31	NA		
3	S Tel	2.32	3.55			
4	Etisalat	0.26	1.67	NA		
5	Spice*					
6	BSNL (Government)	86.71	96.76	99.92	96.29	-4%
7	MTNL (Government)	5.40	5.68	5.30	3.59	-32%
8	Reliance	125.65	150.08	118.53	117.24	-1%
9	Tata (Docomo)	84.23	83.49	69.56	63.21	-9%
10	Telewings	NA	NA	41.52	32.78	-21%
11	Systema Shyam	8.43	15.01	14.88	9.81	-34%
12	Loop	3.04	3.24	3.00	2.98	-1%
13	Videocon	7.32	5.44	3.64	3.31	-9%
14	Quadrant (HFCL)	1.61	1.19	1.70	1.21	-29%
15	Airtel	152.5	175.65	181.91	198.41	9%
16	Vodafone (Essar)	124.26	147.75	147.48	160.41	9%
17	Idea Cellular	81.78	106.38	113.95	128.69	13%
18	Aircel (Maxis)	50.17	61.64	63.35	66.91	6%

NA -Data not available, * Spice was taken over by Idea Source: COAI

Source: COAI Report 2014 (Cellular Operators Association of India)

There has been growing concern from the Human resources managers of Indian telecommunication firms on the talent crisis faced by the sector. Talent depreciation is mostly visible as a potential issue in the areas of high technology, research and evolution as well as telecommunication and data engineering in India, as reported by Ashok Ramachandran, HR Head of Vodafone India. According to him, a large amount of the skilled labour in the telecommunication sector is thriving for the required fourth generation technology skills.

A comprehensive study of the Indian Telecommunication landscape undertaken by the CLC (2014) reveals that India is undergoing a growing shortage of telecommunication competence as the demand for newer technology skills are increasing. The study estimated over 25,000 shortage of technology based competence by the year 2015. This gap is expected to widen with the increasing complexity of global telecommunication technology is accessible to all countries. Talent Neuron (2014) reports that out of the total 244,000 strong research and development team in the Indian Indian Communication and Technology (ICT) sector, only 11% (26,090) are deployed in Telecommunication sector. This is a clear indicator of the Research & Development focus to the sector, which caters for highly innovative applications in high technology platforms for mass consumption. India, being a dominant player in the communication technology arena, should augment the R&D efforts in the telecom sector and bridge the digital gap left by the new generation technology.

1.2.3 Issues surrounding Telecommunication Industry

Majority of the past studies has confirmed the possibility to differentiate between healthy and unhealthy organisations through the consequences of overall performance and a healthy mix of financial status (Arnetz & Blomkvist, 2007). Janice (2000) terms Organizational Health (OH) as the eagerness of the system to respond to shifting business environments. She further stressed on the collective competence of the firm to align, innovate and execute products and services faster, better and efficient than the competitor. If we can embrace the fact that healthy people can perform well to get the desired effects, the same can be applied to the organizational functioning as well (Lucia & Lepsinger, 1999). Every governing body wants to be healthy and successful, however small, or large it is. It is not merely the power to conform to the current environmental changes, but the anticipation around what is coming and shaping up accordingly, even before the competition realizes about it also specifies the direction of organizational health indicator to the acceptable range (Dubey & Ali, 2011).

Ehrnberg (1995) reminds that in telecommunication industry, the disruptive move from analog to digital technology was connected with the decline of many of the accomplished firms. He further exhibits empirical examples to illustrate that Technology Disruption (TD) often has catastrophic effects on the competence equilibrium of an organisation. With the inability to adapt to the new changes posed by technology, many of these organisations start exhibiting infant characteristics.

There have been studies (see Kauffman, Lobo, & Macready, 2000) around prominent changes in the competence requirements to design and develop new products, where technology related competence (Knowledge, skills, abilities and other characteristics) is particularly emphasized. These studies discuss the importance of keeping the technological regimes within the firm, which is the cognitive ability of individuals to take reasoned decisions on the product development. 'Technological paradigm shift' is the term used by Dosi (1982), where a set of procedures defines a paradigm, a definition of the overarching problems and specific competence required to arrive at a solution. A related definition for disruption in technology focuses on ideas and techniques with the definition given by Utterback (1986) as the radical change that diminishes most of a firm's collective technical knowledge and skills, on designs and production. For example, when there is an innovation or upgrade in Universal Mobile Technology Standards (UMTS), it changes the global telecommunication landscape like the functions related to internet protocols, security, virtualization of network etc. It means a wide variety of competence related this area needs improvement and upgrade. Similarly, new generation streaming technology like 3G, 4G etc. would substantially change the way people access internet through mobile devices, which in turn requires complete overhaul of the telecommunication infrastructure, and peripheral devices. It is imperative that when any changes in the technology happens, employees from the related functions need to be trained to upgrade the competence required to keep the business going.

Table 1.2 explains the framework of competence impacted due to the change in any of the telecommunication technologies.

Table 1.2
Telecommunication competence framework

Technology	**Impacted function**	**Related competence**
UMTS Changes	Internet Security	Data and device protection
	Roaming	International alliance, handover etc.
	Virtual private network	Spectrum management
New generation network technology	Accessories	Phone, computer and device accessories
	Chip Manufacturing	Smaller sized higher magnitude chips
	Communications	Voice, data and IP based communication
	Internet	MPLS, IPLC, Broadband, wireless, Bluetooth etc.
	Phone Hardware	Touch screen, glasses, fiber
	Radio equipment	Femtocells, receivers, decoders, MIMO etc.
	Routers & Switches	Extender, enhancer, booster etc.
	Wi-Fi	Last mile connectivity
Software	Internet of things	Access to internet through mobile
	Application store/portal	Portal development and content. HTML5
	Cloud applications	Storage, application management, ERP etc.
	Gaming	Mobile gaming console
	Operating Systems	Windows, Android, iOS
	Service management	Virtual services, storage, data management etc.
	Social networking	Profiles, networking and knowledge sharing
Mobile applications	Location-based services	Tracking and proximity marketing
	Native applications	Host of specific and distinct services
	Infotainment	Entertainment through mobile applications
	Money	All type money transactions over internet.
	Utility services	M2M services like ISAS, SAS etc.
Value added services	Advertising	Internet based mobile advertising
	Customer Service	Enhance customer experience
	Digital services	Life sciences, banking, business applications etc.
	Education	e-learning and content activities
	Healthcare	Integration of healthcare facilities
	Personalization	Customised personal services and user profiles
	TV/video	Multi-screen services, content, recording etc.

Source: Own illustration

As explained in Table 1.2, slightest of the technology changes creates a reverse funnel impact in the telecommunication industry worldwide, be it software changes, device manufacturing, network infrastructure, mobile applications (business to customer and business to business) and value added services (location services, environment, global positioning, education, medicine) etc.

The rapidity of technology disruption today is pushing the velocity of innovation in communication companies beyond imagination, flattening the time-to-obsolescence curve faster than ever before. A decade ago, the time-to-obsolescence for web-enabled services was 3-5 years, whereas presumably today this period has shrunk to 14-18 months. Today a mobile-based innovation may be obsolete within 12 months. As the technology disruption overthrows the existing technology infrastructure companies will very often fail to recreate the established product lines (Walsh, Kirchhoff, & Newbert, 2002). The time-to-obsolescence is arguably shorter than the time to innovate a product.

In order to sustain in the ever-increasing competition, it is essential that companies adjust themselves to the imminent paradigm shifts happening in the realms of technology. Such adjustments can be done only if the companies are able to realign the human capital towards the innovation capacity by anticipating the competence needs of the future. Whenever there is a decline in organizational health, appropriate organizational development activities need to be undertaken to correct it (Appelbaum, 2002). It involves working with the organization as a system to bring about the planned and controlled iterations in preferred directions. Competence Building (CB) in anticipation is one such organizational development intervention. The intervention model suggested by Ingham (2006) places the act of competence building in anticipation of future as the highest value-creating component for business. It is evident from the recent case studies of Nokia, Motorola and Blackberry that firm's readiness and capacity to predict its future competence requirements almost accurately will have positive implications on its financial health and on its long-term survival. To be able to implement the business strategy successfully, the firm needs to address the most important question of its workforce competence needs for the future (Huselid, Becker, & Beatty 2005). This question can be answered through multiple resource building approaches by building competence in anticipation by developing and transforming the right mix of talent that will be contributory to the success at each point in time in future (Director, 2006). Advent of Internet has changed the traditional approach of competition among firms, thereby creating new opportunities for the unrestrained ones and at the same time, posing challenges to well-established firms in terms of the way they conduct business (Hitt, Ireland, & Hoskisson, 2001).

Innovation is the key source of competitive advantage of the company (Bharadwaj, Varadarajan & Fahi, 1993). As limited studies around innovation in service sector have been published, and the link between innovation and health remain understudied topic (Hung & Chou, 2013). Evolutionary theory in strategic management as explained by Nelson and Winter (1982) argue that an organization attempts to increase innovation capacity as a response to address a problem. When problem caused by environmental changes occurs, the firm stimulates and combines resources to recreate knowledge and skills to discover solutions to the problem. The theory confirms that the ability of the firm to innovate during such problem is a function of the quality of resources [competence] and the how the organisation anticipate the change and renew the competence (Teece et al., 1998; Nelson & Winter, 1982; Katila, 2002; Stuart & Podolny, 1996).

The evolutionist assumption of competence process suggests that whenever there is prolonged disturbance in environment, the system starts course correcting internally to adapt to the new environmental conditions and emerges the cognitive iteration like innovation (Heudin, 1998). To validate this argument, the researcher has gathered the data around telecom innovations as a fall out of 4G/LTE technology roll out in 2012-13. Out of the 438 telecommunication innovations rolled out in the year 2013, Asia Pacific countries accounted for only 85 of them, whereas European companies rolled out 50% of the innovations (219 of them) with African telecommunication companies catering for 32 innovations (Kaufman, 2014).

The assessment is based on the addressable market for a service and how likely it is that the service will tap into that market. A service can score highly here if we believe that it can achieve mass-market significance, or if we expect it to act as a catalyst to encourage others to launch similar services. This addressable market is mainly at the national level.

The pivotal role of innovation in an Organisation's success is a topic much discussed and evaluated by the academicians and practitioners as well in the recent past. Knowing about which potential products or improvisations in the current product customers seek is the central theme of the theory of disruptive innovation developed by Christensen (2006). Presumably, developing and maintaining a steady line of game changing products is the most daunting task companies are facing today. Studies centered on the disruptive innovation gained momentum in the second half of the last decade when companies recovered from a long-term recession coincided with the global competitive pressure in the market place. While academicians and practitioners started recognizing the relevance of Innovation Capacity in the firms, there remains a prevalent confusion on what constitutes the innovation capacity from the competence perspective. The relatively small number of published technology studies have generally addressed the manufacturing sector (Yam, Guan, Pun, & Tang, 2004; Guan & Ma, 2003), and these focus primarily on product innovation in organisations.

1.3 Problem Statement

When new generations of technology emerges over a short span of period, leaving the previous versions rapidly obsolete, the skills which were then required to manage the versions also become obsolete. The world has been witnessing such rapid changes in technology in telecommunication sector (Kapoor & McGrath, 2014). The critical competence required to maintain a particular technology today becomes no more relevant and becomes out of the critical list from the competence framework of those companies, leaving behind a profound gap in competence requirement, resulted in Technology Disruption (TD). Such gaps widen over a period of time, critically impacting the Organisational Health (OH). Firms with declining competence will no more be able to maintain the competitive advantage in the market, which they have been enjoying thus far.

Competence Adequacy (CA) might influence the overall productivity of the employee group (Neuman & Weiss, 1995) and lower the labour market participation of workers with obsolete skills (Van Loo, de Grip, & de Steur, 2001). One of the direct and immediate consequences of such frequent changes in technology is competence depletion. Value based approach to competence at firm level gives clarity in terms of adequacy and deficiency with changing environmental factors (Rathe & Witt, 1999) and this calls for detailed study of collective competence through the environmental uncertainties. Competence depletion is a serious concern for technology companies as they grapple with the ever-changing competence requirements to keep up with the technology demands.

Technology disruption not only depletes accumulated competence required for the current line, but also offers competitive opportunities to develop appropriate competence (Mirabile, 1997) through Competence Building (CB) measures. Furthermore, with most other investments in commercial enterprise, organizations can reasonably estimate the life span of such investment, however human competence remains beyond any such estimation. Hence unexpected loss, depletion, erosion, etc. from competence make a severe dent in the competence pool, forfeiting potential returns on investments in human capital, placing management in a constant dilemma on the decision of investment (Coff, 1997).

When collective competence of the firm is depleted, skills of employees must be substituted or upgraded, causing an additional fiscal burden to organisation, and a series of ongoing improvement costs as well, while the most suitable part of competence is identified and rechristened into the new business environment (Hatch & Dyer, 2004; Lepak & Shaw, 2008). This competence building effort eventually can minimize the impact of technology disruption on competence adequacy. Telecommunication continues to be a priority sector for all the progressive governments. To ensure sustenance of the telecommunication sector, it is essential to keep the competence supply in equilibrium. Any competence shortage at any point may jeopardize the planned development in the sector and in turn the economic development. With the growth of technology, the supply side of the telecommunication competence is trending down, giving worries to companies.

With the intense change which technology is bringing in all walks of life, innovation becomes the critical success factor for technology companies. Innovation is no more an option for companies, as the competitive spirit in the marketplace is increasing with the global consumer pressure. Adam Smith (1937) has dealt the relation between innovation and technology changes in his seminal works and later Joseph Schumpeter (1939) supported this in his work ‘Theory of Economic Development’. Firms, which desire to sustain organizational health, should ensure continuous improvement in collective Innovation Capacity (IC). For high technology organisations, innovation is no more an option but an essential survival kit (Grimpe & Kaiser, 2010).

As such, there is a need to better understand how Competence Adequacy relates to Organizational Health with the intensity of Technology Disruption. It is also significant to realize the controllable factors like Innovation Capacity and Competence Building, which may positively influence the Competence Adequacy and further augment and sustain organizational health. There exists a dearth of research in competence based organizational health in the telecommunication sector. Though there are several relevant literatures available on the health and the organizational performance (Lyden & Klingele, 2000; Wilson, et al., 2004; Lencioni, 2012; Bisilkas, García & Barreda 2012), telecommunication sector is yet to come under the radar of the academicians on specific study on competence adequacy and related organizational health. Given the high relevance of the topic, there is a limited literature around competence adequacy in the technology sector. Presumably, this is due to the lack of longitudinal data on the competence stock and the shift in demand of the competence in telecommunication companies. Several previous studies suggest different types of human capital obsolescence due to work force depletion (Ulrich & Van Glinow, 1993; Bennett & O'Brien, 1994; Watkins & Golembiewski, 1995; Ahmed, Loh, & Zairi, 1999; Popper & Lipshitz, 2000). A closer look at the organisational health literature reveals that competence obsolescence due to environmental changes like technology disruptions was not sufficiently explored in the academic research. Moreover, the impact of the competence adequacy resulting on the organizational health in terms of competitive advantage is a topic, which requires immediate attention. This is very essential and important for telecommunication companies. There are also limitations in the measurement modes available on the competence obsolescence studies to explain different consequences.

This study is aimed to examine the use of technology disruption on organizational health of telecommunication companies in India. The work will also test the roles of competence adequacy, innovation capacity, and competence building in defining the intensity and centering of the relationship between technology disruption and organizational health.

1.4 Research Questions

Established on the problems identified, the core research questions that guide this study can be submitted as follows:

1. How does the competence adequacy vary in relationship with organisational health?
2. How does technology disruption change the competence adequacy?
3. What is the relationship of technology disruption with organisational health?
4. How is competence building related to organisational health?
5. Does innovation capacity relate to organisational health?
6. Does competence adequacy mediate the relationship between technology disruption and organisational health?
7. Does a moderation effect exist with innovation capacity in the relationship between technology disruption and competence adequacy?

8. Does competence building moderate the relationship between technology disruption and competence adequacy?

1.5 Research Objectives

The primary objective of this study is to determine the relationship between technology disruption and organizational health with competence adequacy impacted by the technology changes. The objective is also to examine factors like innovation capacity and competence building in relation to the competence adequacy and organisational health.

To get answers to the research questions identified, there are eight specific objectives identified in this survey.

1. To study the relationship between competence adequacy and organisational health.
2. To investigate the relationship between technology disruption and competence adequacy.
3. To examine the relationship between technology disruption and organisational health.
4. To determine the relationship between competence building and Organisational health.
5. To study the relationship between innovation capacity and organisational health.
6. To find out if there is a mediating role of competence adequacy between technology disruption and organisational health.

7. To investigate the moderating role of competence building between technology disruption and competence adequacy.
8. To investigate the moderating role of innovation capacity between technology disruption and competence adequacy.

1.6 Significance of The Study

Telecommunications sector requires huge initial investment to set up infrastructure and procure licenses and spectrum. With successful operations, an incumbent firm is expected to reach breakeven after 4-5 years of operation. Many of the multinational firms that invested in the Indian telecommunication sector had to close the operations within the first few years in business, incurring huge financial losses. Many of the incumbent operators scaled down the business to move out of the unprofitable areas. Unable to cope up with the competence upgrade requirements against the imminent technology changes, few of the firms even went on a decelerated mode, staying firm on the voice technology. As such, there is a pressing need to understand what contributes to the declining organizational health in telecommunication sector and to establish corrective and preventive measures. This is an area, which needs immediate attention from researchers, practitioners, and academicians. There is limited work done in a combinative portfolio with multiple competence elements to seek a convergence of organisational health. Empirical research on competence equilibrium is relatively a new undertaking. Organisational health also has been an independent topic of research for many during the early part 2000-10. As per the literature search, there is limited study conducted on this topic and it becomes unique, current and relevant for industry and academics as well.

The significance of this research can be expressed as follows:

1.6.1 *Theoretical and methodological significance*

This research intends to help meet the gap identified in the literature, that there is an incomplete understanding of how competence adequacy varies between systems, letting in what types of mental abilities and incentives they draw from the organization's health (Hjalager, 2010), and that technology organizations often lack sufficient competence to face sudden and unexpected changes (Vermeulen, 2004). This research complements the thinking underlying Bowman and Collier's (2006) contingency framework for the competence anticipation process. By providing insights into the particular capabilities needed to support organisational health, this research aims to understand how assets and capabilities in the business can be developed in order to sustain adequate level of health.

In particular, this research supports the proposition that measures of competence that are industry and sector specific (Lawson & Samson 2001), and findings that firm capabilities are often context-specific (Ethiraj, Guler, & Singh, 2000). The research is expected to provide a rich menu of activities that could be developed as "competence preparedness for technology changes" in telecommunication sector.

This research re-constructs an existing instrument to measure Organisational Health (OH) with an extension to balanced scorecard and competitive advantage. The current available instrument does not include the important dimensions of Competitive advantage and Performance as constructs of OH. This instrument will be of significant importance to technology companies looking for a timely measure of the readiness for future business.

1.6.2 *Practical significance*

The risks of competence deficiency in telecommunication sector belong to the heart of the economic challenge for thriving economies like India. India, though a young nation, still faces this impending challenge of quality technical education which may indicate severe risks of technical competence deficiency. India's universities, firms and policy makers need to come together to address this skill demand issue in telecommunication sector by bridging the gap between academia and telecommunication sector. Collaboration among the institutions, government and industry is essential to bring about significant progress in building fundamental aspect of telecommunication competence countries across the world.

In addition, the measurement instruments suggested here can be used by managers themselves or by consultants as a diagnostic tool to identify the specific components of business operations that can be developed and improved to provide the greatest impact to competitiveness, and business results.

1.7 Scope of The Study

This research examined the role of technology disruption, innovation capacity and competence building on competence adequacy and organizational health. This research draws on telecommunication operators, as representatives of the high technology sector, and focuses on Indian telecommunication industry. Four major telecommunication operators Bharti Airtel, Vodafone, Idea cellular and Aircel were chosen as the sample organisations for this research with the managers of these companies as the unit of analysis. These four companies have invested heavily into the technology upgrade initiatives and are now at the forefront in delivering technology-based products over mobile internet to the masses in India.

1.8 Definition of Terms

1.8.1 Organisational Health

Although there are varied definitions of organisational health by different researchers and scholars, for the purpose of this study it is appropriate to follow the definition given by McHugh and Brotherton (2000). They defined healthy organisation as the one whose objective focus, change culture and competitive readiness such that the organisation is able to sustain its superior performance through changing times and stay ahead of competition.

1.8.2 Competence adequacy

Coyne, Hall, and Clifford (1997) defined competence adequacy as the required quantity of competence in combination of complementary skills and knowledge embedded in a group or team that results in the ability to execute one or more critical processes to a world-class standard. In line with variety of definitions provided by other scholars (Hofer & Schendell, 1978; Dubois, 1998; Marrelli, 1998; Jackson & Schuler, 2003), this study confines the definition of competence adequacy as the collection of integrative, technological and market competence of a firm in adequate quality and quantity for the firm to sustain the health in changing business and technological environments.

1.8.3 Technology disruption

Majority of researchers explain technology disruption as the perceived discrepancy between the expected level of performance and available amount of competence to perform the business functions (Reeser 1977; Fossum et al. 1986; Harel & Cohen 1982; Dubin 1990; Norgren 1965; Pazy 1996). For the purpose of this research, technology disruption is referred as the amount of turbulence caused on the level of collective competence of the firm by changing technologies.

1.8.4 Competence building

Hammond (1989) and Chauhan (2009) in relative terms call competence building as enhancement of a number of interacting factors within the firm, which strengthen the capability of the firm to balance competence requirements through changing times. This study operationalize the term as efforts towards creating and maintaining individual expertise and the collective knowledge, skills, abilities and other characteristics of employees of the firm.

1.8.5 Innovation capacity

In this research, it is proposed to measure innovation capacity through the aggregation of measurement of the dimensions such as innovation support, innovation task, innovation behavior, innovation integration and information and communication as elaborated by Tang (1999) through the inventory of organizational innovation.

1.9 Organisation of The Thesis

For the design of the study, this dissertation is structured in five chapters.

Chapter I provided an overview of the research with a brief backgrounder on the phenomena of technology disruption and its observed consequence on telecommunication companies across the world and in India specifically. This section is compiled by the problem statement, research questions, objectives and scope of the inquiry. Major variables proposed in the subsequent chapters are introduced briefly in this chapter.

Chapter II presented an extensive review of literature related to technology disruption, competence adequacy, organisational health, innovation capacity and competence building. This chapter also attempts to uncover the previous studies conducted on the hypothetical relationship among the variables proposed. A conceptual model of competence equilibrium is explained with relevant theories underpinning the relationships. Knowledge evolution theory as the backbone of the framework is also presented in this chapter.

Chapter III developed the relational hypothesis with the support of literature and also presents the theoretical framework. The chapter further elaborates the methodological part of this study consisting data collection and sampling procedures, measurement and instrument design. The researcher has highlighted the origin of items used in the study instrument. Data analysis of a sample survey done to check the reliability and validity of the adopted instruments is also presented in this chapter.

Chapter IV reported the findings of the research study. Various sections of this chapter explain the steps and measures taken to establish the goodness of measures of the data collected. Two level factor analysis of exploratory and confirmatory nature are also included in this chapter. Hypothesis testing results using the path analysis in structural equation model are reported in chapter IV.

Chapter V is the concluding section where the findings of the study are analysed in details to arrive at recommendations to industry, academics and practitioners for improvement in competence related interventions. Further, significant contributions rendered by this research to the body of knowledge are elaborated in this chapter. Limitations identified during the research and clear directions for future research in the area of competence are also included in this concluding chapter.

The thesis ends with the reference and appendices section. The reference section contains a list of secondary source which is gathered from documentation and archival evidence such as articles, journals, reference books, annual reports, websites and other materials related to the study. The Annexure section consists of a set of measurement models of the variables generated through the AMOS graphic as a prelude to the structural equation model. The questionnaire used for the study is also included in the Annexure.

1.10 Summary

This chapter laid the organisation for this research work. The research is framed in the context of the technology companies where environmental disruption is inevitable and frequent, particularly as applied to the telecommunication sector. This chapter offered the background and rationale of the subject followed by a statement of the research problem and research inquiries. Corresponding variables applied in the theoretical framework were explained briefly in this chapter. The next Chapter grounds, this research in the relevant literature to arrive at the research framework. The literature review will handle each variable from the theoretical and conceptual perspective and examine the available literature of the study.

CHAPTER TWO

REVIEW OF LITERATURE

2.1 Introduction

This chapter introduces an integrated literature review, focusing on the current level of available scholarly research on organizational health, competence adequacy, technology disruption, competence building, and innovation capacity along with its related dimensions. In the first section, literature pertaining to the definition and constructs of the proposed variables is unveiled. In the second part, relational hypothesis of the variables are examined with the support of previous literature. The third and concluding part of this chapter discusses the theories pertaining to the hypothesis and overall structural framework.

2.2 Defining Organizational Health

'Health' as defined by the World Health Organization (WHO, 1948) is an equilibrium state of adequacy, comprising physical, mental and spiritual well-being and not just the absence of pathological balance and other diseases (James & Bretones, 2011). Beholding a 'healthy' environment is the vision of every organization, in order to sustain productivity, firm development, continued efficiency and minimize counterproductive behavior and turnover of employees. To meaningfully gauge organizational health, it is important to see how it translates into meaningful performance. Selye (1974) highlighted cohesion among team members as a fundamental requirement for building organizational health. Looking at from a different angle, Gears (2011) elaborated on collaborative environments, free flow of information, and knowledge creation as essential elements of a healthy and wealthy establishment. In the same year, another discussion on organizational health emerged when Keller and Price (2011), brought out the nine health elements encompassing Climate, external orientation, management, culture, Leadership capabilities, motivation, accountability, control & coordination, and innovation & learning.

As Lencioni (2012) puts it, even smartest of the organisations with mastery over strategy, finance and marketing can fail, if it is unhealthy. Brache (2001) elaborated on health as a function of intricate and entwined set of variables as explained in human anatomy, physiology, and psychology. Organizational health is synonymous to the sustainable competitive advantage of the firm through the well-being of the integrated internal systems (Chopra, 2012). Rummler and Brache (2012) have taken this forward by explaining that as the doctor needs to understand the patient's external factors, it is important to look into the external environment of an organization to better understand its health. According to them, this environment consists of customers, suppliers, resource providers, government, and economy. As equal as external factors, it is also essential to understand the internal factors like culture and human capabilities. Fiorelli et. al. (1998) describes Organisational health as a relatively new HR metric to assess the level of commitment by the management towards action.

Wilson et al. (2004) proposed organizational health as the ability of the firm to create and sustain work related processes that engender a position of wholesome mental, physical and social well-being in their employees, which translates into superior firm performance and work efficiency. An unhealthy organization is characterised by alarming levels of performance problems and the consequent decline in production and revenue and bottom lines (Jaimez & Bretones, 2011).

As given in Table 2.1, multiple definitions explained by various scholars in the past touched upon health as the pathological and spiritual readiness of the organization. Few others emphasized the need of competence alignment and hierarchical structure of the firm to be healthy. Many of the definitions lead to a single health factor such as the innate ability of the firm to anticipate changes and be ready for the inevitable.

Table 2.1
Definitions of organizational health

Author	**Definitions of organisational health**
McNamee and McHugh (1990)	Health is the status of an organisation to scan through the environment to identify and align clear goals, formulate appropriate competence strategy and be ready for change for the future.
Kriger and Hanson (1999)	One significance of to be 'healthy' is to be entire; and to experience wholeness is the very heart of what it plans to be otherworldly. Along these lines of taking a gander at things what is otherworldly, that is, wholeness is not the selective territory of any of the world's religious conventions, yet every one of them.
MacIntosh and MacLean (1999)	Positive symptoms of organisational health are vibrant, innovative, energetic & profitable. Further, defensive routines and learning defects are cited as negative symptoms of health.
Danna and Griffin (1999)	Lowered business performance is one of the consequences of poor organisational health. Employee well-being and business performance are well connected components within the firm.
McHugh and Brotherton (2000)	Organisational health is a status where firm’s internal systems, culture and management processes lead to high degrees of organizational functioning. As part of this it is believed that individual and organizational health are interdependent entities.
Lowe, Schellenberg and Shannon (2003)	Employee's perception on occupation fulfilment, worker responsibility, work environment resolve, truancy, and intention to leave etc. will impact organisational health.
DeJoy, Wilson, Vandenberg, McGrath-Higgins and C. Griffin-Blake (2010)	Organisational health is the single characteristic which has capacity building or expanding the organization’s ability to identify, mobilize, and address important and relevant problems.

Keller and Price (2011)	Nine components that prompt organisational wellbeing: responsibility, abilities, coordination and control, society and atmosphere, guiding, outside inspiration, advancement and learning, administration, and inspiration.
Lencioni (2012)	Organization health is the ability to withstand failure, politics, ambiguity, dysfunction and confusion and individuals are engaged to outline items, administration customers, tackle issues and help each other.

Source: Own illustration

Promotion of healthy work practices was given priority while observing health as opposed to having policies and process around to prevent physical and physiological problems in the workplace (Sorge & van Witteloostuijn, 2004; Kelloway & Day, 2005; Grawitch, Trares, & Kohler, 2007). They propose that the way the organization is positioned in terms of change capacity, competence readiness and common goal alignment may have a wide range of impact on the effectiveness of the organisation (Wilson, et al., 2004).

As indicated by Kriger and Hanson (1999), in today's turbulent times, associations are always being dedicated through ability building to accomplish more prominent productivity and viability in money related terms. However there is a necessity for the associations to accomplish more prominent closeness of fit with what is most human, highlighting the spiritual aspect of the firm. Hence, sustainable in the long term. Lyden and Klingele (2000) developed eleven related dimensions to measure organisational health of higher education colleges in Ohio. The dimensions they described are participation and involvement, morale, communication, institutional reputation, ethics, goal alignment, leadership, loyalty & commitment, development & resource utilisation and performance recognition.

Despite the fact that the definition and idea of Organizational Health have been changed and unique, a watched unanimity can obviously presume that it is the capacity of the association to maintain its predominant execution and stay in front of rivalry. From the above explained definitions it can be concluded that the organizational health is the status of the organization to keep the overall business goals aligned with employees, the impeccable competitive advantage and the capacity to adapt changes from within and outside.

2.3 Components of Organisational Health

According to Jaffe (1995), the performance of an organization and its employee's health & satisfaction are important factors comprising Organisational health. Health is never at static state. The dynamic process of health is created and sustained through the complex integration of biological, psychological, and internal organizational processes (Macintosh, MacLean & Burns, 2007). If the OH constructs can be metamorphosed into a state of three-dimensional personified existences through physical, mental and social well-being, an explanation of these distinct but integrated dimensions can be compared as constructs of competitive advantage, goal alignment and change capacity.

The concept of OH was first discussed in literatures when Miles (1969) developed an initial configuration of OH, comprising ten core elements. Ever since, there have been many research and intellectual discussions conducted around the topic. The ten elements identified by Miles (1969) are reproduced in the Table 2.2 under three broad system constructs.

Table 2.2
Core elements of OH

Maintenance needs	Task needs	Growth and change needs
Resource utilization	Goal focus	Autonomy
Cohesiveness	Communication adequacy	Adaptation
Morale	Optimal power	Innovativeness
		Problem-solving adequacy

Source: Miles (1969)

These constructs, on a close examination, can further be reorganised into three broad organizational needs such as; (1) resource readiness with appropriate competence adequacy to face the business requirements (Maintenance needs-Competetive advantage), (2) the ability of the organization to ensure complete alignment of vision, values and strategy with the long term and short term goals (Task needs-Goal alignment) and (3) the strength of the culture and change capacity to adapt and innovate (Growth & change needs- Culture & Change capacity). Figure 2.1 is a reproduction of Organizational health constructs as explained by Miles (1969) with the representation of reflective indicators of the underlying theoretical model as suggested in the present study.

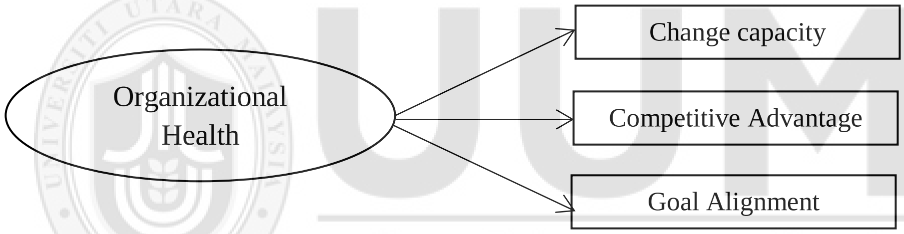

Figure 2.1
Components of OH
Source: Nair et. al. (2014) based on Miles (1969)

Nair et. al. (2014) elaborated that the Organizational health constructs as the harmonic combination of change capacity, competitive advantage, and goal alignment.

2.3.1 Change Capacity

According to McKinsey and Company (2009), sustaining health involves concentrating towards the human side of an organization (change capacity) and not so important for the management of hard numbers. This approach is a departure from the objective measurement driven approach suggested by the proponents of Balanced Score Card. According to McKinsey, aspiring is the beginning of any journey.

Aspiring where the organization wants to be and visualizing changes and challenges through the journey are cornerstones of a healthy organization. Aspiration makes change vision meaningful to employees and it defines the underlying health. Clear management objectives and alignment of action and words are important in the aspiration phase. Healthy work conditions will accelerate the organizational aspiration.

2.3.2 Competitive Advantage

Health, if looked at from the perspective of Resource-Based Theory (RBT), will be supplemented and complemented by sustainable competitive advantage (Barney, 1991). Such advantage is seemingly derived from the organisation's internal pool of resources, which constantly are refreshed for value, rarity, inimitability and are non-substitutability (Cappelli & Hefter, 1996; Ellestro¨m, 1992; Foss & Knudsen, 1996). Focus on firm level capability that are particular and specific to the association that gives reasonable upper hand (Bergenhenegouwen, Horn, & Mooijman, 1996). The extension for framework of competence is restricted; as Thompson, Stuart, and Lindsay (1996) put it, unbending adherence to the present competence may undermine the very things that have prompted its present achievement and resultant health.

While technology is driving the newer planes of competitive environment today, the growth and success of Organizations are clearly governed by the availability of knowledge and expertise, i.e. fitting competence of the business embedded in the workforce should be rare (Bartlett & Ghoshal, 1993). Core competencies, if developed from within are sustainable than those picked up through imitation from the competition or adopted off the shelf and remain most valuable resource to the organization (Collis 1994). Intentionally inbuilt causal ambiguity makes the core competencies in imitable, as the nature and operability of its components remain invisible and hazy making them complicated for the competition to understand copy or imitate (Ethiraj, & Levinthal, 2004; Teece 1998). Zander and Kogut (1995) noted that codified competencies within the firm are unique to positions, functions and domains, which more importantly, are aligned to the product, process and service value chain.

2.3.3 Goal Alignment

As established through their concept of Balanced Score Card (BSC), Kaplan and Norton (1992) argued, a performance oriented organizational environment has always been conducive to financial growth. Through BSC, they introduced the measurement model of intangible assets of a firm, which are integral part of the value creation system. Kaplan and Norton segmented such intangibles into four dimensions i.e. Financial, Customer, Learning, and Development and Internal processes.

The importance of customer centricity remains a non-negotiable instrument in defining the products and services of a company. Customer is central to everything an organization tries to do. With this underlying fact, the BSC identifies all the customer related initiatives and key performance indicators (KPIs) segregated under one basket. Financial measures are integral part of an organization's performance measurement matrices. Unless created for the objective of social service and non-profit, all firms look forward for revenue generation and profit maximization. Internal processes are the vehicles for companies to carry out various initiatives in delivering services and products to market. It is essential to have an operating efficiency in each process area. Companies recognized the power of learning and development when the knowledge industry became predominant in the later part of the twentieth century. People development through learning and training, thus found a strategic place in organizational scorecards.

2.4 Definition of Competence Adequacy

As indicated by Lucia and Lepsinger (1999), capability sufficiency can be characterized as the required level of learning, aptitudes, capacities, and qualities that are important for viably meeting the execution objectives of an association. Competence adequacy is that of firm's readiness reflected in the definition by Mahler (1965) wherein adequacy is termed as the capability of the firm to attain desired outcomes that are in line with the strategic objectives. Mahler (1965) identified two types of capabilities at the individual level: skill, ability which is employee's skills which are adequate to fulfill the present job requirements; and the ability to uphold tractability in attitude and approach to changing business conditions and problems. Some of the explanations of competence adequacy derived from the literature are given in Table 2.3.

Table 2.3
Summary of studies on competence adequacy

Author	**Definition of competence adequacy**
Winterscheid (1994)	The particular substantial and elusive resources of the firm amassed in incorporated bunches, which compass people and gatherings to permit exercises to be performed.
Spencer, McClelland and Spencer (1994)	Thought processes, qualities, self-ideas, mentalities, and qualities which, if blended in the right amount will on the whole guarantee business results
Huselid (1995)	The association's capacity to activate its association, consolidating individuals of diverse aptitudes to cooperate.
McGrath, Tsai, Venkataraman, and MacMillan (1996)	Union of exclusive resources not effortlessly obtained, stolen, imitated or substituted for. The most intense of such resources are set to be impalpable or tacit.
Fleishman, Wetrogan, Uhlman and Marshall-Mies (1995)	The right level of association's capacity as far as aggregate capability to produce change with respect to technologies.

Coyne, Hall, & Clifford (1997)	The required amount of fitness in mix of correlative aptitudes and learning bases installed in a gathering or group that outcomes in the capacity execute one or more basic procedures to a world-class standard.
Mirabile (1997)	Knowledge, aptitudes, and capacities in the right measure at diverse times of the business.
Schippmann et al. (2000)	The expanded spotlight on hierarchical capabilities in the mainstream presses, and the expanding pace of changes in the realm of business, likely energized a parallel increment in enthusiasm for individual skills that could bolster the improvement of an organisations technique and centre abilities.
Martone (2003)	At the highest level, collection of competencies may be used to guide the culture and competitive advantage of an organization
Chen and Naquin (2006)	Motivation, beliefs, values, and interests aggregated to produce desired results

Source: Own illustration

At the firm level, both of these adequacies can be supported by effective competence build up process. Hausknecht & Holwerda, (2013) described it as the collection of behaviors and skills that organizations expect employees to display while at work. The essence of competence is that it acknowledges the interaction of technology with people and their skills, which fundamentally address the firm performance (Scarborough, 1998).

Resource-based theorists argue that the inimitability of the resources within the firm is path dependent. Significant retention of total accumulated KSAO (knowledge, skills, abilities and other characteristics) (in this research it is termed as competence), found in lower turnover situations should be tied in with strong collective performance, mainly due to the fact that competition cannot replicate the structure and essence of competence quickly and easily (Ployhart, Weekley & Ramsey, 2009; 2011). For any firm, it is vain to recreate ability with the same worth it held in which the capability was created for a more extended time frame (Ployhart et al., 2009) on account of these compacted time and economies of scale (Dierickx & Cool, 1989). As fitness consumption happens through turnover, the complexities and way conditions connected with the long haul workforce are deleted; contenders can then all the more effortless recreate the remaining assets and wipe out any upper hands.

The expressions "fitness" and 'competency', some of the time alluding to the plurals ('capabilities', 'skills') with its irregularity in utilization, were pervasive in the administration methodology writing of the 1990s. Snyder and Ebeling (1992) project health as a utility component; however, utilize "skills" for the specialized perspectives. The predominant use of the term ‘competence’ was coupled with the concepts of ‘core competence’ and ‘competitive advantage’ which the resource based researchers introduced and discussed (Prahalad & Hamel, 1990; Ellestro¨ m, 1992; Mitrani et al., 1992; Hamel & Prahalad, 1994; Foss & Knudsen, 1996; Cappelli & Crocker-Hefter, 1996; Campbell & Sommers Luchs, 1997; Nadler & Tushman, 1999; Scarborough, 1998).

The concept of competence adequacy is part and parcel of the strategic management discussion for more than half a century now (Prahalad & Hamel, 1990; Wernerfelt, 1984), which is spreading its wings to innovation and technology space (Nelson & Winter, 1982; Dosi & Marengo, 1993; Carlsson & Eliasson, 1994). Technological competence or the core competence of telecommunication companies as part of the larger set has been referred to while explaining important phenomena like globalization, disruptive technology, and innovations (Tushman & Anderson, 1986; Dunning, 2000). Firm level discussions around survival, growth, and sustenance have always been centered on the theme of competence adequacy (Dierickx & Cool, 1989; Nelson, 1991). Sustenance of competitive advantage is largely dependent on the level of internal competence and to an extent on the external environment as Henderson and Mitchell (1997) put it as a cohesive dependence created by both the factors. Knudsen (1995) explains competence adequacy as the position of the firm as the current stock of collective competence and the complex interaction between the competence accumulation process and the external environment.

2.5 Components of Competence Adequacy

Conceptually at the individual level, competence refers to superior performance (Gabor, Campeanu, Sonea & Muresan, 2011). Mansfield (1999) defined competence as an individual's basic characteristic, which leads to superior performance or efficiency. Lawler (1994) observed adequacy as collection of the knowledge, skills, and abilities (KSA) that are prerequisites for the high performance on the job. Characteristics like skills, mindsets and thought patterns (Others), which, when applied at work in the right combinations, result into desired competence (Hofer & Schendell, 1978; Dubois, 1998; Marrelli, 1998; Jackson & Schuler, 2003). In spite of the divergent terminology and definitions used to explain competence adequacy, there exists some consensus in terms of its components. A large portion of the skill studies concurs that idea of ability maleness' is a quantifiable apparatus to offer us some assistance with understanding how the accumulation of capabilities are connected with association's execution (Hitt, Ireland, & Hoskisson, 2002). Wanga et. al. (2004) examined these important competence components to integrate them to form the essence of competence adequacy. They are, marketing competence, technological competence and integrative competence.

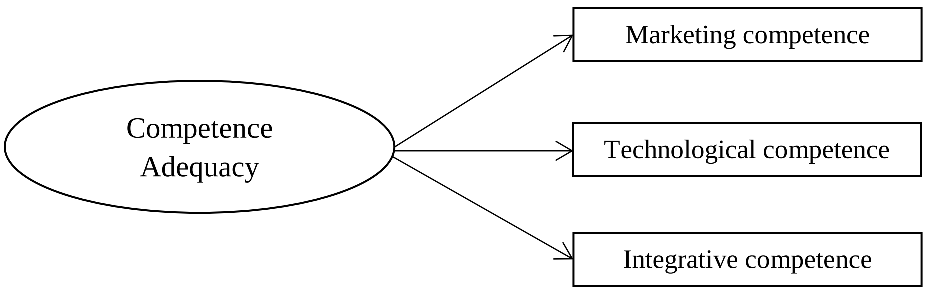

Figure 2.2
Components of competence adequacy
Source: Wanga et. al. (2004)

Each of these components is explained briefly here.

2.5.1 Marketing competence

Various market orientation studies have highlighted the importance of intelligence in making and shaping products and services, which are best suited to the consumer. The generation of such market intelligence is fundamental to the anticipation of competence (Kohli & Jaworski, 1990). They further elaborated on the methodological internalization of such intelligence by disseminating such information through the organization. Such market intelligence has profound impact on the development process of products and services. Lawrence and Dyer (1983) were the first ones to introduce the concept of competence renewal based on specific demands of the future.

2.5.2 Technology competence

Technological competence is the special ability to transform knowledge into designs and new products in unique ways (Wang et. al., 2004). In a study of the competence framework published by the Corporate Leadership Council (CLC) in 2010, the requirement of future competence building is emphasized as part of the suggested model. It is recommended that while creating the competence framework, future resource requirements based on the technology changes need to be included to ensure continuity incompetence. The model also suggested the inclusion of key leadership competence required for the future. The process of identifying the competence and core employees is also part of the CLC framework. While most of the competence literature talked about the clear and present requirements of firm level competence,

Competence development programs focusing future business developments are one of the important success factors of the firms (O'Driscoll, Carson, & Gilmore, 2001). To alleviate the effect of technology competence obsolescence, Rosen and Jerdee (1985) argued the need of setting up dedicated technology research team within the firm. Though this approach looks radical, it is an essential talent management strategy for high technology firms. There are many companies in the telecommunication sector, which nurture in-house technology research teams. Organisational theorists have always struggled to identify the factors that strengthen the ability of the firm to generate business critical ideas. The investment of a considerable amount of money, time and efforts towards technology research is quintessential to strengthen this ability. Telecommunication organizations operate in an interrelated technology eco system and it is important to initiate collaborative technology research within this partner ecosystem.

Technology competence is the ability to extend the mastery of technical capabilities to mobilize resources and deploy them effectively through the full stream of products across the firm (Walsh & Linton, 2002; Afuah, 2002; Torkkeli & Tuominen, 2002). They represent a heterogeneous area of technologies from design, process, product, and information.

2.5.3 Integrative competence

It is imperative that when technological redundancy happens, the related competences also become obsolete. The CLC competence model suggests that firms should critically evaluate and identify the technology and functional competence, which are likely to be obsolete due to the imminent change in technology. This identification can give the firm an advantage of tuning such competences keeping in mind the future requirements. Acquisition of such futuristic competence from the market may be difficult due to the non-availability of such updated skills. In such situation, CLC suggests that the firms should be prepared to review the entire talent portfolio by building a pool of anticipated skills. Athey and Orth (1999) demanded that while growing such skill programs, it is essential to include countless all the while.

2.6 Definition of Technology Disruption

There has been a wide variety of definitions used by the researchers in the past while explaining about the changes in technology. Depending on the impact caused by the technology; terms like "breakthrough" or "discontinuous," (Freeman, 1974; Tushman & Anderson 1986; Garcia & Calantone 2002) were commonly referred. An Early study by Schumpeter (1939) mentions “disruptive” to define the effects of technology changes. In the technology literature, the evolution of technology is most commonly represented through an S curve, suggesting an initial steady growth followed by a steep growth and finally culminating into a plateau. Such phenomenon, if plotted against time will resemble an S curve, which was initially explained by Foster (1986) and Sahal (1981) which was further supported by Utterback (1994). These creators address the problematic advancement in innovation on some essential measurement that is basic to clients when the development limit rises.

A technology for an organization is often termed as a particular space of niche skill, which the firm is operating in (Ehrnberg, 1995). Hamilton and Singh (1992) discuss the changes in competence, capabilities with the emergence of new technologies, and define technology disruption as a major factor in deciding the firm’s position in the market in terms of its readiness to take on newer planes of technology growth. Changes in technologies and resultant misalignment of firm competence are also the base for the definitions given by Granstrand and Sjiilander (1990) and Ehrnberg and Jacobsson (1993). The common theme evolving from these three studies are the categorization of disruption based on how a new technology affects the incumbent set of internal competence of the organisation.

Individuals who are affected by the technological changes need to adapt and change very fast to ensure they are not the reason for the declining productivity of the firm. Absence of such adaptation will devalue them and the organisation may not consider them for future roles (Dhar, 1994). In his book The 8th Habit, Covey (2004) forewarned the perils of obsolescence at workplace by projecting the statistics that over 20 per cent of the present global competence is becoming out of use due to changes in technologies, and that unless firms adapt and readjust according to the changing requirements, it is likely that the balance of the workforce will also become obsolete.

Disruption can actually occur for technical changes incorporated into new technologies, which makes them more efficient and productive, or also by changes in the economic system. These changes make obsolescence in some circumstances not inherent in the technology itself, but are derived from its relationship to the economic environment or technology package that uses it. According to Pangburn and Sundaresan (2009), the market may demand a product design and quality by individuals who can no longer be satisfied with the obsolete product. The sources of this obsolescence depend on the nature of the product, whether it is an intermediate, or final consumer product. Changes in intermediate products of an economic system are due to technological changes in the specific system in use. By contrast, changes in the demand for final consumer products depend on changes in consumer tastes, which are the consequence of changes in the levels and distribution of income, promotion of products and technical changes incorporated into them for fresh purposes.

Many of the major operators in the telecommunication technology have the ability to create and deploy their own proprietary software packages in the market. This can create significant difference among the operating platforms used for the technology. For example, Apple uses proprietary software on its series of devices, which is the primary selling point for the company. The characteristics of telecommunication industry demands continuous innovation, which resulted in accumulation of patents in companies like Motorola in the last two decades. All the key players in the industry hold various product related patents and invest considerably in research and development to stay competitive. The Apple's iPhone arrangement is a late and a substantial sample of expense focal points through patent holding.

Disruption refers to an effect due to abrupt change of context, which results into a service, knowledge or practice going out of use even if they still be in good working condition. A replacement with better or newer features becomes available and more so it makes it convenient to replace than keeping the current creates the state of obsolescence. Something that is already considered outdated, irrelevant to the current context, disused, discarded or antiquated is termed as obsolete. Typically, disruption is preceded by obsolescence, which is a gradual decline in popularity, however this decline is observed to be steep in the technology area.

On the same note, disruption is also applicable to human competence which occurs when the environmental changes alters specific job requirements significantly and the existing stock of knowledge, skills, and abilities become incongruent with the job demands (Fossum, Arvey, Paradise, & Robbins, 1986). Competence related obsolescence in technology context lacks adequate research support and is a growing concern for researchers and scholars in this area. Definitions related to technology performance and disruption is commonly referred in the literature (Burack & Pati 1970; Reeser 1977; Fossum et al. 1986; Harel & Cohen 1982; Dubin 1990; Norgren 1965; Pazy 1996). Most of them explain disruption thorough the discrepancy between the expected level of performance and available amount of competence, which incorporates knowledge into a new level.

2.7 Components of Technology Disruption

According to Wang et. al. (2006), technology disruption comes through the turbulence in environment and market. All the more critically, innovation disturbance causes sudden diminishment in existing information including hypothetical and viable ability, item advancement strategies, client systems, experience and physical gadgets and gear. The overall technology disruption is constructed through the below components

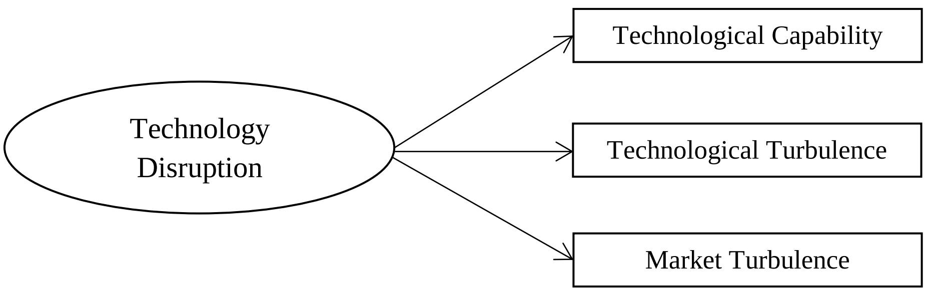

Figure 2.3
Components of technology disruption
Source: Wang et. al. (2006)

2.7.1 Technological capability

Technology remains as the fundamental of the core capabilities of a firm. Technology explains the systematic and logic way of interaction of various elements in a system. It is a collection of knowledge embedded in human brains and muscles, machines, and in software and working structures of the organization. Form et. al. (1988) was one of the first proponents of specialized knowledge as an integral component of Technology disruption. Being integral to an organisation's strategy, technology is an inevitable part of any organization today. Cantner and Pyka (1998) confirm that an organisation's competence base is unconsciously impacted by the development of standards of technology within the firm and this progress will make applied technologies go out of date. Von Glinow, (1988) further establishes that new technologies entails discovery of new competence, which becomes the fuel for sustaining health in organisations. However, it is questionable that how far and how much the technical professionals can contribute to improving organizational health in context of the rapidity of technology change and as a consequence to it, deceleration of the level of their knowledge, skills, and attributes. As Kaufman, Parcel, & Wallace (1988) point out, decline in competence leads to low morale, limited career opportunities, and decreased professional success among technical employees.

2.7.2 Technological turbulence

Bracker and Pearson (1986) feel that with technology disruption, various complexities are bound to spring up within the firm. These complexities include at the upgrade, business strategy and integration levels. It is desirable for organisations to allow a reasonable amount of chaos to be present within the system. The notion of ‘edge of chaos’ was conceptualized by the proponents of complexity theory (Gleick, 1987; Miller 1996; Prigogine, 1993; Prigogine, 1996). Edge of chaos is a constant dynamic state as opposed to relative stability. Staying in the edge of chaos will enable orgnaisations to be agile, flexible, and adaptable to the imminent change. Complexity theorists claim that the edge of chaos offers organization great opportunities to sow the seeds of innovation and creativity in the home ground, which in turn result into cultivable fields of competitive advantage (Brown & Eisenhardt, 1998). Higher the technology turbulence, larger the impact of disruption to the firm and it is imperative that firm reduces the effect of turbulence by appropriate precautionary measures.

2.7.3 Market turbulence

Bower and Christensen (1995) advocated that staying closer to the customers will endanger the company’s ability to adapt disruptive technologies which would initially look irrelevant to the current business. For managers, it is essential to understand the impact of disruptive technology and locate the emerging markets for that technology. Rapidity of change is through evolution and product depletion is part and parcel of the Technology Disruption (Kozlowski & Farr, 1988). Adner and Zemsky (2005) opine that technology disruption has a novel mix of attributes to offer in comparison to the established technology. Kaufman (1989) in his long standing technology based research on firms emphasize that it is possible to measure the impact of the growth of technology in the business scenario where the organisation operates. The effect on business output of technology disruption as analysed by Adner (2002) are the profitability and innovation inventiveness.

Goggin (2008) feels that environmental changes such as technology have brought about the pressing need to continually enhance technical kills. His suggestion to avoid obsolescence is that employees must continually explore new knowledge, skills, and abilities to suit the new environment. Tagliavini and Pigni (2012) observed that the factor for organization of today is to continually renew competence in anticipation of environmental changes. He expresses that today's workspace is a world of constant and imminent change. Higher the market turbulence, larger will be the disruptive impact.

2.8 Definitions of Competence Building

McClelland (1973) clarified the groups of life results presented competence as an idea as parts of execution. Sykes (1997) cites from the Concise Oxford Dictionary of Current English for the importance of words "skill" and "competency" as capacity (to do, for an undertaking), adequacy of mean for simple circumstances, lawful limit, living and so forth. The lexicon eludes both the words as it and expresses that both the terms are effectively compatible. A skill is just the capacity and readiness to perform an undertaking (Burgoyne, 1989). Cotton and Hart (2003) suggest that building competence in anticipation has two dimensions, future technical competence and future functional competence. Further, it is the ability of the firm to collectively foresee, analyse and evaluate the future competence landscape to ensure sustainability of the competitive advantage. Technology related competence that the organization beholds and the efforts towards developing competence for future will have direct impact on the strategy of the firm (Itami & Numagami, 1992).

In technology, everything happens so fast. Just over three years ago, Blackberry was leading the world of Smartphone's and now the company is facing towards an uncertain future in the competitive landscape of mobile devices (Ang, Tekwani, & Wang, 2012). BlackBerry (formally RIM) who a few years ago was the undisputed leader in smartphone's and mobile devices with permanent connection to the internet is now in serious trouble. Their devices do not totally convincing, do not sell enough, have lost a large percentage of market share but above all seem to have ceased to be relevant (Zielińskia, & Zieliński, 2013).

The open field of study by the firm's Resource-Based approach (Resource Based View - RBV), which proposes to enhance the internal attributes of the company as a source of sustainable competitive advantage, has been elaborated by Foss (1998). From the perspective of Foss, firms are seen as a set of features that underlie the growth strategies launched by entrepreneurs. Although these concepts have been proposed in the late 1950s, it was only in the mid-1980s that were actually seen as a strategic alternative for companies. Foss and Knudsen (2003), proposed an evolutionary view, which influenced the whole neo-Schumpeterian thought, revaluing the contributions of scholars on competitive advantage thus far.

There is a concern to formally define which the resources are, but it is clear that besides the tangible assets already mentioned by Barney (1986), it is also important to consider intangible assets, primarily by its emphasis on technology as an important factor in the company's strategy. In the early 1990s, new studies within the RBV were published (Hamel & Prahalad, 1991) which developed the idea of core competence, currently a widespread and somewhat trivialized concept. Despite the wide acceptance of the RBV approach, there is still a great debate on the terms and concepts used over time by different authors. There is still no consensus on what is considered an asset of the firm (Collis, 1994).

The RBV explains an inside out theory of reasons behind firm's success and failure (Srivastava, Fahey & Christensen 2001, p. 778, citing Dickson 1996), and it has a practical focus on firm resources (assets and capabilities) that managers could acquire and/or manage and develop. Rightful amount of intellectual capital should be built up and maintained to face the imminent changes in technology. For this reason, it was considered that the RBV approach, with its straightforward focus on the overall competence requirements for the firm, would be appropriate for this study.

Resources and competence though complement each other; they have clear distinction at the firm level (Mills, Platts, Bourne, & Richards, 2002). While resource is something which the firm has access to and possesses, competence is the ability to do something to bring desirable organizational outcomes. Competence is built upon the building blocks called resources (Mills et al., 2002). Therefore, competence is an aggregation of those that are core as well as the organizational ones, making a healthy combination of resources and of the portfolio of individual competencies. In systemic terms, the final outcome, collective competence, are greater than the sum of the individual competences.

The Resource-Based View (R-BV) hypothesizes that it is the company's 'core competencies' that give health to the establishment further bolstering economical good fortune. In addition to the introduction of R-BT by Barney (1986), Prahalad and Hamel (1990) discussed R-BV through their core competence model. Barney (1991) initiated amalgamating all the R-BT and R-BV, a detailed discussion on core competencies through the theoretical characteristics of sustainable competitive advantage.

2.9 Components of Competence Building

According to Sanchez, Heene, and Thomas, (1996), a firm can leverage the existing competence by extending it to the current and newer market opportunities. Identifying similar or relate competence which the firm already using and developing them future is also an important activity towards enhancing competitive advantage. Adding to the prevailing confusion around the meaning of these two words, the literature generated from the USA and UK follow different views based on the use of English language in these countries. Following the USA standards, Boyatzis (1982) explains 'competence' as the underlying characteristics of an individual which resulting in superior performance.

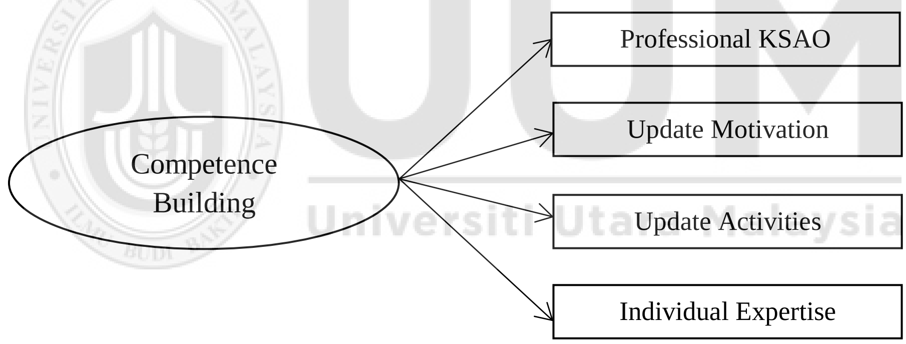

Figure 2.4
Components of competence building
Source: Chauhan and Chauhan (2009)

The debate arises here whether this refers to 'behaviours' or 'attributes'. In opposition to this, the UK principles system characterizes "fitness" as portrayal of an activity, conduct or result which an individual must have the capacity to illustrate (Training agency, 1988). Following the personal qualities approach, Hammond (1989) calls competencies as enablers for people to perform the task. Chauhan and Chauhan (2009) suggested a number of interacting factors, which form the competence building. These factors can be located at both individual and firm level.

2.9.1 *Professional KSAO*

Lawler (1994) viewed it as composure of the knowledge, skills, and abilities (KSA) that are associated with high performance on the job. Characteristics like skills, mindsets, and thought patterns (Others), which when used in the right combinations at the right context results in successful firm performance (Marrelli, 1998; Dubois, 1998; Hofer & Schendell, 1978; Jackson & Schuler, 2003). Bandura (1999) describes the relevance of Knowledge, Skill, Abilities, and Other Characteristics (KSAO) as one of the dimensions of Competence building. This dimension is supported in the instrument of Professional obsolescence scale (POS) developed by Mohan and Chauhan (2000).

2.9.2 *Update motivation*

Bisilkas, García and Barreda (2012) say that an organization health depends on the altering forms of competence. According to Tushman and Romanelli (1985), it is possible for a company to change its form to transition from a low fitness to a high fitness status. Clavareau and Labeau, (2009) suggests measurement of any competence changes to assess the impact of Competence adequacy. It is important for individual employees in the company to have enough motivation to update their own skills according to the changing demand from the business. Barney (1991) initiated amalgamating all the R-BT and R-BV a detailed discussion on core competencies through the theoretical characteristics of sustainable competitive advantage. Thus, in line with Mohan and Chauhan's (2000) Professional Obsolescence Scale, update motivation is considered as the second dimension of the competence building.

2.9.3 *Update activities*

Activities around the competence update at individual and firm level play very important role in deciding collective competence adequacy of the company. Needless to mention that Competence building of a firm stems from the RBV theory. Thus, competence correction through organizational learning plays a vital role in maintaining the adequacy level at changing times (Bartunek; Huang & Walsh, 2008). Before the theorizing of the R-BT, a resource based reasoning of firm performance from a sociological viewpoint was discussed by Price (1977). His argument on the human capital was generally referring to the headcount loss from the organization and its consequence on the firm performance. Considering the inherent competence at varying levels involved in the human capital movement, Price's model compliments the R-BT when evaluating OH.

2.9.4 Individual expertise

Senge (1990) introduced technical expertise in the form of personal mastery as one of the core elements of learning organisation. An organisation, which is subject to continuous technology disruption, needs to evolve the internal competence through the personal mastery and expertise of its individuals who contribute to the collective competitive advantage (Senge, 1990; Nevens, 1992; Porth, Ulrich & Van Glinow, 1993; Ahmed, Loh, & Zairi, 1999; Bennett & O'Brien, 1994; Watkins & Golembiewski, 1995; DiBella, 1997; Popper & Lipshitz, 2000). Applying the characteristics of the learning organization to the competence adequacy level, Senge (1996) explains the importance of the specific skill expertise a firm as expressed by the personal mastery, which is confirmed as the last dimension of CB in the POS.

2.10 Definition of Innovation Capacity

Innovation capacity (IC) is the collective ability of a firm to look into future through the eyes of customer and reengineer products and services accordingly (Bose et al., 2002). This involves an element of risk, which needs to be calibrated to take appropriate investment decisions. The intentional effort to develop organizational capability and readiness to embrace changing technologies, internal business dynamics and product portfolios, are what McGrath (2001) terms as innovation capacity. Innovation capacity (i.e., the capacity to innovate) is an embedded organizational procedures and collective workplace behaviors used by the firm to segregate innovation opportunities, share information seamlessly, encourage discussion and call for new ideas (Nelson & Winter, 1982; McGrath, 2001). Organisations need to inculcate this internal routines as a common behavior to scan the environment on regular basis to identify opportunities (Danneels, 2004), and willing to share the data and formation gained through the process of scanning (Barney, 1991), diversity in thought process but unanimity in solution identification and free discussion on alternative solutions (March, 1991), and a harmonious team culture, mutual trust and experiential learning, and putting new strategies into action that leverage the firm's collective competence (Ellington, Jones & Deane, 1996; Thomke, 2003). Such habitual norms created by the routines are critical in growing the capacity of innovation within the firm.

The study conducted by Goddard and Eccles (2012) on organizational failures enumerates the causal effect of internal factors on failure are as high as 93%. The effects from external environment contribute only 17% to the failure. The major share of these failure reasons can be controlled internally by building innovation capacity, concentrating on the core business, careful diversification, developing compatible leadership, flat organizational designs, and ensuring constant talent pipeline. A summary of innovation capacity definitions collected from the literature is in Table 2.4.

Table 2.4
Summary of definitions on innovation capacity

Author (Year)	Definition of Innovation Capacity
Keller, and Husig (2009)	Property of an organisation that supports a seamless flow of multiple, value-creating and novel initiatives.
Akman and Yilmaz (2008)	A critical component that encourages an imaginative authoritative society, abilities of comprehension and reacting to the outer environment and qualities of inward advancing exercises.
Elmquist and Le Masson (2009)	Comprises in producing new thoughts and information to exploit market opportunities.
Malaysia Productivity Corporation (2009)	The ability to produce new thoughts which prompt higher execution, make new open doors, expand future limit, innovative administration and also expanded learning base through overseeing mechanical changes.
Wonglimpiyarat (2010)	The capacity to make real upgrades and changes to existing advances, and to make new innovations.
Laforet (2011)	Availability of resources, collaborative structure and process to solve problems.
Withers, Drnevich and Marino (2011)	The degree to which a firm possesses resources and capabilities presumed necessary for innovation.

Adaptability is a visible differentiating factor between the companies which survive the odds of the market and the ones not. It is very essential for telecommunication companies to be adaptable when technology disruption is imminent (Abbott, 2013). Technical product innovation, focusing on the process of technology development (Cooper 1991), and the "innovative leader" approach where innovation is driven by a key person in the business (Kirton 1984), are examples of an internal perspective of innovation where the focus is on what happens inside the organisation.

Network or systems theories propose that innovation arises from interaction with other organisations (Etzkowitz 2002), and the lead user theory views innovation as arising from innovator customers (von Hippel 1986), are examples of an external perspective of innovation where the focus is on what happens outside the business. Integrating theories that combine external and internal considerations include open systems innovation that treats organisations as open systems that receive inputs and produce outputs through the interactions of its members that are in turn, influenced by the environment and the organizational culture (Katz & Kahn 1978; Lawrence & Lorsch 1986).

2.11 Components of Innovation Capacity

On a close scrutiny of the available literature on innovation related to the Innovation Capacity revealed five closely linked constructs as explained by Tang (1999) in his Inventory of Organizational Innovativeness (IOI).

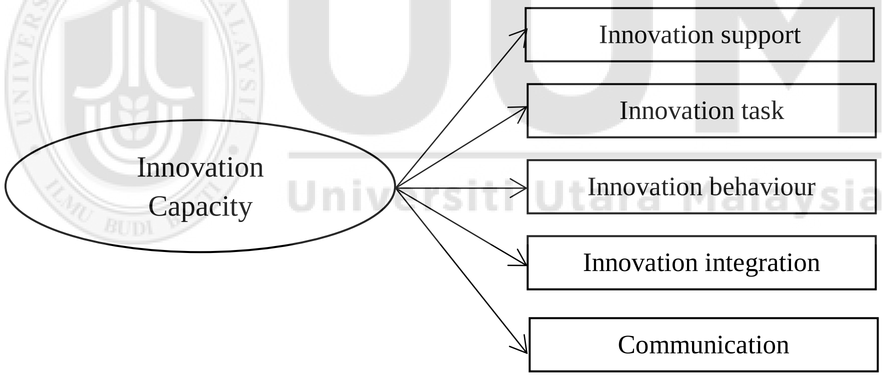

Figure 2.5
Components of innovation capacity
Source: Tang (1999)

In his model, Tang explained how innovation capacity can be increased within a firm by managing competence. These constructs, though disparate in the innovation studies, when put together, make a reasonable model of IC. The constructs thus identified are Innovation support, Innovation task, Innovation behaviour, Innovation integration and Information & communication. Each of these constructs is explained briefly here.

Organisational innovation that describes a holistic or strategic perspective to change in all aspects of the organisation and its interplay with markets (Schlegelmilch, Diamantopoulos & Kreuz 2003), the Resource Based View (RBV) of the organisation that suggests that a firm's internal resources in the form of sets of capabilities and assets are essential in supporting its competitive advantage and in implementing corporate and marketing strategy (Barney 1991; Peteraf 1993). The dynamic capabilities approach that describes the process that is particular to the firm by which its assets can be deployed and redeployed in changing market circumstances (Eisenhardt & Martin 2000; Wang & Ahmed 2007).

2.11.1 Innovation support

Global competition has given much required emphasis to the competitive advantage by recognizing differentiating factors in all markets. Domestic players in all markets saw a sudden influx of foreign products with lower price and higher quality. When investment in product development was no more an option to the companies, smaller firms, caught in the global competition started looking for innovation methods to match the quality and price of their foreign counterparts. According to Charney (1991), product development in traditional methods will run into risk of losing revenue targets. Concurrent engineering as an innovative method was a natural evolution in the product development space adopted by many companies. Poolton and Ismail (2000) explained the support as team based element when members within the team share the basic objective of accomplishing creative products, the advancement of shared trust, and regard for interchange perspectives. They also emphasized the need to integrate disparate inter disciplinary teams into singular entity with structure customer and product vision.

Concurrent engineering as a concept focused on reducing the gap between collecting latent needs of customers and converting them into new and improved products. This tame gap is crucial in defining competitive advantage of firms. Concurrent engineering as the name suggests is the process of parallel development of products while the existing product is declining in terms of features and customer needs. People and team have been the central theme of innovation evolution where researchers recognized the need to promote inter-personnel relationships in teams (Maliniak; 1991; Vasilash & Bergstrom, 1991; Pugh, 1992). Many scholars (Pascale & Athos, 1981; Peters & Waterman, 1982; Peters, 1988) called investment in human capital as a definite factor for innovative product development.

2.11.2 Innovation task

Real life discussions and negotiations with customers and the product sales team are essential to understand the potential needs of customers (Walker et al., 1996). The body of knowledge around innovation studies highlights the importance of feedback loop as fundamental requirement for developing scientific, technological and market innovations (Rothwell, 1977; von Hippel, 1988; Lundvall, 1988). Leonard and Rayport (1997) developed 'empathic design' as an ethnographic method in collecting product feedback from different type of customers in natural environment. The feedback thus collected is analysed by a cross functional team within the company. The observations and data are then developed into product alterations and prototypes. The method focuses on collecting latent requirements of customer that traditional market feedback methods do not capture. While explaining about building innovation capacity, Lester, Piore, and Malek, (1998) emphasized the need of deploying product designers with each distinct customer segment to collect their specific latent needs.

2.11.3 Innovation behaviour

Intense competition and compressed time are increasingly becoming the reality of business life today. Resonating the actual or latent needs of the customers into the products they want is a key issue firms facing currently (Leonard & Rayport, 1997; Fournier, Dobscha, & Mick, 1998; Leith & Riley, 1998; Martin, 1999). The search for new methodologies and techniques in product development paved way to improvisation. Irby (1992) argues that improvisation is an ongoing process where the firms think constantly in the midst of action, pressure, and time compression. To compensate the compressed time periods for go-to-market, it is required to improve the lapse between planning and implementation while developing new products (Moorman & Miner, 1998). According to Bjurwill (1993), improvisation is the essence of innovation is where reading customer's requirements and reacting to them in parallel through improvised methods. Real time composition as explained by Pressing (1988) is also very important factor of improvisation.

2.11.4 Innovation integration

Conventional models and systems are increasingly becoming inefficient to deal with the spiraling altitude of turmoil in the business situations (Poolton & Ismail, 2000). This situation is forcing teams to adapt innovations, which calls for apparent need of teamwork, integration, and trust among the team members. A relaxed organizational environment in terms of informal regulations and rules will provide ways to encourage experimentation and innovation. Letting the members abandoning conventional procedures and allowing breaking rules will be favourable for experimentation (Freemantle, 1999). It is important for companies to allow employees to use own judgment in all business situations. Risk taking is an integral part of experimentation as it strengthens superiority in performance, with the combination of organizational support, it will influence the collective innovation capacity of the firm. When combined with encouragement and support from supervisors, this healthy environment will positively influence product innovation (Caldwell & O'Reilly, 2003; Dewett, 2004).

2.11.5 Information and communication

Innovation is endemic within each individual. Hence, managers should make an effort to ignite this in each team member to generate its collective potential. It is the brainpower rather than manpower works in technology firms and tremendous amount of creative potential is within the brains of the individuals. Tapping this potential in the workplace is a challenge for managers of today. Canfield and Miller (1998) while explaining about creative potential of teams set about nurturing relationships by managers if they want the employees to be committed and creative. The Inventory of Organisational Innovation (IOI) model developed by Tang (1999) mentions the need of dedicated time and resources for generating meaningful business and product ideas. The IOI model also touches upon importance of a diversely skilled workgroup for ensuring optimal creative potential. Further, Amabile and Grykiewicz (1989) emphasized the need of rewards and recognition within the firm to encourage creativity. Constant upgrade of skills and collective knowledge, timely sharing of information and managing the firm's intellectual assets properly are important corner stones for ensuring innovation capacity.

2.12 Critical Review of Previous Studies

A broad review of literature around organisational health, competence, technology disruption, competence building, and innovation was conducted using a multidisciplinary approach. To encompass the transition of current competence position from the post-world war through the industrial revolution to reach up to the current knowledge economy, a wide range of organisational intervention literature from 1950 to 2015 were reviewed.

The academic literature related to Competence and Organisational health have been found in a trend of diminishing importance and moreover the academic oriented competence studies in Technology sector is rarely cited. Organisational health studies predominantly concentrated on the culture and capacity of the firm and competence based approach to health remains to be a topic of academic interest and research. Technology sector, specifically the telecommunication industry is yet to be exposed to the context based competence studies even though the sector faces impending talent shortage and sheer competition in terms of competence. The relational and causal studies on technology disruption and competence are yet to gain momentum in the academic world.

2.12.1 Competence adequacy and organisational health

Jones and Cooper's (1980) definition of Competence adequacy goes with the extent to which the employee's collective skills and knowledge have facilitated the organisation to keep pace with the current and anticipatory skill requirements of the business in future. Evidence show that human competence of the firm is the most valuable asset of an organisaton and the deficiency in such competence in relation to business will negatively affect the Organisation's health (Hislop, 2003; Oltra, 2005). Competence of the organisation is the aggregated knowledge that is significantly related to each individual's specific roles, skills, and cognitive abilities which eventually contributing to organisational performance (Grant, 1996; Hislop, 2002).

According to Cabrera et al. (2006), collective competence held by the organization needs regular review to align with current and future requirements for its value to be appropriated. Andrawina, Govindaraju, Samadhi, and Sudirman, (2008) argue that the organisations with greater competence renewal success will have better position in responding to the changing business environment to deliver relatively better results. However, their study did not explain how competence renewal would influence the position of the oragnisation. Resource based view (RBV) of the HRM (Penrose, 1959) gives theoretical support to this hypothetical argument. Additionally a case study conducted by Massa and Testa (2009) on Italian food producers found that the competitive advantage of the food producers is directly linked to the competence adequacy of the respective firm. Empirical studies undertaken by Kearns and Lederer (2003) also strengthen the argument that RBV based competence adequacy has direct alignment with organizational health.

The aggregate measure of individual knowledge, skills, and attitudes (KSO) at organizational level will represent the collective competence of the firm. According to McClelland (1973), competences can be learnt, observable, and measurable qualities that should be visible and accessible to people for replicating the same at work. Competence should result into real time outcomes at work. If this approach is further extended to the RBV, firms exist for profits and increasing it over the period. To grow profits and keep it, firms need to be healthy (Organization Health). A healthy firm will have sustainable Competitive Advantage over others (Prahalad & Hamel, 1990). A firm with competitive advantage would have internal capability, which is firm specific, and Valuable, Rare, In-imitable and Non-substitutable (VRIN). Industry Specific and Firm specific Core Competencies are the differentiating factors in creating VRIN. It is important for a firm to evaluate the competence at frequent intervals to ensure adequacy level is achieved and maintained by the firm through proactive development process. The studies are yet to explore the nature of relationship and the strength of such relationship between competence changes and firm health.

According to McClelland (1973), the key features of the competence approach is fundamentally leading to organizational health. To understand competence requirements, the best way is to observe what high performers actually do and allow people to perform key aspects of the competence to measure performance. The argument of aligning strategy and performance metrics is widely discussed among academicians (Powell, 1992; Bourne et al., 2000; O'Leary-Kelly & Flores, 2002). Several studies have suggested the evidential cause-effect relationship between goal alignment and organisational health and this relationship is essential in an organization due to the importance of measurement of non-financial aspects, especially the core competencies (de Haas & Kleingeld,1999), which questions the traditional importance of accounting data in projecting organizational health (Kaplan & Norton,1996a).

McHugh and Brotherton (2000) questioned the commonly accepted belief that organizational wealth is direct indicator of health. They argued that health and wealth are not interdependent entities and the proliferation of one does not improve the status of the other. However, contrary to their own argument of this interdependence, their comparative study focused on the psychological well-being of individuals in two sets of financially healthy and unhealthy organisations. The result of the study revealed that the employees in the financially healthy organisations have better well-being than those of the financially un-healthy organisations. They further argue that an organization may appear to be healthy in terms of financial outputs but could carry symptoms of ill health due to other environmental influences. Such ill health, according to them would be highlighted in the event of intense competition.

With the idea of Core Competencies, Hamel and Prahalad (1994) introduced a newer approach to the organizational health. They argued that the Core Competencies if identified and nurtured within the organization would fetch clear and sustainable competitive advantage to the firm. With sustainable competitive advantage, a firm can attain progressive performance over a long period in comparison to the competition. Standing firm on the RBV, the firm level competence deficiency thus clearly explained the organizational health as communicated by Eisenhardt and Martin (2000). The studies by Priem and Butler (2000), Mosakowski, and Mckelvey (1997) further strengthened the argument that firm level competence points to competitive advantage. According to Barney (1995), firm specific resources, which are not easily imitable, create competitive advantage. Sustenance of such competitive advantage entirely depends on the organisation’s capacity to refine current practices and seeking newer level of abilities to sustain in the market (Ketchen, Ireland, & Snow, 2007).

Collective turnover causes undesirable erosion of firm specific competence and human capital, which further creates additional cost towards acquisition and effort towards onboarding and training activities (Price, 1977; Staw, 1980; Bluedorn, 1982;; Mobley, 1982; Osterman, 1987; Dess & Shaw, 2001). Firm competences are part of overall Knowledge, Skill, Attributes & Other characteristics (KSAO), which each employee beholds in varying rates and levels. Core Competencies can be identified & segregated within KSAO. Previous research gives empirical evidence of relation between declining competence with declined profits (McElroy, Morrow & Rude, 2001; Riordan, Vandenberg & Richardson, 2005; Peterson & Luthans, 2006; Morrow & McElroy, 2007), reduced sales (McElroy et al., 2001; Shaw, Duffy, Johnson, & Lockhart, 2005; Gelade & Ive;ry, 2003; Siebert & Zubanov, 2009), lower revenue (Batt, 2002; Baron, Hannan, & Burton, 2001), increased accident rates (Shaw, Gupta, & Delery, 2005), lower customer satisfaction (Kacmar, Andrews, Van Rooy, Steilberg, & Cerrone, 2006; Peterson & Luthans, 2006) and reduced quality of service (Hausknecht, Trevor, & Howard, 2009). If collective competence can be identified, it can be measured at individual level. Aggregation of individual competence is the collective competence of the firm which if depletes can cause counter productivity (Gelade & Ivery, 2003; Kacmar et al., 2006), and lowered product efficiency (Shaw, Gupta, & Delery, 2005). The essence of competence is that it fairly acknowledges the interaction of technology with people and their skills, which fundamentally addresses the firm performance (Scarborough, 1998). According to Lucia and Lepsinger (1999), competence can be defined as required knowledge, skills and characteristics, which are necessary for effectively performing a role as well as meeting the performance goals of an organization.

Based on the extensive empirical study conducted by Crook et al. (2011) on the human capital performance, they put forward that the understanding start point and environmental conditions which human capital starts losing its value is a critical focal point to begin strategic resource based research. Addressing such imbalance in competence is essential because unlike other organizational resources, employees can choose to exit the firm (Coff, 1997). The literature reviewed establish a relationship between competence and organizational health, however it does not explore how competence variance negatively affecting the organizational health.

2.12.2 Technology disruption and competence adequacy

Depletion in human competence could cause deceleration of productivity at the group and firm level. However, according to Allen and De Grip (2004), technological and competence changes will lead to organizational realignment and increased investment of time and effort towards re-skilling. Bartel and Sicherman (1993) suggest that unexpected and radical changes will affect the value of human capital in terms of the competence advantage. This study however, did not elaborate the specific reason behind the variance in advantage in relation to the radical changes. In majority cases of technology disruption, organisations do not have a menu of technologies to choose to lessen the effort of adjusting to the new environment, which intensifies the pressure on the organization in terms of declining competence value (Wright, Dunford, & Snell, 2011). One of the negative components of competence deficiency in telecommunication companies is based on their technological dependence. Any variation in the environment (technology) or the level of the role in the firm or a combination of both make it difficult to replicate the specific competence within the firm (Hayes et al., 2000; Wickramasinghe & Zoyza, 2009; Barber & Tietje, 2004; Chen, Kondratowicz, & Yi, 2005; Davis, Naughton, & Rothwell, 2004).

Organisations should be wary of the fact that the source of change can arise from expected or unexpected areas including globalization, standardization, newer definitions of competition based on price, personalization, speed and also the newer demands from the stakeholders. Among all these sources of change, technological advancement is perhaps the most important one that organisations currently experience with unprecedented speed (Macky, & Boxall, 2007). Keeping the internal and external boundaries permeable will make the organization to be closely integrated with the overall eco system it belongs to. It is also important for the organisations to develop a healthy network of relationship with external world to ensure seamless exchange of information, resources, and services. There is a stronghold of potential relationship out there in the form of customers, suppliers, partners, regulators, and even competitors. It is essential to keep these relationships fluid to allow flexibility and strong enough to ensure longevity and sustenance. The past studies on competence related to technology companies were mostly centered on the overall effect of technology on the organization in terms of products, price, and customers. Competence based studies in this field are yet to be evolved to understand the relationship between technology and competence.

2.12.3 Technology disruption and organisational health

In this fast moving world, technological obsolescence is one of the most critical reasons for competence deficiency in technology companies. In the process of choosing a technology, and analyzing the characteristics of the technologies available, it is necessary to analyze the extent of disruption it can cause to the business (Fitzpatrick, 2011). In the telecommunication sector, nothing but technology change is the only constant factor. Organisational context (climate and environmental complexity) has moderating impact on the dynamic relationship between competence adequacy and Human capital resource (Nyberg & Ployhart 2013).

The obsolescence caused by the emergence of disruptive technology can make the products unprofitable; for the development of knowledge that enables innovations in production processes; for changes in the economic structure associated with the scale of production; the availability of resources, or a combination of these factors (Clavareau & Labeau, 2009). According to Tidd and Bessant, (2011), disruption sometimes is associated with the age of technology. This concept is related to the efficiency of a technology and its incompatibility with the social and environmental context. For example, diaspora of disruptive communication technology (2G, 3G, and LTE etc) has made the related technologies obsolete abruptly. To stay compatible with consequent changes, sporadic innovations around the group of technologies need to be galvanized. Technology related literature reviewed mostly exhibit positive organizational changes in terms of enhanced products, improved revenues and better customer experience as a consequence of technology changes. However, focus on competence related consequence of technology changes remain as field of study yet to be explored.

The Technology Life-cycle model suggested by Ansoff (1984), explains that when dynamic technological development occurs, firms operating in such markets come under constant pressure to introduce new state-of-the-art products. In such condition, innovation becomes a critical success factor; even though life cycles are short, maintaining competitiveness demands an adequate return on investment. In markets with turbulent technological development, discontinuities occur frequently and old technologies are constantly replaced by new ones (Benkenstein & Bloch, 1993). The primary factor of any innovation process is technology. Both empirical and theoretical studies proved that technology not only brings new waves of innovation in products and process, but it radically changes the rules of the game in business. Such tectonic shift in the way business is done due technological changes can destroy established markets and create fresh markets in unexpected geographical regions (Tushman & Anderson, 1986). Business sensible and remarkable innovations can clearly push firms to higher levels of competitive advantage (Gobeli & Brown, 1994). Technology orientation as an inbuilt component is integral to the innovation and is popular in innovation literature (Berry & Taggart, 1994). However, technology need not be always synonymous with innovation (Claver, Llopis, Garcia, & Molina, 1998; Kim & Mauborgne, 1999). Betz's (1998) argument on balancing view of technology orientation and innovation holds good for telecommunication companies, which was further explained by Rothwell (1994) in his coupling model of innovation.

2.12.4 Technology disruption, Competence adequacy and Organisational health

In high technology organisations, technical professionals are the driving force behind the discovery of newer technologies and channelizing the effort towards building anticipatory competence to create and sustain competitive advantage (Von Glinow, 1988). He further opines that the rapidity of technology changes make consequent obsolescence of their knowledge and skills impacting the technical professional's ability to contribute to the organizational effectiveness. In addition to this, according to Form et. al. (1988) competence obsolescence leads to low employee morale, restricted career opportunities and limited success possibilities among technical professionals.

Organizational performance dimensions can be bracketed into three broad categories based on the proximity towards the contribution probability to performance. It is foreseen that the steady loss (fitness exhaustion) ends up being the hardest and closest (e.g., customer fulfillment, representative work demeanors, truancy), unobtrusive for respectably closest measures (e.g., efficiency, assets, safety), and frail for distal ones (e.g., money related execution) (Park & Shaw, 2012). Warmington (1974) states that any form of obsolescence in an organisation in terms of equipment or production process can often be attributed to a reduction in efficiency which is caused by a deficiency in competence.

According to Goggin (2008), the rate at which the firm adjusts the competence deficiency to the changing technology environment defines the direction and strength of firm performance, the deficiency of competence, if not handled appropriately, can render huge gap in the collective performance of the firm. According to Barney (1995), firm specific resources are directly measurable (e.g., access to inputs) or immeasurable (e.g., skills managerial or technical) based on tangibility. Measure of competence as a product of resources can indicate the level of organizational health. To sustain competitive advantage in the market, firms must not only review their current pool of talent but also anticipate resource requirements to succeed (Ketchen, Ireland, & Snow, 2007). Firms that evaluate newer pastures and seek opportunities to acquire competitive knowledge will be most adaptive and improve performance (March, 1991). According to Leonard-Barton (1992), any continuous competence building activities in related technology areas lead to strengthening of the firm's knowledge base, however over time, this may create competence deficiencies. Hence, in the short run, competence leveraging tends to look at the survival of the foundation competence, but over a period of time, the continued concentration of present competence base may impact detrimentally on the anticipatory competence. To leverage competence the firm needs to recycle competence at regular intervals of time. Leverage of firm specific competence may not always be feasible especially in the fast moving technology environment.

Bandura (1997) defined competence adequacy as a team's shared perception on its aggregate competencies. Depending on the operating context and available resources, this perception can vary and remains debatable (Yu, & Hang, 2009).

According to the social constructionism theorists, when members of a group interact with one another through a social system, the aggregate knowledge is generated and stored through the interactions (Berger & Luckmann 1966). Risk of competence obsolescence on organisation's competitive advantage, change capacity and goal focus was not covered adequately in these studies.

2.12.5 Competence Building and Organisational Health

The requirement of developing newer and futuristic competencies as the need of the hour to maintain the OH has been highlighted by researchers in the past (Suutari, 2002). March (1991) further elaborated saying firms which seek and explore new opportunities by upgrading the competence will sustain in the market and improve performance. Competence related to technology has been deemed the most relevant one to achieve sustainable competitive advantage specifically in the high technology sector and exists a positive correlation between competence adequacy and firm's health (Malerba & Marengo, 1995). With the idea of Core Competencies, Hamel and Prahalad (1994) introduced a newer approach to the organizational health. They argued that the Core Competencies if identified and nurtured within the organization would provide a clear and sustainable competitive advantage for the firm. With sustainable competitive advantage, a firm can attain progressive performance over a long period in comparison to the competition.

It is clear from the late contextual analyses of Nokia, Motorola and Blackberry, that that firm's readiness and capacity to precisely appraise its future skill necessities will have genuine ramifications on its benefit, and its long haul survival. To be able to implement the business strategy successfully, the firm needs to address the most important question of its workforce competence needs for the future (Huselid, Becker, & Beatty 2005). This question can be answered through multiple resource building approaches by building competence in anticipation of developing, motivating, and retaining the number and mix of employees that will be required at each point in time in the future (Sharp, 2006). The study conducted by Goddard and Eccles (2012) on organizational failures enumerates the causal effect of internal factors on failure are as high as 93%. The effects from external environment contribute only 17% to the failure. The lion's share of these failures causes can be controlled internally by building competence, concentrating on the core business and by ensuring constant anticipatory talent pipeline.

Many researchers have acknowledged the importance of aligning collective competence of the firm with organizational strategy and objectives so that an organization achieves its common goals and long-term future success (Dubois & Rothwell, 2004; Vakola, Soderquist, & Prastacos, 2007). In addition, organizational core competence is made up of collective competence that can have a profound impact on many products and services and provide competitiveness in the marketplace (Green, 1999; Henderson, 2007; King, Fowler, & Zeithaml, 2001). Therefore, it is essential to ensure competence anticipation and efforts towards building up such important future resources.

Resource-based arguments can be cited to describe the use of competence building in increasing the value and rarity of the collective competence and, by reference, making competence deficiency more damaging to organizational health (Arthur, 1994; Guthrie, 2001). The RBV theory proposes that employees become more valuable when their competence is aligned and tuned with changing business environments (Coff, 1997). Competence readiness thus can make the intrinsic resource valuable, rare & inimitable (Ployhart et al., 2009). Supporting the RBV arguments, Arthur (1994) further stated that substantial investment in competence building will result into accelerating performance through critical role creations for employees. Their increased value means that they are expected to contribute more and often have jobs that demand more experience and longer tenure. Organizations that invest little in competence renewal, instead seek competitive advantage through, for instance, price reductions or technology enhancements (Osterman, 1987). Efforts towards competence renewal bring equilibrium to the level of competence and organizational performance.

After evaluating the management practices of 160 orgaisations over a decade, Harvard Business School published a report in 2003, which stated a clear dichotomy between the competence building process within the organization and its financial performance. The study suggests that the competence can either augment the performance or prove detrimental to the same depending on level of obsolescence existing. Very close to the Harvard study, in 2002 a similar report was published by the Corporate Leadership Council (CLC, 2002) emphasizing the importance of competence traits such as risk taking, seamless internal communication efforts and flexibility around the business process as key drivers to Organisational Health.

Healthy organisations can recover faster from adversities, as they are immune to internal politics, functional disorders and procedural confusion. Such organisations continuously flush out incompetence to create exciting opportunities for the worthy and inculcate superlative performance. Such organisations seldom fail as they set individuals free to design products of the future, deliver compelling customer experience and solve problems together. Organizational health related research studies cited here are mostly commercial in nature or opinions of experts based on their observations. Empirical studies to show the advantages associates with competence building and performance related disadvantages associated with competence obsolescence and the proportion to their variance in relation to one another needs further elaboration.

Cohesive leadership, simple systems, clarity in organizational targets and multi-channel communication are the pre requisites of OH (Lencioni, 2012). Bill Gates, in his work titled, ‘Business@Speed of Thought’, states that the world is just two years away from failure at any point of time. This statement though stated casually, is a serious pointer towards the perils which obsolescence will bring forth into technological organisations in terms of competence requirements. Such unprecedented changes in technological space will make every skill obsolete in three to five years (Noceraz, 1996). He adds that this frequent but impending obsolescence demands un-learning of older skills and relearning of newer techniques to stay afloat. Cotton and Hart (2003) enumerate that competence building positively impacts performance. However, such studies need further explanation to understand whether competence building moderates between health and competence adequacy of the firm.

2.12.6 Technology disruption, Competence building and Competence adequacy

The challenges of the new millennium further reinforce the importance of technology. Globalization, compressed life cycle of products and processes and technological convergence promote an ever-changing competition that companies are exposed to. The current competitive landscape makes companies coexist with increasingly complex organizational environments. This puts pressure on companies to develop a set of anticipatory skills to deal with the multiple variables that affect the strategic choices of firms (Ashington & Hardy, 2009). The rapid obsolescence of technology is alarmingly high especially in the telecommunication sector. But human resources have the potential to renew competence and stay ahead of obsolescence, and are capable of skill upgrade and transfer across a wide range of technologies, products and markets. (Flood & Olian, 1995).

Scarce resources and the cumulative nature of technological know-how of the company emphasize the need to define a strategy to expand the content of existing technologies and to access and absorb emerging technologies at minimal cost (Pawar, Menon, & Reidel, 1994). The technological strategy has turned into a focal fixing in the idea of the organization, and the innovation now constitutes one of the establishments of vital arranging, controlling the central inquiry of how to set up an upper hand and how to guarantee the survival of the firm. With this, business strategies and technology become increasingly interdependent, while the formulation of technology strategy shall have to consider internal and external aspects of the firm. This means that companies are not entirely free to define their technology strategies without considering the competence requirements for future (Fitzpatrick, 2011).

One often-mentioned characteristic of telecommunication sector is that the pace at which competences is created and destroyed increases. To manage with this turbulence, a firm can strengthen the position by establishing the requisite competence in anticipation of the environment changes or diversify from the competition by through disruptive innovation strategies (Chakravarthy, 1997). Strengthening of the competence base within a particular area leverages the existing competences, whereas diversification points to the world of new competencies. Technical professionals of the telecommunication organizations are the driving force behind the discovery of newer technologies and channelizing the effort towards building anticipatory competence to create and sustain competitive advantage (Von Glinow, 1988). He further opines that the rapidity of technological changes makes consequent obsolescence of their knowledge and skills, impacting the technical professional's ability to contribute to the organizational effectiveness.

Competence level of individual may vary with respect to the service with the firm, complexity of the role and seniority of the position in terms of accountability and know-how. If competence at individual level can be measured, the Human Capital Depletion (HCD) due to inadequate acquisition process (efficiency & time) and non-availability of skills in the market can also be measured. If competence at individual level can be measured, competence erosion due to technology disruption and other environmental changes can also be measured. According to Hansson (2001), by taking into account an employee's view of specific functional competence for performing a particular job, one can avoid focusing on less important competencies. Competence related to specific business function is perceived as a constant energy source to maintain competitive advantage (Li, 2000; Droge, Vickery, & Markland, 1994; Hoffman, 2000).

The independent studies on competence building, development, and assessments have featured in human resources studies in the past. However, Organisational health related few consulting firms performed studies merely as a survey based approach rather than a causal academic oriented research. Innovation studies also were also in most cases part of the technology and product development arena and not part of the competence based research. The relevance and importance of the competence-based studies in technology context with regard to the organizational health is a much-required topic of deliberation in academic as well as practice space.

2.12.7 Innovation Capacity and Organisational Health

Looking at the recent downfall of Nokia, Motorola and Blackberry, the much accomplished telecommunication firms, it is evident that IC is a game-changing factor for technology companies, however small or big it is. It has been proved by Christensen (1997), that traditional customer inputs can sometimes misguide companies in their product development process.

Table 2.5
Relational studies on innovation capacity and organizational health

Author (Year)	**Independent Variable**	**Dependent Variable**	**Findings**
Jaruzelski and Dehoff (2008)	Customer orientation. Technological orientation. i. Innovation strategy. ii. Innovation success.	Performance: Innovation capacity	There is a positive relationship between Customer presentation and Innovative capacity. Mechanical introduction has no association with Innovative capacity.
Fruhling and Siau (2007)	Innovation Strategy Model i. Collaborative process. ii. Performance measures. iii. Education and development iv. Organization's distributed v. Intelligence market positioning vi. Knowledge of products and services. vii. Collaborative market penetration. viii. The market image campaign. ix. Leadership competencies. x. Communications technology.	Innovation outcome & e-commerce activities	The organisation that focus on innovation attributes tend to do well in e-commerce activities (Qualitative case study)

Akman and Yilmaz (2008)	Customer orientation. Technological orientation. i. Innovation strategy. ii. Innovation success.	Performance : Innovation capacity	Technological orientation has no relationship with Innovative capability. Thither is a positive significant relationship between Innovation strategy and Innovation. Innovation capacity has a substantial and positive effect on success of innovation.
Chaveerug and Ussahawanitchakit (2008)	Innovation capacity: i. Innovativeness. ii. Capacity to innovate. iii. The willingness to change.	Organizational performance: i. Market performance. ii. Financial performance. iii. Product/service.	Innovation capacity has strong influence on Organizational performance
Jaruzelski and Dehoff (2010)	R&D investment.	Financial performance	The percentage of revenue spent on R&D has no discernible relationship with most measures on Financial performance.

Source: Own illustration

Christensen's theory of disruptive innovation proved right when Nokia imprisoned by its own past success, was more than complacent to calibrate any risk to invest into the unknown territories of smartphone market, notwithstanding the fact that it had already pioneered the smartphone manufacturing. Organisations, which are focused and committed towards fulfilling the real-time demands of the industry on technology, will have better chance of growth compared to their competitors (Table 2.5). Empirical evidence of the correlation between innovation and organizational performance in terms of market share and profitability has been confirmed by the researchers from studies in the past (Calantone, Vickery, & Dröge, 1995; Han, Kim, & Srivasta, 1998).

The question whether innovation capacity remains as a personal attribute with employees or can be extended to the organization as an emergent property has been discussed by few researchers in the past (Leavy, 1997). Roberts (2003) explained the need of improving organization's Innovation capacity in order to adapt to the advanced technological systems so as to move faster than the competition. Such competitive pressure among the firms are increasing globally, resulting into reduced life cycle of technologies and products, and pushing companies into compelling proposition of innovation (Griffin, 1997).

As it has been widely discussed in the competence theory literature, the failure or falling organizational health is attributable to the diminishing competence due to various environmental reasons. One of such potential reasons is hypothesized in this study as Technology disruption. In order to bring about a competence equilibrium approach while dealing with changing technology and erratic organizational health, it is also important to look at the focused efforts the firm put in place in terms of promoting innovation capacity and building competence base. This study, in essence, was a response to that impending requirement, using the changing environment as the technology context in extending the application of Knowledge evolution theory.

2.12.8 Technology disruption, Innovation capacity and Competence adequacy

According to Frohman (1985), technological innovation can make or break profitability, while Maidique and Patch (1982) stated that 'capacity to innovate' is a vital force in the competitive environment of the modern firm. The current competitive landscape makes companies coexist with increasingly complex organizational environments. This puts pressure on companies to develop a set of anticipatory skills to deal with the multiple variables that affect the strategic choices of firms (Ashington & Hardy, 2009). The ultimate answer lies in how much and how fast the organization can go to the market with innovative products and services. Wu, Wang, Tseng, & Wu (2008) explained the need of improving organization's Innovation capacity in order to adapt to the advanced technological systems so as to move faster than the competition. Such competitive pressure among the firms are increasing globally, resulting into reduced life cycle of technologies and products, and putting companies to compelling proposition of innovation.

Two major streams of approach can be seen in the space of innovation studies. While one stream focuses on the technological aspects of innovation as antecedent, the other stream looks at the competence aspect. Napolitano (1991) extended the fields around a technological view of innovation and LeBlanc, Gaston, and Nguyen (1997) emphasized the dichotomy of research and development and technology in innovation. This stream of study projects technology and R&D as the front end of innovation. The other stream of study strongly views human capital as the center stage to launch innovation. Needless to mention that a vast majority of previous studies support that human competence is the essential causal factor in determining the level of innovation capacity of a firm (Cooper & Kleinschmidt, 1995; Zien & Buckler, 1997). The model of innovation developed by Vrakking (1990) integrates various organizational fields within the spectrum of competence such as technical resources that are impacted by the aggregation of firm specific knowledge and skills in relation to the existing and emerging technologies, management of overall human resources, team-competence, career management, and a flexible culture.

There are several approaches suggested in determining the competence management with technology disruption. In the competence management context, it is important to systematically monitor changes required to the existing technologies and identifying emerging technologies. Competitors' technological capabilities play an important role in the firm's competitive advantage. Hence it is essential to assess the same to re-establish firm specific core competence based on desired capabilities (Burgelman, Christensen, & Wheelwright, 2004).

While explaining the underlying principles of innovation, it is the people who make substantial difference as opposed to technology. Hence, it is imperative that competence management constitute one of the basic factors in organizational success. Contextual imbalances created by the technology disruption can be neutralized to a great extent through competence intervention and effort should be directed towards creating and sustaining perfect levels of (Kanter, 1983; Woodman, Sawyer, & Griffin, 1993; Claver et al., 1998). In managing innovation, the major role of management is to create an environment for the firm to innovate, to improve the firm's capacity of innovation (Hauser, 1998). The researcher here puts forward the perspective of innovation capacity as a moderating factor between technology disruption and competence adequacy.

The literature review revealed several gaps and opportunities for research identified. Firstly, Organizational health, as a concept has been understood and practiced differently by different companies. There is no integrated approach to tackle Organisational health problems as the antecedents of which are examined from different perspectives. Secondly, competency related studies have reached its pinnacle in the early nineties with the advent of resource based theories and modern concepts like balanced scorecard. The studies focused more on what is the content of competence and at different functional groups, what elements will make these competencies differ. That calls for a pressing requirement of studies around how competence can be improved, maintained and sustained. Thirdly, it is also important to put different competence eroding contexts to understand how competence balance can be maintained within the rapidly changing technology segments. An integrated effort now is essential with organizational health as the target, competence at the hindsight and technology changes at the foresight. This integration could help organizations to seek high quality profile while, at the same time, producing innovative products and services to sustain a competitive advantage, especially in the fast-paced technological era. The role of organizational health (OH) in organizational strategy implementation processes remains inefficiently explored. In the light of resource based theory, knowledge evolution theory and the competence equilibrium model, this area of research offers a promising field of studies.

2.13 Systems Theory

To explain organizational health, it is essential to examine the aggregate health in relation to the health of various components of the organization. Systems theory underpins this aggregate health scenario. Systems theory was conceived by a many scholars as a means of examining and engaging with a miscellany of topics in complex organizational process (Boulding, 1956; Ashby, 1962; Churchman, 1968). Systems theory elaborates into two fundamental issues. Firstly, the correlation of several constituents within the organization and with the organization as a whole. Secondly, the kinship between the whole system and its feeder environment. There have been concentrated studies conducted to interpret these relationships better in the field of organization health and competence, for example, in relation to development (Argyris & Schon, 1978; Senge, 1990). According to Brown (1997), organizational health can be assessed by observing the verbal and visual behavioural patterns of internal communication such as employee conversations, office humour, corridor talks.

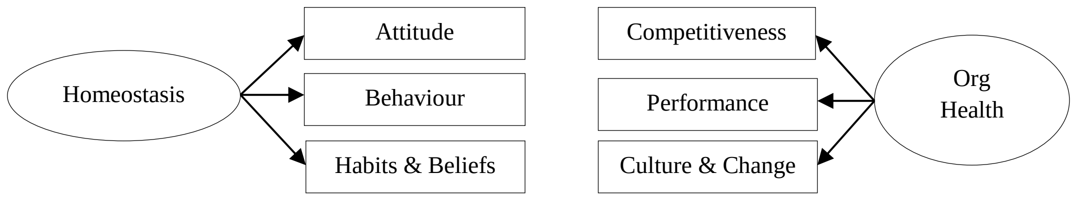

Figure 2.6
Constructs of OH as explained in Homeostasis
Source: Chopra (2013)

In a system model, each cell acts as an independent intelligent unit. These cells are held together to form the body through an enormous and a continuous stream of information. A dynamically balanced state of health is represented by the term, 'Homeostasis' and any imbalance in the health system is represented by Inflammation which causes many if not most diseases (Chopra, 2013).

If Homeostasis or well-being of a person can be derived from her habits, beliefs, attitudes and behavior, the same constructs will be applicable in case of an organization under the realms of systems theory. While the habits and beliefs can be correlated to Culture and change capacity within a firm, the attitudes can be equated to the business readiness in terms of competitiveness and at the same time, the behaviour can be explained through the business performance or the balanced goal alignment process.

2.14 Competence Equilibrium

The static nature of the RBV has been a subject of long standing argument among scholars and academicians, between the substance of the resource and the methodology of building competence adequacy (Teece & Pisano, 1994). In accordance with this disregard, there have been experiments to identify firm level resources, which contribute to the competitive advantage and ultimate revenue (Black & Boal, 1994; Day & Wensley, 1988). Competence adequacy at the firm level has essentially two components. The amount or quantity in terms of the aggregate human capital and the quality or value in terms of the aggregate Knowledge, Skill and Abilities (or attributes) (KSA). The impression of aggregate or firm level value of collective competence remains ignored to a great extent in the resource based initiatives. As the value of the collective competence, directly impact the firm performance, Rathe and Witt (1999) calls for developing a competence equilibrium model encompassing antecedent and consequent components of competence. The model thus proposed in this study can be explained using an improvised version of Bathtub metaphor developed by Dierickx and Cool (1989) as given in Figure 2.7.

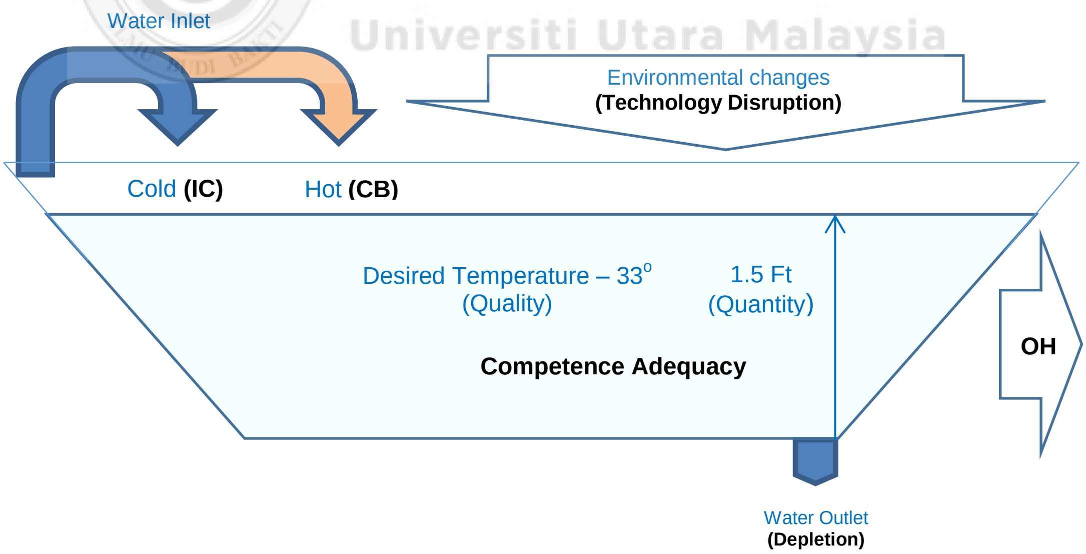

Figure 2.7
Bathtub metaphor
Source: Dierickx and Cool (1989)

Maintaining competence adequacy takes the notion of aggregation into account and the researcher speak of deficiency (opposite of adequacy) caused by environmental changes and accumulation through alternative competence build up measures. Competence adequacy deals with both the positive additions (accumulations) and deductions (collective turnover) to the competence base. Sustainability of competitive advantage poses growing concern for firms and as such Teece et al. (1998), proposed the concept of "dynamic capabilities". The term dynamic refers to the ability of the firm to sustain the level of competences through accumulation of newer competence and renewal of existing base to face changes in the business environment.

2.15 Gaps Identified in Literature

Previous studies on competence were focused more at individual performance influenced by individual competence (Spencer & Spencer, 1993; Russ-Eft, 1995; Rothwell, 1996). If the same theory is applied and extended to the firm level, it can be implied that any deficiency in competence at firm level at any given point of time will lead to poor organizational health. Resource based studies on competence clearly shows that competence depletion can substantially and negatively affect organizational health (Hitt. et. al., 2001). The available literature provides inadequate guidance to the researcher on how human capital losses (competence depletion/erosion/deficiency) negatively impact organizational health. In effect, human capital researchers have concentrated on the depletion of human capital in terms of headcount loss, but have tended to discount the risks of competence obsolescence due to environmental shifts like technology changes (Hausknecht &

Trevor, 2011; Shaw, 2011). It is fair, to question whether the organizational health related advantages associated with building competence are proportional to the performance related disadvantages of obsolete competence. As such there is a huge gap in literature on the aspect of competence based organisational health studies.

From the epistemological perspective, half a century of competence studies have generated two distinct streams. An individual level approach focusing skills and behaviours and, a firm level approach centered on building collective competence for competitive advantage (Haddadj & Besson, 2000). It is the collective responsibility of the employees and company to ensure update activities are kept in momentum through appropriate learning and development efforts (Bartunek; Huang & Walsh, 2008). Most of the literature reveals higher order usage of the term 'competence' while dealing with the organizational capability research. Hence, the researcher has decided to adapt the same term through this entire study. A set of achievement-oriented individuals with personal mastery over products and processes would enhance the overall individual expertise, which the company holds towards the competence building (Senge, 1996). Recognizing the fact that there exists apparent diversity in approach among different countries on the typology of competence, the researcher attempts to investigate collective competence at the firm level using Resource Based View (RBV) as the central theme of this study.

Turnover studies have always focused on individual based headcount loss. Traditionally reported turnover rates are calculated by dividing total number of separations over a period of time with the average total headcount over the same period. This calculation merely gives the percentage of employees left the company. However, from the resource-based view, the loss of collective competence due to this turn over may have larger impact on the competitive advantage of the firm than the headcount loss. The impact of such loss has temporal dynamics based on the time of loss (Siebert & Zubanov, 2009). There are other competence based dynamics associated with the collective turn-over which require further investigation to understand the competence gap created by such turn-over (Hausknecht & Holwerda, 2010). It is apparent that studies on employee turn over need to be channelized to a more meaningful competence based analytics for better preparing the firm for anticipated changes in business and technology. Application of headcount based rationale and individual theories on the turn over need to be changed to develop collective competence based theories to better understand the deficiency of competence due to employee separations (Bartunek, Huang, & Walsh, 2008). The gap in literature on concentrated studies around collective competence needs to be addressed, especially in the technology sector where the study is most relevant at this juncture.

While the proponents of the competence framework treated this movement as revolutionary towards the organisational building process (McClelland 1973; 1994) academicians also criticised the validity of the competence approach (Barriett & Depinet, 1991). Notwithstanding the questions raised, competence approach gained momentum in the last few decades. Recent studies branching out from the traditional competence management show some indication of future competence building, however the extent of it is limited to the gap analysis based on organization strategy, and individuals career development ambitions, ignoring the most important factor of technology disruption (Jukic & Huljenic, 2007). There is little literature available on the competence building process specifically from an environment where competence demand changes more often than not.

Further, Yamin, Mavondo, Gunasekaran, and Sarros (1997) state that anticipating potential of new technologies and acquiring them in advance puts firms in much advantageous position than the competition. They suggest that firms with strong innovation capacity will constantly think about newer technologies and encourage people to leverage technological innovation. Within the telecommunication sector, any shift in contemporary technology will bring in incredible impact to the products and operations as technology is profusely embedded into the intrinsic systems of this sector. Little research has been done to develop assessment models of competence adequacy and the ways it can be increased in a work team. Bandura (1999) in his research on this topic identified four major sources, which can influence the competence adequacy in a group. The first and foremost he suggested is KSAO relevance, which predominantly shapes out of the group perceptions of the knowledge and experience of individuals in various situations and contexts. The other dimensions he suggested are Competence change, Learning and expertise.

While discussing about fast occurring changes, Waitley (2004) emphasized the importance of adaption to change by individuals and companies. He further reiterates that failure to adapt changes through the challenging environments will result in companies turning into non-performing units, and skills become obsolete due to the lack of advanced competence to compete in the changed business scenario. This has happened to Motorola, Nokia and RIM. A range of literature on innovation put forward the need to integrate research and technology for refine the competence in terms of the organizational context, so that technology is not considered in isolation when deciding the innovation capacity (Tidd, Bessant, & Pavitt, 1997). While superimposing technology and competence, the literature generally refers to anticipation of emerging technologies, building on new technological competence, identifying the ways to acquire new skills in given technology and selecting the strategy to diffuse the new technology into firm's products and services quickly (Dussauge, Hart, & Ramanantsoa, 1992; Phaal, Paterson, & Probert, 1998).

Advances in telecommunication sector have been strong catalyst in expanding the global services beyond borders with substantial increase in per capita incomes, spread of communication technology, vertical specialization and exponential growth of virtual production networks (Hummels, Ishii & Yi, 2001; Chen, Kondratowicz, & Yi, 2005; Amador & Cabral, 2009). A few experts anticipated that by 2020, services rendered through the telecom network will represent half of world exchange (Dicken, 2007). India has been seeing much more extensive sensational development than some other nation, where the industry based economy is experiencing a tectonic movement to an information based, service centered economy, specifically, in the service and knowledge areas, education, healthcare, tourism, logistics and communication. Adding to the perils associated with the inorganic growth, there has been increasing shortfall in skilled human capital not only in India, but also in the emerging and developed markets as well (Economist Intelligence Unit, 2007). Vedior (2008) reported that 61% of Asia Pacific organizations in the services area reported genuine trouble in sourcing talent. Any reduction in competence adequacy constrains productive limit (Hausknecht & Holwerda, 2013), which hinder both short and long-term execution. There is a pressing need to enhance empirical studies on the competence-based environment of technology companies more specifically in telecommunication sector where there seems to be a clear competence equilibrium issue created by the frequent and comprehensive technology changes.

2.16 Underpinning Theory

In a chaotic environment, the change process is characterized by the fluidity of the initial conditions (Saulais & Ermine, 2012). Needless to mention that natural processes are built to be chaotic in nature, irrespective of the order of whether biological, chemical, physical, or even psychological they are. Introduction of a regulation loop into the chaotic structure can lead to emergence of equilibrium within these phenomena. With the regulated internal environment, the structure becomes new and matched to the given problem.

2.17 Knowledge Evolution Theory (KET)

The intrinsic transformation of structures within a system can be influenced by its confrontation with external and internal environment (Heudin, 1998). It is imminent that the organization has to confront with the environmental changes, which will result in variations in the competence structures. The finality and stability of these structures are expressed by their attributes. However it can be altered by the regulating loops in the transformation process. This performance of relevant properties generation can be considered as an emergence phenomenon as it is a new solution matched the evolution of giving system. Saulais and Ermine (2012) established this as Knowledge Evolution Theory (KET).

Saulais and Ermine (2012) designed the Knowledge Evolution Theory (KET) with the support of Theory Evolution by Charles Darwin from 19th century. KET acknowledges organization as an individual struggling to survive through the evolving environments. To support this, Levinthal (1997) explained the position of a firm as a reflection of the collection of competences and knowledge that lead to the present position, both being constrained by the external factors. The external environment poses a dual threat on a firm's opportunity space. First, new technological frontiers emerge leading to obsolescence of some subset of competence, forcing the firm to respond by building newer competences suitable for the new rugged landscape. Second, the revelation of new opportunities opens a fresh space to extend into. The estimate of the firm's position is thus not just a matter of evaluating the collective competence required for current business, but also a subject of complex interactions between the firm's competence renewal processes in context of the changing environment Schmalensee (1987). The important question at present is therefore how these relationships can be managed in an empirical background, while bearing in mind that the environment encompasses among others in the ecosystem. Nevertheless, to cope with complexity we have to limit the analysis to the deficiency in competence and balancing it by building anticipatory competence. From the research point of view, the purpose is to identify and identify forms of competence deficiency due to the environmental changes and from these characterizations to derive implications to Organizational Health.

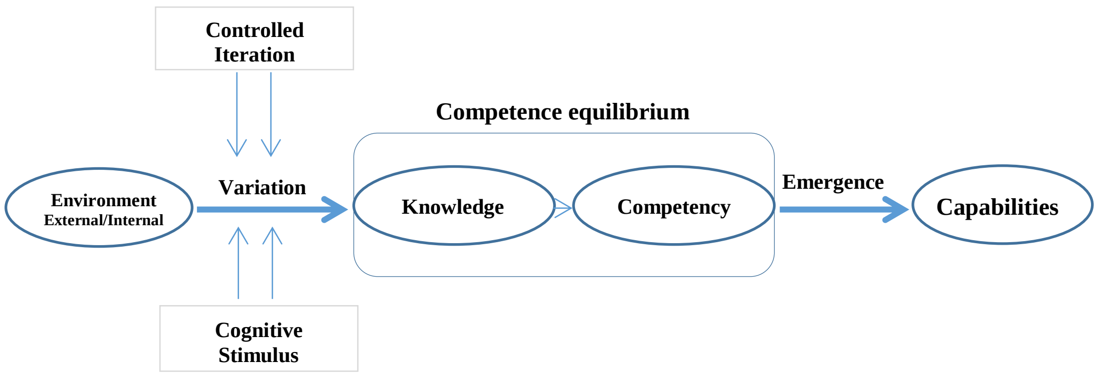

Figure 2.8
Knowledge evolution model
Source: Saulais and Ermine (2012)

This idea of organizational existence, survival and sustainance has essential support by the 'Evolution by characteristic choice' promoted by Darwin (1859). Through his theory of evolution, Darwin contended that in an evolving domain, frequently the flexible species that has the best achievement. From an evolutionary theory perspective, the capable species are simply the ones who have the combination of traits (competence) that allow them to survive and produce more offspring (performance) that in turn survive to reproduce. For a competence intensive system, the evolutive structures are represented by the competence equilibrium consisting function specific knowledge and firm specific competencies.

Rapid environmental (technology) changes and fierce rivalry among firms trigger internal processes of competence renewal and that these processes generate further competitive pressure upon the doers in the surroundings. Held in concert, these processes become self-reinforcing, continuous processes of competence accumulation. This means that in order to keep the present competitive advantage, a firm must operate at least as tight as its rivals. Ace of the obvious effects of such dynamics is the accomplishment of a steady state defined by the long run constancy in total evolutionary rate (Van Valen, 1973). For this study, the implication is that, three possible positions can be identified: first, the steady state where the maintenance of the position requires the same growth as the industry as such (labelled as ‘Competence adequacy’ in the framework), second, a positive effect of competence building (labelled as ‘competence building’), and finally, organizational performance issues due to technology changes reflects the negative effect of the Red Queen evolution (termed as ‘Organisational health’). The aim is to generate theoretical and empirical descriptions of these three positions for each technological field, to aggregate these to the firm level to identify the impact of this on the Organizational health.

The competence, the essence of equilibrium becomes weaker with the change in the external environment (technology obsolescence) and becomes stronger with a controlled iteration process (anticipatory competence building) and by introducing a cognitive stimulus (innovation capacity). This manipulated equilibrium in knowledge and competencies determines the strength and direction of the capabilities (health) of the system. This capability generation can be seen as an emergence phenomenon, corresponds to what biologists call “emergent quality” and what psychologists call “Gestalt” (Goldstein, 1951; Raoult, 2003). The above-described evolution process leads to a competence equilibrium stage in the organization with ability to generate new ideas, fully regulated, weighted, and aligned with the organisation objectives. The phrase "survival of the fittest" was apparently first used in 1851 by the influential British philosopher Herbert Spencer (1820-1903) as a central tenet of what later became known as "Social Darwinism."

2.18 Summary

This chapter presented an analytical review of the available literature around the problem related variables stated in Chapter I. The Chapter introduced the suggested variables in details with the dimensions of variables proposed by various researchers in the past. There was an effort towards establishing hypothetical relations among the variables culled out from the literature. Next chapter will attempt to present the theoretical framework proposed in this research with the underpinning theory and variable based concepts. The importance of competence as a balancing factor was explained through the equilibrium model. Further, the change in competence landscape due to environmental changes was explained through the Knowledge Evolution theory, which is the underpinning theory for the research.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter proposes a research framework based on the variables and hypothetical relations identified in Chapter II. The chapter attempts to bridge the problem statement and background explained in Chapter I with the underpinning theoretical concepts. The main objective of this study is to determine the causal elements leading to Organisational Health (OH) in telecommunication companies in India and the consequent and moderating variables in the relationship between OH and its antecedents, which are explained in the theoretical framework identified in this chapter. Specifically, this chapter will examine the research questions and the associated hypotheses for the variables Technology Disruption (TD), Competence Adequacy (CA) and Organisational Health (OH) with moderating effects of Innovation Capacity (IC) and Competence Building (CB). In addition, the target population, research design, the usage of each variable, the survey instrument, and its previous validity and reliability, and data collection techniques are presented. This chapter gives a brief overview of the methodological approach adopted in this study designed to develop a Competence Equilibrium Model for telecommunication sector.

3.2 Theoretical Framework

When established beliefs and concepts are portrayed through a conceptual framework, the researcher can recognize the problem, build research questions, and locate appropriate information (Smyth, 2004). Such conceptual frameworks help the researcher to simplify the problems and narrate the objectives. As clarified earlier, the targets of this study are, in the first place, to analyze the relationship between the Organizational health and Technology disruption with Competence adequacy as interceding element with directing variables of Innovation capacity and Competence building. In order to fulfill this objective, a research framework has been developed as illustrated in Figure 3.1. Looking at the proposed theoretical model as portrayed below, there rise four types of variables, for example, such as dependent variable, independent variable, moderating variable and mediating variable. Figure 3.1 indicates that Organizational health as a dependent variable and Technology disruption as an independent variable, Researcher hypothesizes that competence adequacy plays a mediating role and innovation capacity and competence building play moderating roles in the relationship between the dependent and independent variable. The model is structurally housed within the Knowledge Evolution Theory (KET) put forward by Saulais and Ermine (2012).

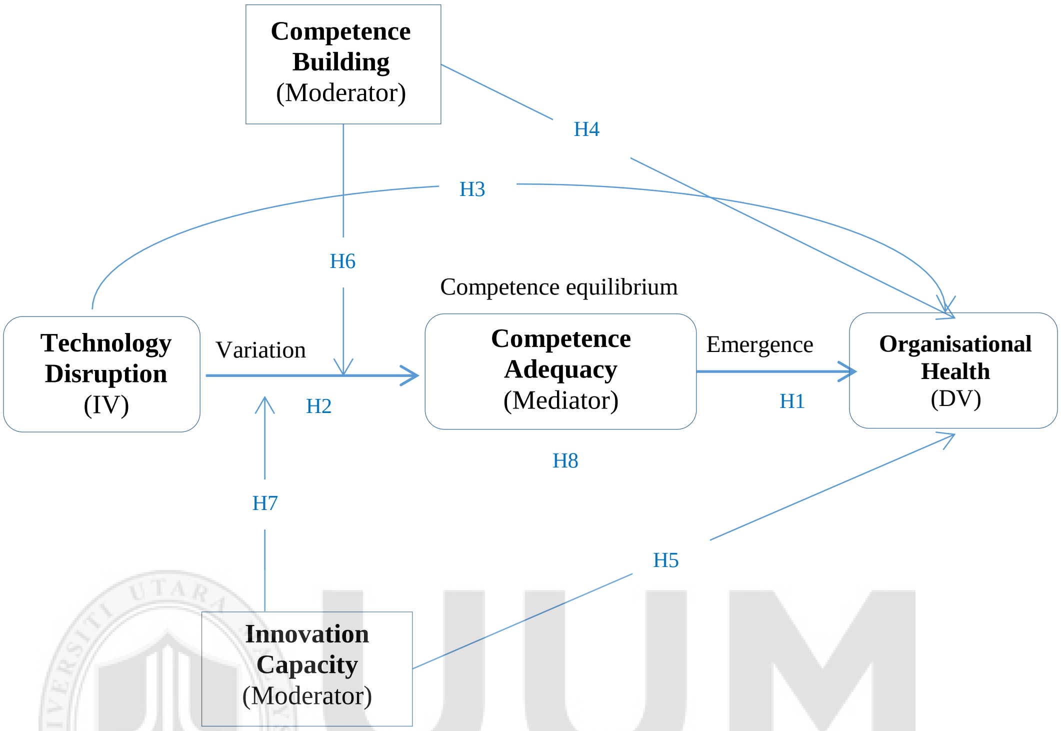

Figure 3.1
Research framework

In essence changes in operating environment in terms of rapid technology disruption causes variation in the firm's competence adequacy. Such deflection in competence will create an emergence of poor organizational health. As explained in KET, the variation caused by environment can be adjusted through a controlled iteration namely, anticipatory competence building. The cognitive stimulus into the variation path can be injected through the innovation capacity.

The relation between technology disruption and competence adequacy is also supported by the concept of adaptation of rugged landscape, which is derived from the evolution theory. The NK model proposed by Kaufman (1989) fits into the research framework. Considering environmental changes as one of the N binary attributes and Technology disruption being the attribute K, the effect size of K changes the number of peaks in the competence landscape. In other words higher the frequency and intensity of Technology disruption, the more rugged the competence landscape would be.

3.3 Hypothesis Development

The confirmation of the linkage of individual competence with individual performance is extendable to the firm level as collective competence positively related to firm performance (Boyatzis, 1982; McLagan, 1989; Lucia & Lepsinger, 1999; Dubois & Rothwell, 2004; Gangani, McLean, & Braden, 2004; Gupta, Sleezer, & Russ-Eft, 2007). A study by Bove and Johnson, (2000) on the perception of managers on the competence revealed that competence is positively related to financial performance. Technical competences are specific to the technology, which the firm is operating in, and further to it, each unique role will have role based functional competence. Adequacy of such competence drives high performance and quality results for the specific position in the firm. (Evans & Lindsay, 1996; Capon, Farley, & Hoenig, 1990; Droge et al., 1994; Dubey & Ali, 2011). Depletion of competence affects organizational performance because it directly reflects the loss of invaluable knowledge, skills, and abilities (KSA) of the firm (Osterman, 1987). Such depletion directly affects the health of the firm by creating deficiency in the overall competence pool (Shaw, Gupta, & Delery, 2005). In all the cases discussed here, it is evident that there exists a positive relationship between competence adequacy and organisational health.

It has been empirically proven that the quality of human resources can drive the competitive advantage of the firm (Coff, 1997; 2002; Coff & Kryscynski, 2011;

Ployhart, Weekley, & Baughman, 2006; Prahalad, 1983). Empirical studies conducted in the past found that there is a strong positive correlation between Orgnisational health and performance. A comparison of companies in the study revealed that those at the upper quartile of Organisational health showed tendency to outperform the companies in the lower quartile for EBIDTA margin, Enterprise value to Book value and growth in Net income to Sales in the range of 2.2 times, 2 times and 1.5 times respectively (Keller & Price, 2011). They further opine that organisation's long-term success is partially determined by its health.

Hypothesis 1: There is a significant relationship between Competence adequacy and Organisational health (such that when required competence of the firm reaches the adequate level, the firm achieves health to sustain competitive advantage).

Kaufman (1989) in his early studies examined the relation between technology disruption and competence adequacy. He used rapidity of change, complexity of technology and growth of knowledge as the dimensions to measure technology disruption. Organizations are not left alone in the technology disruption and competence leveling process (Christensen & Lundvall, 2004). The stronger the positioning of the firm in the changing environment, the faster, and better the firm can recalibrate the imbalance in competence. In his article on personal obsolescence, Fox (1965) identified rapidity of change and technology disruption as two most instrumental factors causing competence depletion. In the recent times, these factors emerge with importance when we move towards technology dependent sectors resulting in inorganically growing rate of redundancies in collective competence (Hartley, 1978; Ganguly, & Nilchiani, 2010). Olleros (1986) argues that any discontinuous change in technology displaces time tested set of established competence, whether in marketing, R&D or production. He further reiterates that, in the past, developed countries have seen various technological disruptions followed by periods of unusual competitive turbulence, with high rates of new entries, high rates of exits, bankruptcies, and mergers, and a high turnover in leadership positions. According to him, firms that advocated the new technologies rose to prominence, while those that stayed with the old ones were gradually phased out. Cantwell (1993) analysed the sustenance of competence in a firm caused by path dependencies using patent data over seven years from 1969. He found that the technical competence of firms in manufacturing industries tends to persist over time, where the distinctive competences in technology firms tend to decline over a period of time.

Hypothesis 2: Technology disruption has relationship on the Competence adequacy (such that when there is a significant change in technology which the firm's core competence is built upon, the level of firm's competence depletes).

In a competence study conducted in the high technology sector by Malerba (2004) found existence of a positive relationship between technological disruption and firm performance which essentially indicates that technological competence is one of the most relevant factors to achieve organizational health. De Liso and Metcalfe (1994) suggests a three dimensional leading impacts on technology disruption such as collective competence and other resource changes, physical changes in product and service itself and Organisational health issues. Morrow and McElroy (2007) mention that any negative change in firm's competence will directly affect the firm's health, through reduced performance and declining profits. Technology disruption often is marked by diminishing organizational performance resulting speedier R&D efforts within the firm (Henderson, 1995; Utterback, 1994).

Smith (1937) and Schumpeter (1961) have studied correlation between technology progress and innovational dynamics in their seminal works on macroeconomic studies. Changes in technologies are dynamic and complex, which leads to far-reaching and multi-faceted impact on the market the firm operating in (Dunn, Friar, & Thomas, 1991; Meffert & Remmerbach, 1988; Willard & Cooper, 1985). Emergence of technologies frequently leads to changes in internal competitive structures, because enterprises with a high level of technological know-how enter into existing markets and threaten the market position of established firms (Benkenstein & Bloch, 1993). Market structures can also be changed by new technologies, for example, the emergence of new fields of application for established products (Ela & Irwin, 1983). It is reasonable to assume that technological dynamism correlates with organizational health (Utterback, 1974).

Hypothesis 3: Technology disruption relates to Organisational health (such that upward changes in technology temporarily lowers the Organisational health and continues until corrective measures in building competence is undertaken).

Managing knowledge through the changing technology context is very essential to keep adequate levels of competence at all times (Nonaka & Takeuchi, 1995). The core of competence building with respect to technology disruption is that it offers a real-time dashboard to the management to monitor the altering levels of competence adequacy (Cohen & Levinthal, 1990). It enhances the ability of the organisation to timely identify such newly developed knowledge, absorb, and use them to the advantage. This ability is central to the level of collective competence. Fiol (1996) agrees to this as he says that the accumulation of competence may not always lead the organization towards competitive advantage, but the effort towards refreshing the same will pay off in the long run. The emergence of competence management therefore has enhanced the reciprocity between disruption and competence in terms of acting as mutual leveling factors. In the same way, outcomes from technology disruption give way to embodiment of new generation of knowledge within the organization (Carneiro, 2000). From the strategic viewpoint, management should recognize collective competence as firm's intellectual capital and constantly work towards appreciating this capital (Leonard-Barton, 1995). A clear and robust competence management strategy that focuses on building and maintaining firm level competence within the core technology area the firm operating in is essential for technology companies (Wiig, 1997). In accordance with the changes happening in the technology space, organisations should encourage individuals in the technology functions to improvise their competence and stimulate a culture of competence rebuilding as an ongoing operational requirement. From this, it is evident that sharing of information needs to be supported because it is one of the most important tools of realigning competence (Nonaka & Takeuchi, 1995). Information exchange facilitates appreciation of intellectual assets within the organisation (Carneiro, 2000).

Hypothesis 4: Competence building has relationship with Organisational health (such that the competence developed ahead of the impending environmental changes brings competitive advantage to the firm).

Empirical evidences of the correlation between innovation and organizational performance in terms of market share and profitability have been confirmed by the researchers in many a study in the past (Narver & Slater, 1990; Griffin, 1997; Han et al., 1998). Positive culture promotes high involvement, robust communications activities, and an acceptance and encouragement of a calculated risk-taking to augment innovation (Cooper, 1993; Calantone et al., 1995). Zhang, Ryan, Prybutok, and Kappelman. (2012) confirm that the firm's innovative capacity has a positive influence on its performance. The study conducted by Becker and Huselid (1998) suggests that there is evidence to indicate positive correlation between innovation and performance of the organization.

Hypothesis 5: Innovation capacity has relationship to Organisational health (such that the competence deficiency created by the technology disruption is partially negated by the innovation capacity).

Deficiency or gap in competence adequacy impacts organizational health because it aggravates the competence replacement cost in turn reducing the potential financial gains (Cascio, 2006). Creation of a healthy organization involves the process of internal capability building and its ability to identify the right and relevant problems to mobilise adequate resources to annihilate the problem urgently (DeJoy et. al., 2010). Disruptive technological changes, economic downturn, and regulations are the predominant external factors causing poor organizational health. Change is the most observed phenomena in the universe as it is the only constant thing in our lives. Change is pervasive in all domains, as writers from time immemorial have addressed it at various facets of human life, be it the general speed of change or the amount of uncertainty and turbulence it can bring along into a co existent environment. The proponents of change have written literatures from diverse backgrounds through the past decades. They all have emphasized the need for change in organisations whether it is manufacturing, service, or high technology sector. Many researchers have identified the driving forces of change in the past (Davidow & Malone, 1992; Drucker, 1988; Hammer, 1990; Kanter, 1989). A lean internal structure, open and networked culture, broken silos, high standards of customer orientation, empowered employees etc. will facilitate the organization to embrace change quickly.

Hypothesis 6: Competence adequacy mediates the relationship between Technology disruption and Organizational Health (such that the changes in technology alters the level of competence of the firm leading to performance issues related to organizational health).

Cotton and Hart (2003) suggest that building competence in anticipation has two dimensions, future technical competence and future functional competence. They further enumerate that competence building positively impacts organisational health with an extension of hypothesis that competence building moderates between health and competence adequacy of the firm. As the change sweeps in with unprecedented speed, many organisations are turning towards developing the capacity to anticipate future competence in order to be battle-ready for the imminent change in technology space. Such capacity will indeed give organisations, real competitive advantage. When there is continuous change in technology, it is difficult for companies to find company specific skills in the immediate market (Atkinson et. al., 1984), and companies will like to retain and retrain such important core competence with adequate retention measures which creates the so called the human resource barriers as termed by Capelli and Singh (1992). Rapid change in technology environment causes major consequence to the wide use of skills in telecommunication sector, placing tacit skills at the higher planes of demand. This could be one of the reasons for technical skills being much sought-after in the market (Bandura, 1999). Organisations in such context need to have homogenous and stable competence development activities. Since the long-term success of the organization depends on the flexibility to adapt new business environments (competence building) and the capability to instill change (innovation), firm specific knowledge remains crucial for sustenance. Collective competence in such situation tends to grow in importance in the firm in relation to the competitive advantage. In such fields where the rate of innovation and knowledge creation is exponentially high, there exists a visible tendency to take over embedded tacit knowledge from similar smaller originations (Parks, Shin, & Park, 2007).

Hypothesis 7: Competence building moderates the relationship between Technology disruption and Competence adequacy (such that at higher level of CB, the effect of TD on CA will be reduced and at lower levels of CB, the effect will be higher).

It is interesting to see other organizational corrective measures kicking in as linear supporting processes when competence adequacy is threatened by technology disruption (Lawler, 1994). The recent models of disruptive technology studies elucidate mutual dependency of technology, competence, and innovation process where the interaction of firms with its partner eco system becomes crucial in defining the residual level of competence.

Most of the innovation literature highlights the dichotomy of technology changes with innovation (Teece & Pisano, 1994; Nelson, 1995). Innovation as a mantra has been part and parcel of the industrial sector post the industrial revolution. Ehrnberg (1995) notes that despite having enormous amount of research time spent on innovation, its analysis and interpretations remain quite ambiguous. There have been studies to distinguish competence-enhancing innovations from incremental innovations (Anderson & Tushman, 1990; Green, Krieger, & Vavra, 1997). Differences of architectural innovations and disruptive innovations were the favorite topic of study in the nomology of innovation studies in the last decade (Henderson & Clark, 1990; Christensen, 1998). The correlation of radical innovation with core system changes in the organization was elaborated in the innovation studies (Tushman & Murmann, 2002; Baldwin & Clark, 2000).

Hypothesis 8: The relationship between Technology disruption and Competence adequacy is moderated by Innovation Capacity (such that at higher rates of innovation capacity, the effect of TD on CA will be lower and lower the innovation capacity the effect will be higher).

3.4 Conceptual and Operational Definitions

In this section, the variables identified in the theoretical model are operationalized with instrument-based definitions.

3.4.1 Organisational health

Conceptually, organisational health can be defined as the ability of the organization to sustain business performance over time and through changing environment, which will be attributed directly on the ability to learn faster than the competition and its capacity to change internal structures dynamically (Gupta, Sleezer, & Russ-Eft, 2007).

Operationally for this research, organizational health is a combination of three clear dimensions such as change capacity, goal alignment, and competitive advantage (Miles, 1969). Factors like management's ability and willingness, team collaboration and organizational structural make up change capacity (McHugh & Brotherton, 2000). Further, change capacity is the measure of the readiness of organisations to change through the changing business environments. Goal alignment as a second dimension of OH, which suggests strategic and tactical alignment, resulting superior performance (McKinsey & Co, 2006). The framework of balanced scorecard defines the essential goals of the organization into four buckets such as customer, finance, people, and process. The third dimension of OH is competitive advantage, which stems from the resource based theory to ensure the available resources in the organization are valuable, rare, in-imitable and non-substitutable (Barney, 1991). Measurement of these three dimensions will together determine the rate of health in the organization.

3.4.2 Competence adequacy

Hayes (1979) defined competence as a combination of possibilities as generic knowledge, traits, social role, motive, and or skill of an individual. Competence adequacy is termed as the collection of all the required competences to run and sustain the business successfully.

The model of competence adequacy as suggested by Wanga et. al. (2004) has three distinct components such as marketing, technological, and integrative competence. Marketing competence of a firm is the capability to obtain real-time information about customers and competitors and to communicate and involve customers to translate the information into meaningful products and services (Jackson & Schuler, 2003). Technological competence deals with the accumulation, management, and development of technical skills and effort put towards the research and development activities. Innovation and leadership in technology also feature as building blocks of technological competence (Chen & Naquin, 2006). For a technology firm the integrative competence is the ability of the firm to optimally mobilize and energies all the business enabling competence to enhance performance capabilities firms (O'Driscoll, Carson, & Gilmore, 2001). This includes the cross function communication and partnership of external and internal resources. From the literature, review it is learned that adequate amount of these three components give competitive advantage to a technology company. Woodruff (1991) suggests that competence can be attributed to the factors of evidence-based ability to perform a job competently and a set of behaviours a person exhibits while performing the task. Supporting this view, Armstrong (1998) describes ‘competence’ as what people need to be able to perform a job well and ‘competency’ as dimensions of behaviors leading to performance.

3.4.3 Technology disruption

Technology change has been expressed using a wide variety of terms for the magnitude and intensity of technology changes (Raffi & Kampas, 2002). Technology disruption has been classified in terms of the magnitude as 'small vs. large', in terms of intensity as: incremental vs. radical; for time dimension as continuous vs. discontinuous; in terms of generational differences as evolution vs. revolution; and further such as evolution vs. breakthroughs; progress vs. paradigm shifts; etc (Brown & Eisenhardt, 1998). In addition to the term technology disruption, to express a substantial and rapid change were presented by researchers using terms such as technology diffusion, creative destruction, emerging technologies, technological transition, etc (Govindarajan & Kopalle, 2006). However, for the very reason of internal competence equilibrium it causes, for this study the abrupt and rapid changes in technology is adopted as definition of technology disruption.

Technology disruption is measured through the intensity of specialized knowledge required at each time there is a change in technology space, complexity brought in to the business, measuring the rapidity of change and the growth in technology itself. According to Wang et. al. (2006), technology disruption is a collective ability to adjust technological capability of the firm along with the turbulence in technology and market. Complexity in emerging technology and frequency with which the disruption occurs in the market determines the extent of technology disruption. Sometimes the speed and intensity of the technology change can greatly impact the business significance of the firms (Koc, 2007).

When a new technology abruptly supersedes the old, a technology disruption occurs and the entire eco system needs to adapt to the environmental interaction conditions to suite the new technology, even if the old technology is still valid and functional (Adner, 2002). Technology proliferation and predictability of future technologies also are cited as relevant factors of technology disruption. Significant past examples of superseding technologies causing disruption include emergence of digital video over cassette recorders and the obvious generational shifts in telecommunication changes from analog processing to digital. Universal mobile Telecommunication standards bring up newer generations of technology every 5-10 years.

3.4.4 Innovation capacity

Innovation capacity is the ability to see through future and reengineer products and services accordingly. Innovation is traditionally defined as the adoption of a new idea, artifact or behavior, which is unprecedented for the adopter (Rogers & Shoemaker 1971). Not necessarily, all the ideas, artifacts and behaviors can turn into innovation, as newness and novelty are the distinct features of innovation (Lyytinen & Rose 2003). Majority of the theories in innovation literature were derived out of the need for industrial innovation when time demanded quicker and diverse products to the market with same or reduced production cost. Industrial innovation predominantly examined how and why the ideas, artifacts, and behaviors emerged and the business impact of such innovations created on the firms. The studies were mostly concentrated on products, customers and organizations (Abernathy et al., 1985), leaving a gap on the human capital and their collective IC.

In this research, it is proposed to operationalise innovation capacity through the aggregation of measurement of the dimensions such as innovation support, innovation task, innovation behavior, innovation integration and information & communication as elaborated by Tang (1999) through the inventory of organizational innovation. Taking further, Koc (2007) conducted a study of these factors through an empirical research among small and medium software development firms in Turkey. Innovation support expresses the organisation's readiness and willingness to support innovation activities such as appropriate and timely rewards, opportunity for employees to generate ideas and top management's commitment towards innovation. Innovation task deals with the work itself, which provides enough room for innovation (Laforet, 2011). The firm's approach towards innovation is dealt in innovation behaviour such as taking the ideas generated by employees to translate into meaningful outcomes. Encouragement of teamwork, cross function collaboration and a one-team attitude of the company explain the innovation integration. Information and communication plays a very important role in improving the innovation capacity, which includes proper systems and channels for communication within and outside the firm.

3.4.5 Competence building

The collective measurement of the components of competence building such as professional Knowledge, Skill, Abilities and Other attributes (KSAO), update motivation, update activities and individual expertise (Chauhan & Chauhan, 2009) will decide the strength of the competence building in an organization. The skills requirements for the telecom sector are complex and ever changing. There is a variety of competence required to maintain the focus areas of communication technology. Owing to a wide spectrum of technology related functions (R&D, software design, software implementation, sales and marketing activities and system and process development to name a few) it offers, majority of the competence remain firm and sector specific (Bisilkas et. al., 2012). The relatively large size of the telecom sector in India also means that investment in a particular segment of technology has the potential to have a disproportionately large impact on overall competence demand in the industry. Taken together all these, the widening competence gap are a threat to Organisation health of telecommunication companies. Keeping the knowledge and skills relevant in line with the skill demand at all times is the measure of professional KSAO in competence building (Bandura, 1999). Individual's motivation to update competence also is crucial in building collective competence. If optimum utilization of the current skills is not applied on the job, there will be issue around employability of the individual, which warrants update of skills (Senge, 1990).

3.5 Research Design

This study is aimed to test the relationship hypothesis among the variables of organizational health, technology disruption, competence adequacy, innovation capacity, and competence building in technology context of the telecom organisations in India. A descriptive cross sectional study design was undertaken for this research, in order to investigate the research questions and to determine appropriate measures of variables in the model.

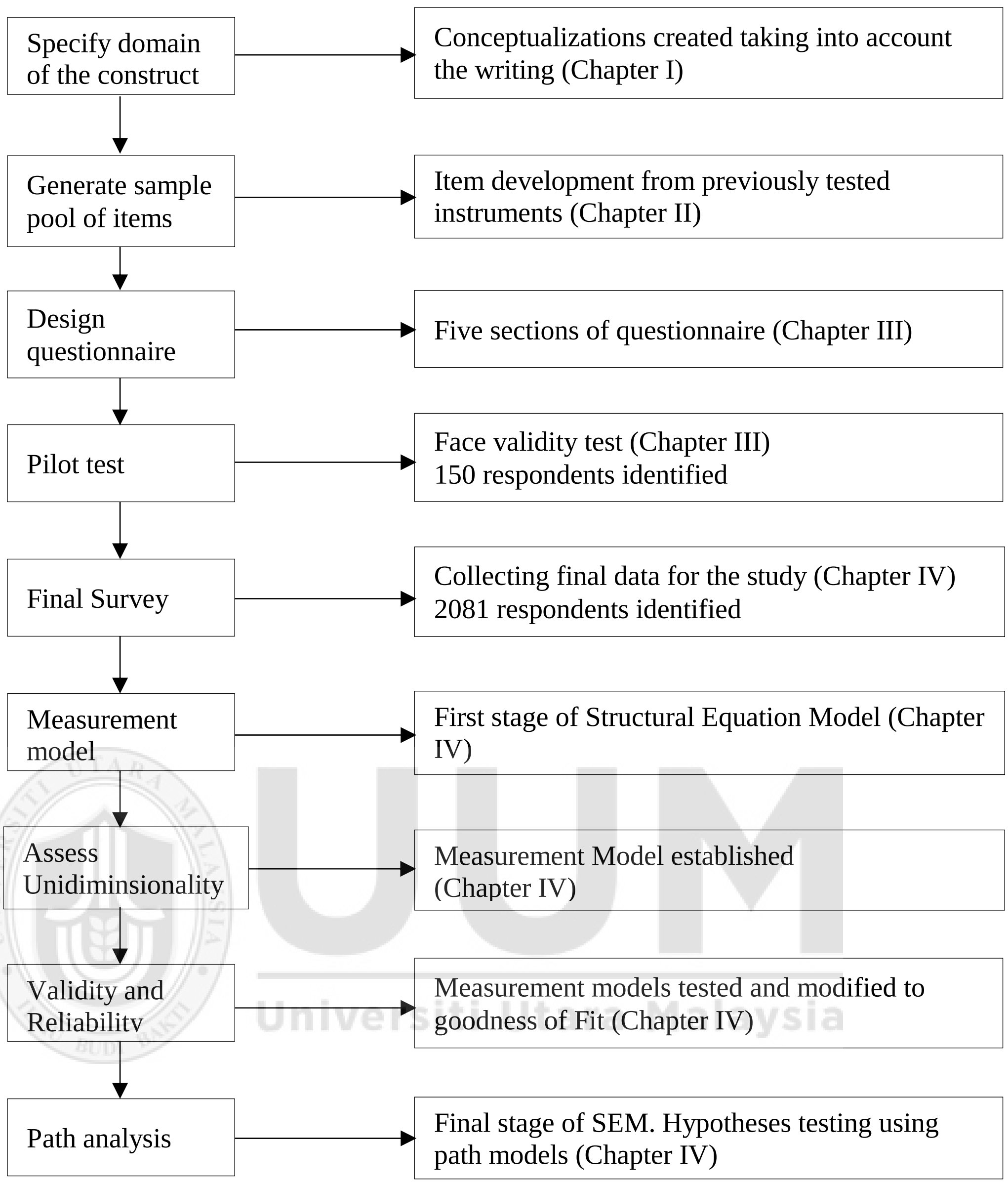

Figure 3.2
Research plan and steps

From the positivist paradigm, the researcher looked at the global phenomenon of technology disruption and its impact on the internal competence of telecommunication firms. From the interpretivist perspective, the researcher was involved fully into the changing context to understand the subjective norms involved in this phenomenon. However once the general view and pattern of the research subject was clear, a positivist approach was adopted to investigate into the problem quantitatively with data support. This positivism assumes replicability of the study results across contexts and time. This research is developed through appropriate ontological, epistemological and methodological stages. Ontological assumptions of the research such as nature of reality, what exists, what it looks like, what units make it up and how these units interact each other (Blaikie, 2000) were ratified through the observation over the years of professional experience which the researcher has gone through in the telecommunication sector.

The ontological claims are enumerated in Chapter I as research problems (existence of TD and its reflective impact on the OH with the mediating effect of CA in telecommunication sector). This stage determined that the problem exists in this industry sector, which remains as an unexplained research area with potential implications to academics, industry, and government as well. According to Blaikie (2000), epistemology is one of the central pillars of research, which is concerned, with the theory of knowledge especially in regards to its methods, validations and possible ways of gaining knowledge of reality. This research adopted a positivist approach to establish variables and constructs from the previous studies conducted in the area. This stage examined the empirical evidence of the relationships among the variables. A thorough analytical review of the available literature from 1950 to 2014 was administered to cull out established instruments on the variables in the model. This stage allowed to segregate the research gaps in the area to ensure the proposed study is relevant and unexplained in the past.

According to Lewis, Thornhill and Saunders (2007) individual researcher's values play an important role in the research philosophy and approach. For this study, the researcher articulates the values of observation and long experience in the field where the study is held as the basis for making judgments about the research topic and approach. Personal interaction and analysis of perception of senior employees are deemed highly valuable for this research study. It is contended that through comprehension and monitoring own qualities and straightforwardly perceiving and articulating these as a major aspect of the research procedure will infer that the exploration is reinforced, as far as transparency, the chance to minimize preference or in guarding decisions, and the establishment of a personal value statement is suggested.

The theme of the research is related to technology disruption and competence adequacy causing organizational health problems. Several studies have come out explaining the 'competitive advantage and firm performance' factors. Interestingly, these result outputs have the clear foundation of quantitative research applications viz., the support of the 'averages of sciences'. Contextualising the topic to Indian scenario in general and telecommunication industry sector in particular, as it is pointed out earlier in this, less research was carried out correlating the factors of competence, technology and organizational health to establish moderating relationship with innovation capacity and competence building.

3.6 Population and Sampling

Sekaran and Bougie (2010) explains population as the generality of group of persons, events, places or things that can be of interest to the investigator of the study. Whereas, Neuman, (2005) characterizes population as the total or aggregate of the considerable number of articles, subjects or individuals that fit in with an arrangement of details. As discussed along Chapter I, the suggested theoretical framework need to be analysed using a sample of managers from the four largest GSM telecommunication companies in India. For this purpose, an online survey using an open platform was found to be ideal. Out of the seven operational telecommunication companies using Global Standards for Mobile (GSM) Communication technology in India, four largest companies (Vodafone, Airtel, Idea Cellular & Aircel) make up more than 90% of the market share in terms of revenue and subscribers. Hence they were chosen as representative field for this study.

In terms of revenue share, the four companies (Airtel, Vodafone, Idea & Aircel) together enjoyed 99% of the GSM market in India. The products of these companies were presented on the latest available technology platform to the customers. In addition, they are pioneers in the GSM technology space in India in terms of voice and data streaming.

A-priory calculation based on the G-Power statistics with four predictors in the framework gives a minimum requirement of 848 samples. To collect adequate responses as per the G-power calculation, it was decided to send the questions to at least 50% of the population identified.

Effect size anticipated	0.02
Minimum statistical power level	0.95
Number of predictors in the model	4
Probability level	0.05
Minimum required sample size	**848**

Though there was no data on total number staff available for companies like Videocon, MTNL and Uninor, it was estimated that looking at the sheer size of their subscribers and revenue enjoyed by the largest GSM companies; it was assumed that the employee base will also be similar or proportionate to the revenue and subscribers. The total population frame identified is approximately 4156 'managers' from the specified four telecom companies. Managers here refer to the ones who have at least one person reporting under. It is assumed that such managers would be the individuals with adequate experience in the industry and the respective function to authentically comment on the questions under the variables in this study. Eventhough the Knowledge Evolution Theory (KET) holds good for supporting organizational hypothesis, individual managers with reasonable number of years of experience in the industry are expectedly the representatives of organizational units (in case of Telecommunication, it is the retail outlets, network units and sales offices) who can be the right voice of the organizational units.

This study administered 'stratified random sampling technique' where the overall employee size of the identified companies was stratified into managers with the criteria mentioned above. The researcher chose this technique to cover focused sampling and also to ensure quality and adequacy of responses. Even though there are several sampling schemes available for quantitative research, according to Patton (1990), if the goal is to obtain insights into a phenomenon (as in this research to obtain perception about technology disruption and its consequences), 'information rich' individuals should be formed into a strata to make a meaningful sampling frame. From such a strata identified (4156 managers), a random sampling was undertaken to cover the adequate sample size. Onwuegbuzie et. al. (2004) suggested minimum 82 participants to statistically test a correlational two-tailed hypothesis, which gives adequate power of prediction. According to Krjcie and Morgan (1970) and based on the a-priori calculation with 20 predictors in the research model, a minimum sample size of 358 responses was required to test the hypotheses. However to cater for the expected lower response rate and the sample being distributed in four different companies, it was decided to cover at least five times the minimum required sample.

A break up of population size and targeted sample size is given in Table 3.1.

Table 3.1
Proportionate stratified random sample selection

Company	**Total employees**	**Managers**	Female	Male	**Sample**	Female	Male

Company 1	4783	823	218	605	412	109	303
Company 2	5401	916	351	565	459	176	283
Company 3	8672	1312	401	911	657	201	456
Company 4	7997	1105	484	621	553	242	311
		4156			**2081**		

Source: Provided by company HR as on 13-Sep-2014

Concerning the sampling technique, the researcher has requested the HR managers of the companies to randomly select a list of specified number of females and males from the strata of managers (Table 3.1). This was intended to ensure homogenous representation of males and females, covering 728 females and 1353 males. Gay (1996) suggested the general rule to determine sample size where the population is 5,000 and beyond, a sample size of 400. The link containing the online page of the questionnaire in a small e-mail note was sent to the identified random sample in bulk mail by the respective HR managers on behalf of the researcher. Throughout the survey communication, the researcher was not allowed to directly interact with the respondents. This was as per the personal data protection requirement. The questionnaire was sent out to 2081 managers, which eventually fetched a return rate of 44% with total 915 responses received.

3.7 Unit of Analysis

The purpose of the study is to gain a clear understanding of factors that influence the OH of telecommunication companies in relation with the Competence Adequacy with changing technological environment. To understand the complexities associated with the competence environment in technology sector it is essential for a person to have reasonable experience dealing with technology and people. Such experience is valuable when assessing the market conditions and the team's readiness to respond to the changing competence landscape. It requires such experience to suitably answer the questionnaire given to measure the variables proposed in the study. It is expected that employees at the manager category with reasonable experience in the industry will be the qualified strata to respond to the questions related to the variables in the study. The criteria for the sample selected for the study were:

1. have been working with the company currently for at least a year; and
2. a manager with one or more people reporting to him/her

Therefore, the unit of analysis is the individual represented by the managers.

3.8 Measurement of Variables and Instrumentation

Majority of the questions in this study intent to collect the opinion of participants from their perception from statements using a 7 point Likert scale (where 7 = strongly agree and 1 = strongly disagree). Under the CB variable, few of the questions were posed with how or what, for which the options are specifically given as 1 = not much or very low and 7 = very much or very high. The respondents were well qualified and use English as the first language of communication in the workplace, hence all the questions were presented in English language only. Three out of five instruments adopted here used seven point Likert scale in the previous studies. To make the measurement scales of all instruments uniform across the questionnaire and to ensure proportion of measurements, all the instruments were rescaled to 7 point Likert type response with numerical descriptors. Malhotra and Peterson (2006) states that seven point Likert scale is the most frequently used scales for verbal response statements in research. A study conducted by Dawes (2008) proved that 5 point and 7 points Likert-type scales can be rescaled interchangeably as both the data produce the same mean scores with little or no difference between the two scale formats about the mean, skewness and kurtosis.

Available instruments from the recent studies conducted to measure the constructs will be used for this study. There are five major variables to be measured in the proposed theoretical framework. These instruments were tested by the respective researchers for reliability and validity. Wherever possible, the questions in the instruments were retained as original except for minor customizations to make the questions tuned to the telecommunication and technology industry. The questions were administered in English only, as the respondents are well educated and fluent in the language.

3.8.1 Scale for Technology Disruption (TD)

The instrument for Technology disruption was adapted from the perceived Technology disruption scale developed by Wang et. al. (2006) with literature support in the dimensions from Bracker and Pearson (1986) for technological capability, Kozlowski and Farr (1988) for market turbulence and Kaufman (1989) for technological turbulence. Using this instrument, Wang et. al. (2006) analysed how technological disruption impacts business performance. Items were measured on a 7-point Likert scale ranging from Strongly Agree to Strongly Disagree.

Table 3.2
Scale for Technology Disruption (TD)

Code	**Item**	**Source**
Technological Capability		
TD11	Value added services and digital contents are released to market with great speed	Wang et. al. (2006); Bracker and Pearson, (1986)
TD12	During the last three years I have seen several changes to our business plans due to a variety of new technologies.	Wang et. al. (2006); Bracker and Pearson, (1986)
TD13	Any change in communication technology will impact our company's skill requirements	Wang et. al. (2006); Bracker and Pearson, (1986)

TD14	There is an unprecedented technology revolution happening in telecommunication sector	Wang et. al. (2006); Bracker and Pearson, (1986)
TD15	We have the ability to accurately predict future technological trends	Wang et. al. (2006); Bracker and Pearson, (1986)
TD16	Due to the change in technology, there is a decrease in demand for our older products	Wang et. al. (2006); Bracker and Pearson, (1986)
TD17	We are one of the leaders in telecom industry to establish and upgrade technology standards	Wang et. al. (2006); Bracker and Pearson, (1986)
TD18	We always lead technology innovation of the principal industry in which we operate	Wang et. al. (2006); Bracker and Pearson, (1986)
TD19	We have strong capability to integrate external technological resources with in-house resources of our firm	Wang et. al. (2006); Bracker and Pearson, (1986)
Market Turbulence		
TD21	The level of market turbulence caused by technology is extremely high	Kozlowski and Farr, (1988); Wang et. al. (2006)
TD22	It is impossible to predict accurately the rapidly changing demands and tastes of consumers	Kozlowski and Farr, (1988); Wang et. al. (2006)
TD23	Activities of major competitors are unpredictable and competition is very intense	Kozlowski and Farr, (1988); Wang et. al. (2006)
Technological Turbulence		
TD31	The speed of technological changes in telecom industry in which our firm operate is fast	Kaufman, (1989); Wang et. al. (2006)
TD32	The technological changes in telecom industry in which we operate is unpredictable	Kaufman, (1989); Wang et. al. (2006)
TD33	The impact of new technology on business operations and competition is rather high	Kaufman, (1989); Wang et. al. (2006)

3.8.2 Scale for Competence Adequacy (CA)

The items of the dimensions of competence adequacy were adapted from studies by Wanga et. al. (2004). The instrument proposed in their study has three dimensions (marketing competence, technology competence & integrative competence) with 25 items. The instrument was used to measure the core competence as an antecedent to firm performance. They used seven point Likert-type scale measuring ‘‘absolutely disagree’’= 1 to ‘‘totally agree’’ = 7.

Table 3.3
Scale for Competence Adequacy (CA)

Code	Item	Source
Marketing Competence		
CA11	Our capability in obtaining real time information about changes of customer needs is very strong.	O'Driscoll et al. (2001), Athey and Orth (2000), Kohli and Jaworski (1992)
CA12	Our capability in communicating with customers about their potential and current demands is very strong	O'Driscoll et al. (2001), Athey and Orth (2000), Kohli and Jaworski (1992)
CA13	We have strong capability of involving customers in the process of product testing and assessment	O'Driscoll et al. (2001), Athey and Orth (2000), Kohli and Jaworski (1992)
CA14	Our capability enables us to respond quickly to customers’ requirements and deliver offerings in time	O'Driscoll et al. (2001), Athey and Orth (2000), Kohli and Jaworski (1992)
CA15	We have strong capability to acquire real time information of competitors’ evolution of strength and weakness	O'Driscoll et al. (2001), Athey and Orth (2000), Kohli and Jaworski (1992)
CA16	Our capability in benchmarking the product and service practices of major competitors is very strong	O'Driscoll et al. (2001), Athey and Orth (2000), Kohli and Jaworski (1992)
CA17	We have strong capability of building and enhancing large-scale marketing channels	O'Driscoll et al. (2001), Athey and Orth (2000), Kohli and Jaworski (1992)
CA18	We have strong capability of managing close customer relationship effectively for long-term	O'Driscoll et al. (2001), Athey and Orth (2000), Kohli and Jaworski (1992)
Technological Competence		
CA21	We always make relatively heavy investment in R&D activities	Rosen and Jerdee (1985), Kohli and Jaworski (1991)
CA22	We have accumulated stronger and various technological skills	Rosen and Jerdee (1985), Kohli and Jaworski (1991)
CA23	On-job training is provided frequently in our firm to improve the technical skills of employees	Rosen and Jerdee (1985), Kohli and Jaworski (1991)

CA24	We are qualified to attract and motivate talented experts	Rosen and Jerdee (1985), Kohli and Jaworski (1991)
CA25	We have the ability to accurately predict future technological trends	Rosen and Jerdee (1985), Kohli and Jaworski (1991)
CA26	We are skilful in applying new technology to problem-solving	Rosen and Jerdee (1985), Kohli and Jaworski (1991)
CA27	We are one of the leaders in our primary industry to establish and upgrade technology standards	Rosen and Jerdee (1985), Kohli and Jaworski (1991)
CA28	We always lead technology innovation of the principal industry in which we operate	Rosen and Jerdee (1985), Kohli and Jaworski (1991)

Integrative Competence

CA31	Our capability in communication among functions in the process of product and service design is very strong	Lawrence and Dyer (1983)
CA32	We have strong capability to share and leverage marketing and technology knowledge among functions/business units	Lawrence and Dyer (1983)
CA33	We have strong capability to integrate external resources with the in-house resources of our firm	Lawrence and Dyer (1983)
CA34	We have strong capability to share and leverage information about competing strategies of major competitors	Lawrence and Dyer (1983)
CA35	We have strong capability to coordinate and integrate activities of functions/business units in our corporate strategy	Lawrence and Dyer (1983)
CA36	We are good at embedding of the newly achieved technological findings in new products and services	Lawrence and Dyer (1983)
CA37	We have strong skills in integrating customers' innovative ideas into final products and services	Lawrence and Dyer (1983)
CA38	We have strong capability to deliver superior value to customers by integrating different processes	Lawrence and Dyer (1983)
CA39	We have strong capability to coordinate effectively in the implementation process of corporate strategy	Lawrence and Dyer (1983)

3.8.3 Scale for Organizational Health (OH)

From the literature reviews, three instruments measuring Organisational Health were identified. First is the Organizational Health Report Index (OHRI) developed by Fiorelli et. al. (1998), the second is the Organisational health Index (OHI) developed by McKinsey and Company (2006) and the latest is the instrument for Organizational Health developed by Nair; Dileep and Subramaniam (2014). While the first instrument measured the overall physical well-being of employees, the second one measures only the change readiness of the company. McKinsey's OHI instrument is developed for commercial use, hence empirical validity on this instrument is not available. Moreover, both these instruments did not fit into the measurement requirements of this study hence, the third instrument developed by Nair et. al. (2014) covering all the three dimensions of health as supported by the literature was selected as the fitting measurement instrument for this study. The items on OH instrument were measured on a seven point Likert-type scale. The instrument suggested in this study has 3 factors and 29 items.

Table 3.4
Scale for Organisational Health (OH)

Code	Item	Source
Change Capacity		
OH11	In my organisation, the management demonstrates by action, a balance between short and long term objectives	McKinsey & Company, (2006); Nair.et.al., (2014)
OH12	In my company, the management backs up words with action	McKinsey & Company, (2006); Nair.et.al., (2014)
OH13	I feel comfortable voicing my opinion even if it is different from that of my supervisor	McKinsey & Company, (2006); Nair.et.al., (2014)
OH14	My supervisor responds to ideas and suggestions on how to improve the way work is done.	McKinsey & Company, (2006); Nair.et.al., (2014)
OH15	I am encouraged to take reasonable risk to solve quality problems in our work.	McKinsey & Company, (2006); Nair.et.al., (2014)
OH16	In my department, all levels of employees work well together.	McKinsey & Company, (2006); Nair.et.al., (2014)
OH17	Management encourages team work among departments to solve common problems.	McKinsey & Company, (2006); Nair.et.al., (2014)
OH18	In my organisation, there is a strong agreement and a belief in our corporate strategies	McKinsey & Company, (2006); Nair.et.al., (2014)

OH19	I have authority to solve work related problems in timely manner.	McKinsey & Company, (2006); Nair.et.al., (2014)
OH110	In my company, views of employees from different cultures and backgrounds are valued.	McKinsey & Company, (2006); Nair.et.al., (2014)
Competitive Advantage		
OH21	Our competences are not easily imitable by our competition	Barney, (1991); Nair.et.al., (2014)
OH22	The measures used in my organisation support and enable the accomplishment of our business strategies	Barney, (1991); Nair.et.al., (2014)
OH23	In my organisation, I have right skills to achieve business strategies	Barney, (1991); Nair.et.al., (2014)
OH24	In my organisation, I have right resources and tools to achieve business strategies	Barney, (1991); Nair.et.al., (2014)
OH25	I understand my work group's objectives and how they contribute to achieving the goals and vision of our company	Barney, (1991); Nair.et.al., (2014)
OH26	My company ensures to develop unique telecom competencies	Barney, (1991); Nair.et.al., (2014)
OH27	I have received sufficient training to do my job well.	Barney, (1991); Nair.et.al., (2014)
Goal Alignment		
OH31	Our customers would say that overall quality of work done by our team is very good.	Kaplan and Norton, (1992); Nair.et.al., (2014)
OH32	I have opportunity to take decision required to exceed customer expectation.	Kaplan and Norton, (1992); Nair.et.al., (2014)
OH33	My organisation structure facilitates accomplishment of our business strategies	Kaplan and Norton, (1992); Nair.et.al., (2014)
OH34	My company is well equipped to meet the challenges of competition in next few years	Kaplan and Norton, (1992); Nair.et.al., (2014)
OH35	I believe that our company is delivering the promises to the shareholders	Kaplan and Norton, (1992); Nair.et.al., (2014)
OH36	My company's business targets are deeply meaningful	Kaplan and Norton, (1992); Nair.et.al., (2014)
OH37	I have clear understanding of my company's business strategies	Kaplan and Norton, (1992); Nair.et.al., (2014)
OH38	I am very clear on my goals and their linkage to the work group strategies	Kaplan and Norton, (1992); Nair.et.al., (2014)
OH39	My roles and responsibilities are every clear	Kaplan and Norton, (1992); Nair.et.al., (2014)
OH310	I am very clear on my workgroup's business strategies	Kaplan and Norton, (1992); Nair.et.al.,

		(2014)
OH311	Communication from the management is open and honest.	Kaplan and Norton, (1992); Nair.et.al., (2014)
OH312	My company has adequate communication meetings.	Kaplan and Norton, (1992); Nair.et.al., (2014)

3.8.4 Scale for Innovation Capacity (IC)

The items for measuring Innovation capacity were adapted from Koc (2007). The dimensions of IC were identified in the literature from previous research done for the dimensional backing of Innovation support (Poolton & Ismail, 2000; Walker, Harper, & Larreche, 1996; Lester, Piore, & Malek, 1998), Bjurwill (1993) and Freemantle (1999) for the dimension, Innovation task, for Innovation behavior (Gobeli & Brown, 1994) and for Information and communication, (Canfield & Miller, 1998; Moorman & Miner, 1998). Prajogo and Ahmed (2006) conducted a study among 194 Australian managers to determine the relationship between Innovation Capacity and Organisational performance. The study used a five point Likert-type scale.

Table 3.5
Scale for Innovation Capacity (IC)

Code	**Item**	**Source**
Innovation Support		
IC11	My organization has active programs to upgrade employees' knowledge and skills.	Poolton and Ismail (2000), Walker et al. (1996), Lester et al. (1998); Tufan (2007)
IC12	There are many opportunities to exchange and generate ideas in my organization.	Poolton and Ismail (2000), Walker et al. (1996), Lester et al. (1998); Tufan (2007)
IC13	Innovation behaviour is timely rewarded in our company	Poolton and Ismail (2000), Walker et al. (1996), Lester et al. (1998); Tufan (2007)
IC14	My organization gives adequate resources to exploring and implementing innovative ideas.	Poolton and Ismail (2000), Walker et al. (1996), Lester et al.

		(1998); Tufan (2007)
IC15	In my organization innovative and enterprising employees are well paid.	Poolton and Ismail (2000), Walker et al. (1996), Lester et al. (1998); Tufan (2007)
IC16	My work schedule allows me time to think of creative solutions to problems.	Poolton and Ismail (2000), Walker et al. (1996), Lester et al. (1998); Tufan (2007)
IC17	Innovation is clearly a part of my organization's mission or basic beliefs.	Poolton and Ismail (2000), Walker et al. (1996), Lester et al. (1998); Tufan (2007)

Innovation Task

IC21	There are many opportunities and freedom in my work to explore and try out new ideas.	Freemantle (1999); Tufan (2007)
IC22	I frequently encounter non-routine and challenging work in my organization.	Freemantle (1999); Tufan (2007)
IC23	The type of work we do requires large amount of imagination and creativity.	Freemantle (1999); Tufan (2007)
IC24	There is much knowledge to gain from the work I do for my organization.	Freemantle (1999); Tufan (2007)

Innovation Behaviour

IC31	I found my colleagues very helpful when I encounter difficulties with my work.	Gobeli and Brown (1994), Yamin et al.(1997); Tufan (2007)
IC32	In my organization people show interest in each other's work.	Gobeli and Brown (1994), Yamin et al.(1997); Tufan (2007)
IC33	I find my colleagues very helpful in sharing knowledge and information.	Gobeli and Brown (1994), Yamin et al.(1997); Tufan (2007)
IC34	In my organization lots of people take the initiatives to raise new projects.	Gobeli and Brown (1994), Yamin et al.(1997); Tufan (2007)

Information Integration

IC41	Teamwork is great in my organization.	Irby (1992), Leonard and Rayport (1997); Tufan (2007)

IC42	In my organization different departments work together harmoniously.	Irby (1992), Leonard and Rayport (1997); Tufan (2007)
IC43	In my organization there is a strong sense of mutual trust.	Irby (1992), Leonard and Rayport (1997); Tufan (2007)
IC44	My organization is able to accumulate knowledge or learn and benefit from experience.	Irby (1992), Leonard and Rayport (1997); Tufan (2007)
Information and Communication		
IC51	In my organization the dissemination of information relevant to work is excellent.	Canfield and Miller (1998), Moorman and Miner (1998); Tufan (2007)
IC52	Documentation, information and databases are well managed in my organization.	Canfield and Miller (1998), Moorman and Miner (1998); Tufan (2007)
IC53	My organization's information system is a great aid to finding ideas and opportunities.	Canfield and Miller (1998), Moorman and Miner (1998); Tufan (2007)
IC54	My organization captures information diligently from external sources, e.g. customers.	Canfield and Miller (1998), Moorman and Miner (1998); Tufan (2007)

3.8.5 Scale for Competence Building (CB)

The items of competence building were adapted from Chauhan and Chauhan (2009) with dimensional support of professional KSAO (Bandura, 1999), update motivation (Clavareau & Labeau, 2009), up-date activities (Bartunek, Huang & Walsh, 2008) and individual expertise from Senge (1996). The original instrument of Professional Obsolescence Scale consists of 16 items, which measures individual obsolescence on four dimensions related to Professional Knowledge/Skills, Motivation to Update, Attitude towards Learning and Self-initiated Updating. The study was conducted by Chauhan and Chauhan (2009) to measure the competence obsolescence of 200 Indian managers in the IT industry. The instrument used five point Likert-type scale.

Table 3.6

Scale for Competence Building (CB)

Code	Item	Source
Professional KSAO		
CB11	How relevant do you consider your present professional knowledge for your current job?	Bandura 1999; Chauhan and Chauhan (2009)
CB12	How relevant do you consider your present skills for your current job?	Bandura 1999; Chauhan and Chauhan (2009)
CB13	How would you rate these skills in relation to the demands of your current job?	Bandura 1999; Chauhan and Chauhan (2009)
Update Motivation		
CB21	To what extent does your present job utilise your competence?	Clavareau and Labeau, 2009; Chauhan and Chauhan (2009)
CB22	How would you rate your present level of motivation to keep up-to-date?	Clavareau and Labeau, 2009; Chauhan and Chauhan (2009)
CB23	How has the competence requirement for the job changed over the past two years?	Clavareau and Labeau, 2009; Chauhan and Chauhan (2009)
CB24	How challenging generally do you find your job assignments?	Clavareau and Labeau, 2009; Chauhan and Chauhan (2009)
CB25	How employable do you think your skills are in other organisations?	Clavareau and Labeau, 2009; Chauhan and Chauhan (2009)
Update Activities		
CB31	In general, how would you rate your present ability to learn work-related knowledge/skill?	Bartunek, Huang and Walsh, (2008); Chauhan and Chauhan (2009)
CB32	To what extent has your ability to learn changed in the past two years?	Bartunek, Huang and Walsh, (2008); Chauhan and Chauhan (2009)
CB33	How much do you enjoy new work-related learning?	Bartunek, Huang and Walsh, (2008); Chauhan and Chauhan (2009)

CB34	According to you how difficult it is to find telecom skills in the job market?	Bartunek, Huang and Walsh, (2008); Chauhan and Chauhan (2009)
Individual Expertise		
CB41	My professional expertise is essential for the achievement of good results.	Senge (1996); Chauhan and Chauhan (2009)
CB42	My company is one of the leaders in the primary industry to establish and upgrade technology standards	Senge (1996); Chauhan and Chauhan (2009)
CB43	My company has a great level of technological experts or specialists	Senge (1996); Chauhan and Chauhan (2009)

3.9 Questionnaire

As per McCelland (1994), questionnaire is one of the the best methods to gather experimental information from vast number of populace. Questionnaire technique is a generally utilized methodology for data gathering as a part of the sociology field, (Clarke, 1999, Saunders et. al., 2003). A set of questions is an arrangement of planned articulations or inquiries to which the respondents give direct answers or a nearly related choice (Sekaran, 2000). At the point when the reseracher is proficient with the variables in the study, the survey turns into an effective device (Bailey, 1994). For the reasons stated here, the researcher chose questionnaire approach as the most suitable strategy for gathering data for the study.

Some researchers opined that sensitive questions related to demography might be asked at the last in order to improve response rate (Janes, 1999; Robertson and Sundstrom, 1990). Such inquiries like age, designation and so on if show up at the beginning of the survey questionnaire, there is a chance that respondents will be suspicious about the purposes behind gathering the individual information and with that the respondents are likely to be less earnest to the survey from there on (Bourque

& Fielder, 2003). In a few countries like the USA, Germany, Netherlands, it is improper to ask the age, sex, salary and so forth, which make the respondents upset in the first occasion (Malhotra, 1996). Hence, it was decided to keep the demographic questions at the second section after respondents have completed all other items related to the variables. The questionnaire was presented to the respondents in two sections.

The first section comprises the main questionnaire, which is further divided into five sub-sections to distinguish variable level statements. The final instrument for the study had 107 items in total. OH had 29 questions, CB had 15 questions, TD consisted of 14 questions, IC had 23 questions and CA had 25 questions. Based on the level of response expected from the questions, each item was categorised into self, organization and market. For example, any question pertaining to perception of an individual on the skills, abilities etc. of herself/himself, the item was classified into 'self'. Similarly, if the question is about the respondents's perception about telecommunication market in general, the item was classified into 'market'. For items, which were meant to get the individual's perception about organisation's approach to competencies, innovation, and health, were categorized into 'Organisation'.

The second section covered basic personal profile of the respondents. To ensure the respondents meet the selection criteria for the sampling requirements (one year of experience) these questions were included in the Section 2. In addition, gender was also mentioned as one of the drop down selections in Section 2.

Different researchers have different approaches when it comes to the length of the questionnaire. Frazer and Lawley (2000) suggest that up to twelve pages of the questionnaire are of acceptable length. However, Zikmund (2003) recommended that, any questionnaire should not exceed six pages in length as a rule of thumb. Questions in this study were presented to the respondents in a neatly arranged online survey, which comprised of three sections. As the arrangement sequence can cause a potential confusion (Kinnear & Taylor, 1996), reasonable measures were taken to ensure the flow of the questions is in a logical manner. Variable based sequencing to follow the items of the respective variable and theme-based arrangement (to ensure dimensional items are grouped) were followed in the online pages (Tull and Hawkins, 1990).

Simple sentence strcuture was used throughout the questionnaire. Statements were self-explanatory, simple and customised to the technology context in Telecommunication industry. As postulated by Fowler (1992), Janes (1999), and Frazer and Lawley (2000), the respondents must be able to follow the questions and should instill an interest to continue the response in sincere manner. Before reaching out to the final respondents, the draft questions prepared from previous instruments were reviewed and confirmed by a panel of experts from the human resources and telecommunication field (see next section of pilot study). At the face validation, all such ambiguities were cleared by reading and understanding the questions and implementing necessary modifications. To establish a reasonable validity of the instrument and confirm reliability of the same, such procedure becomes an effective method (Churchill, 1995; Frazer and Lawley, 2000). The researcher has taken appropriate steps to ensure the response is commensurate to the intended questions and providing considerable accuracy in the measurement (Janes, 2001; Sanchez, 1992; Babbie, 1990), and increasing the expected response rate (Sanchez, 1992).

3.10 Pilot Study

Once face validity of the questionnaire was confirmed by the experts, the items in the measurement instrument identified should be tested in the specific study sector for validity of content, to evaluate the items reflecting the appropriate content from the context which the instrument is meant for (Straub, 1989). Through an organised review process, identified experts from the related industry evaluate the level of synchronisation of the variable with different theoretical dimensions and the respective items and the implicit meaning of each item to see if it conveys what it is supposed to do (Hinkin & Tracey, 1999).

Blair and Presser (1992) identified differences among the pre-test methods as adopted by different scholars. Reynolds and Diamantopoulos (1998) confirmed the disagreement among scholars on the best pilot test method. Overall, the methodological literature explains three distinct pre-test methods, which are interchangeably used in the social research by scholars at different context (Hunt et al., 1982; Reynolds & Diamantopoulos, 1998; Zikmund, 2003). These methods are expert panel, planned field study and face-to-face interview. The first method is about asking a panel of experts to read analyse and judge the instrument items or questions used for suitability to administer to a larger population. The second method employs a cross section of sample size to simulate the actual test instrument (Zikmund, 2003). The third, which is personal interview, is more comprehensive and time consuming as it requires the researcher to have a personal interaction with the respondent to discuss and identify potential problems and obstacles identified in the instrument.

After analyzing the three pre-test methods, Reynolds and Diamantopoulos (1998), suggested field sample study as the most effective pretest method as it covers all the aspects of the instrument response. Thus, the researcher decided to employ expert panel for checking face validity of the instrument and field survey to do the pilot study to confirm reliability and validity of the instrument. As the instruments were adapted from previous empirical studies to suit the present research framework, and modified by the expert panel, appropriate reliability and validity check conducted through a pilot study before the instrument is administered to the identified population. If other researchers use the same approach, they should get similar results.

The first draft of the questionnaire was put through a face validity test by sending to a few of the industry experts to review and comment on the language used for ease of understanding. Based on their inputs the questionnaire was re-phrased three times to align with the telecommunication industry. Moreover, they were asked to annotate on the questions asked whether or not they were easily understandable to cut down the possibility of misinterpreting. Consequently, some of the questions were re-worded to eliminate confusion and increase the accuracy of data.

The selection of items to develop scales was closely followed previous work and all scales were examined carefully (based on content) to ensure that the multiple items within the single scale actually represent the underlying theoretical construct. In addition, to obtain greater confidence in the scales, reliability test was conducted for all constructed scales because good scales are expected to exhibit high reliability scores.

It was essential to conduct a pilot test among the population identified for the main study, to check the reliability and validity of the instruments (Cross & Sproull, 2004). While pretest evaluation of the questionnaire involved HR professionals in India, the pilot test involved respondents from the same group of companies where the actual study is intended to be carried out (Bradburn et al., 2004). The outcome expected from the pilot test was the respondent behavior in terms of time required to complete the test and also the efficacy of the questions used. In order to test the instrument's validity, the questionnaire was distributed to a sample of 150 managers from four identified telecommunication companies in India. The respondents were selected carefully from a stratified sample of employees from the different divisions of the companies with minimum eight years of total experience. Out of the 150 questionnaire distributed, 123 (82%) employees responded. The high response rate was due to the personal follow-up done with every respondent. Hair et. al. (2006) suggested a sample size of 100 or above as adequate to conduct exploratory factor analysis. Based on the collected data the reliability and validity of the instrument were performed. An exploratory factor analysis (EFA) of the test data was conducted.

3.11 Measuring the Reliability and Validity

The analysis of the level of consistency among different estimations of a variable can be termed reliability (Hair et. al., 2011). To assess the consistency of the items to measure of reliability is to be administered. The consistency may be confirmed if the instrument used repeatedly for different measures give similar results. As per Sekaran (2003), generally there are four measurement techniques used to assess the reliability of an instrument. Apart from the most popular Cronbach alpha method, test retest, split half and alternate forms are used to measure reliability. Yet, as per

Venkatesh and Davis (2000), the initial three methods have been condemned to have practical shortcomings. All the more particularly, test retest reliability measure may get lower scores because of the conceivable subject changes. Similarly, split half method may bring about more costs because the researcher is required to get ready two distinctive yet equal types of the same sum. The split half technique, in a way, may deliver diverse dependability coefficients in light of the way in which the points are partitioned.

However, the Cronbach alpha technique to test for measure reliability can hold its own particular strengths to overcome the previously stated issues identified with different methods. In the field of social research, Cronbach alpha method continues to be the most acceptable and widely used reliability measure. Cronbach alpha reliability test was administered for reliability measurement of the instruments used in this research. The alpha scores show the item consistency for measure of the same construct. A high alpha score indicates that the items used in the measurement are consistent and are the most suitable to measure the intended construct. While discussing the threshold value of Cronbach alpha, Nunnally (1978) recommended some acceptable levels and resultant values of alpha. For instance, for exploratory research Cronbach alpha value of 0.7 is acceptable and for confirmatory analysis 0.8 should be the minimum acceptable Alpha value.

To measure the reliability of the measure, this study performed the inter item-construct correlation analysis following the procedures described by Nunnally and Beinstein (1994). As presented in Annexure 5, this analysis was based on the correlation between the average scores of the total construct and the items used to measure their respective constructs. Hence, the correlation between any construct and the items associated to it must be larger than the correlation between the same items. For example, the correlation between the items used to measure Technological Capability construct namely, TDTC1 through TDTC9 have correlation coefficient ranging between 0.85 and 0.95, which are the highest when compared with the correlations with other constructs. In case, if the item correlation with its associated construct is found to be lower than its correlation with any other construct, this item is not appropriately assigned to its intended construct and can be excluded. Based on the results of analysis of item-construct correlation (Annexure 4), it can be claimed that all of the items have been correctly correlated to their intended constructs. The lowest item-construct correlation is 0.70, which is considered to be highly correlated to the respective constructs.

3.11.1 Uni-dimensionality and internal reliability

An exploratory factor analysis (principal component analysis) of the data with varimax rotation was conducted to provide further evidence for the construct validity of the instrument by modeling the correlations among the identified indicators. As a first step to check the applicability and appropriateness of factorability of factor analysis, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was found at 0.588 and the Bartlett‟s test of sphericity showing approximate chi-square value of 13745.

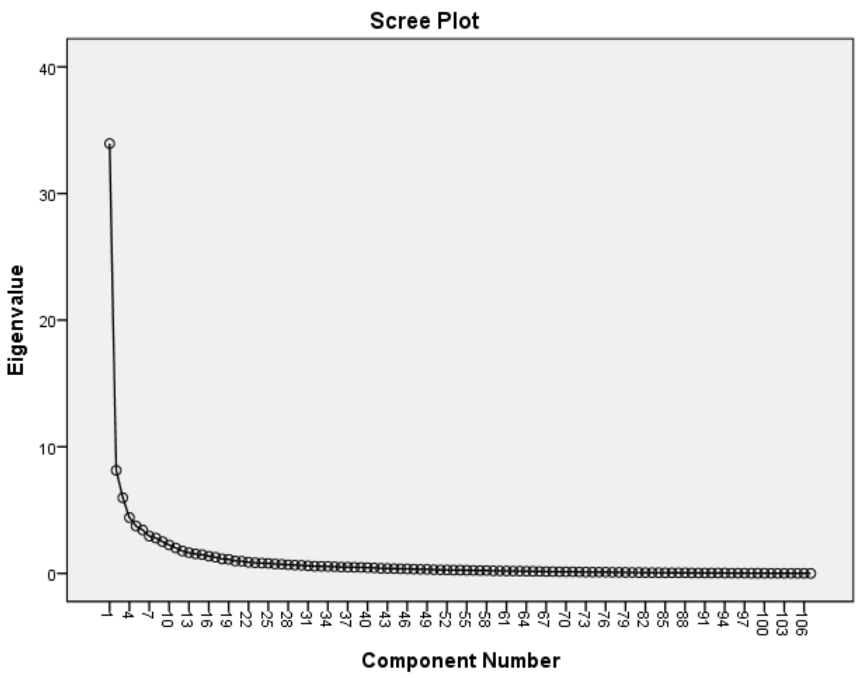

Figure 3.3
Scree plot for the EFA of variables

According to Kaiser (1974), the KMO is the index used to compare the magnitude of the observed correlation coefficient to that of the partial correlation coefficient, which is closer to one (1), is best measure. As expected, the varimax rotation generated 19 factors with more than one Eigen-value. However, 19^{th} factor did not show up any items with coefficients more than 0.30. Hence it was decided to finalise the factors as 18. Figure 3.3 shows the scree plot of the factor analysis.

Factor loading of all the items indicated high scores (above 0.6) providing adequate uni-dimensionality to the constructs (Hair, Ringle, & Sarstedt, 2011). Cronbach alpha score for the three dimensions were above 0.7 giving acceptable internal reliability to the instrument (Bryman and Cramer, 1997). To check convergent validity, AVE (average variance extracted) was calculated which were also found to be above the threshold of 0.5 (Fornell & Cha, 1994). Composite reliability scores (CR) of 0.6 above proved internal consistency of construct dimensions (Hair et al., 2011). The reliability statistics of OH instrument met all the necessary threshold criteria (Table 3.8).

Table 3.7
Reliability statistics of OH instrument

Factor	No. of items	Item Code	Loading	Alpha	AVE	CR
Change capacity	10	OHCC1	.869	0.975	0.677	0.954
		OHCC2	.860			
		OHCC3	.816			
		OHCC4	.803			
		OHCC5	.801			
		OHCC6	.823			
		OHCC7	.809			
		OHCC8	.833			
		OHCC9	.825			
		OHCC10	.783			
Competitive Advantage	7	OHCA1	.845	0.938	0.554	0.896
		OHCA2	.739			
		OHCA3	.729			
		OHCA4	.807			
		OHCA5	.772			
		OHCA6	.652			
		OHCA7	.644			
Goal Alignment	12	OHGA1	.776	0.969	0.577	0.942
		OHGA2	.717			
		OHGA3	.788			
		OHGA4	.766			
		OHGA5	.718			
		OHGA6	.710			
		OHGA7	.721			
		OHGA8	.802			
		OHGA9	.771			
		OHGA10	.822			
		OHGA11	.744			
		OHGA12	.770			

Source: Own illustration

For the CA instrument, factor loading of all the items indicated high scores (above 0.6) cronbach alpha score for the three dimensions were above 0.7, AVE above the threshold of 0.5 and composite reliability scores (CR) of 0.6 above, meeting all the required reliability and validity criteria (Table 3.9).

Table 3.8
Reliability statistics of CA instrument

Factor	No. of items	Item Code	Loading	Alpha	AVE	CR
`Marketing	8	CAMC1	.827	0.906	0.61	0.916

Competence		CAMC2	.762			
		CAMC3	.830			
		CAMC4	.731			
		CAMC5	.870			
		CAMC6	.725			
		CAMC7	.707			
		CAMC8	.648			
Technological Competence	8	CATC1	.847	0.973	0.715	0.952
		CATC2	.800			
		CATC3	.842			
		CATC4	.849			
		CATC5	.873			
		CATC6	.863			
		CATC7	.846			
		CATC8	.842			
Integrative Competence	9	CAIC1	.762	0.952	0.548	0.916
		CAIC2	.758			
		CAIC3	.763			
		CAIC4	.765			
		CAIC5	.732			
		CAIC6	.777			
		CAIC7	.787			
		CAIC8	.689			
		CAIC9	.616			

Source: Own illustration

Subsequently for the TD instrument, factor loading of all the items indicated high scores (above 0.6) cronbach alpha score for the three dimensions were above 0.7, AVE above the threshold of 0.5 and composite reliability scores (CR) of 0.6 above, meeting all the required reliability and validity criteria (Table 3.9).

Table 3.9
Reliability statistics of TD instrument

Factor	No. of items	Item Code	Loading	Alpha	AVE	CR
Technological Capability	9	TDTC1	.919	0.971	0.681	0.95
		TDTC2	.826			
		TDTC3	.818			
		TDTC4	.821			
		TDTC5	.849			
		TDTC6	.808			
		TDTC7	.724			
		TDTC8	.821			
		TDTC9	.831			
Market Turbulence	3	TDMT1	.880	0.954	0.74	0.895
		TDMT2	.844			
		TDMT3	.856			
Technological Turbulence	3	TDTT1	.745	0.918	0.515	0.761
		TDTT2	.685			
		TDTT3	.723			

Source: Own illustration

Further, for the IC instrument, factor loading of all the items indicated high scores (above 0.6) cronbach alpha score for the five dimensions were above 0.7, AVE above the threshold of 0.5 and composite reliability scores (CR) of 0.6 above, meeting all the required reliability and validity criteria (Table 3.10).

Table 3.10
Reliability statistics of IC instrument

Factor	No. of items	Item Code	Loading	Alpha	AVE	CR
Innovation Support	7	ICIS1	.765	0.943	0.612	0.917
		ICIS2	.712			
		ICIS3	.755			
		ICIS4	.748			
		ICIS5	.825			
		ICIS6	.825			
		ICIS7	.838			
Innovation Task	4	ICIT1	.724	0.818	0.509	0.805
		ICIT2	.698			
		ICIT3	.668			
		ICIT4	.761			
Innovation Behaviour	4	ICIB1	.759	0.868	0.527	0.816
		ICIB2	.637			
		ICIB3	.779			
		ICIB4	.721			
Innovation Integration	4	ICII1	.835	0.84	0.545	0.826
		ICII2	.738			
		ICII3	.711			
		ICII4	.657			
Information and Communication	4	ICIC1	.761	0.899	0.517	0.808
		ICIC2	.554			
		ICIC3	.711			
		ICIC4	.821			

Source: Own illustration

Finally, for the CB instrument, factor loading of all the items indicated high scores (above 0.6) cronbach alpha score for the four dimensions were above 0.7, AVE above the threshold of 0.5 and composite reliability scores (CR) of 0.6 above, meeting all the required reliability and validity criteria (Table 3.11).

Table 3.11
Reliability statistics of CB instrument

Factor	No. of items	Item Code	Loading	Alpha	AVE	CR
Professional	3	CBPK1	.807	0.907	0.624	0.823

KSAO		CBPK2	.785			
		CBPK3	.778			
Update Motivation	5	CBUM1	.762	0.873	0.573	0.87
		CBUM2	.684			
		CBUM3	.864			
		CBUM4	.688			
		CBUM5	.774			
Update Activities	4	CBUA1	.740	0.891	0.546	0.828
		CBUA2	.772			
		CBUA3	.736			
		CBUA4	.708			
Individual Expertise	3	CBIE1	.753	0.861	0.562	0.793
		CBIE2	.810			
		CBIE3	.679			

Source: Own illustration

All the instruments in the study thus met the required threshold of reliability, validity and uni-dimensionality.

3.12 Ethical Considerations

Polonsky and Waller (2005), while discussing about the ethical research postulated that the researcher need to comprehend the requirements of an ideal research. Accordingly, various measures were taken to ensure that nobody was adversely influenced by this study. To begin with, appropriate permission letters were sought from the human resources departments of the participating companies. While seeking permission from the companies, it was mentioned that the data collected from the respondents would only be used for academic purpose. Secondly, assurance of keeping the personal data collected confidential was mentioned upfront in the welcome page of the online questionnaire. Essentially, the researcher at every step of this study followed all ethical research prerequisites of Universiti Utara Malaysia. Fourth, the respondents who needed more information before taking part in the study were given the choice to contact the researcher. Finally, to ensure the privacy of the data, the researcher attempted various measures like the names of the organizations provided data were kept secret and they were not depicted in a way in the thesis that allows them to be recognized, Also, except for the gender, experience and designation no other personal data was collected from other responders.

3.13 Data Collection Procedures

According to Dilman (1978), it is important to efficiently administer the questionnaire of the study to generate satisfactory response to each item in the study. Therefore, this study employed the online survey as the mean to collect data. Thus, the quantitative research approach was very much helpful in translating the data collected using the survey questionnaire or measurement instruments into significant results that were useful for the research development (Cooper & Schindler, 2006). As indicated earlier, the questionnaire of the study consisted of 107 questions (using 7-points Likert scale) and followed the online-administration approach that involved the HR department of the identified companies to ensure a high response rate.

The questionnaire was administered to the selected sample on an online platform during the period between 27th April 2015 and 9th July 2015. It was estimated that few rounds of gentle reminders and follow-ups would be required to get a reasonable response rate. Researcher had obtained necessary permission from the company officials to conduct the study and complied with all the ethical requirements by getting consent from participants and assuring them that the data they submitted will be confidential. The respondents had an option not to disclose the personal details like name etc. However to validate the diversity of the respondents, gender and number of years of experience fields were made mandatory.

The researcher has sought further help from the HR departments of the companies to email the first survey reminder together with the link to online questionnaire to respondents who have not responded to the questionnaire roughly after ten days of initiating the survey. Further to that reminder, subsequent gentle reminders with the survey link were pushed to the respondents at frequent intervals until the survey was declared closed on 9th July 2015. Table 3.12 explains the details of the survey dates and the reminder schedules.

Table 3.2
Invite and reminder schedules of the survey

No.	Invite & Reminders	Delivery date
1	Online survey initiated on	27-Apr-15
2	First reminder to the respondents	08-May-15
3	Second reminder to the respondents	12-May-15
4	Third reminder to the respondents	22-May-15
5	Fourth reminder to the respondents	04-Jun-15
6	Fifth reminder to the respondents	16-Jun-15
7	Sixth reminder to the respondents	26-Jun-15
8	Final reminder to the respondents	07-Jul-15
9	Online survey closed on	9-Juy-2015

Source: Own illustration

The online platform gave flexibility to keep response to each item mandatory to move to the next question. Hence this resulted in a data set with no missing values. The segregate responses from four companies the online survey was done in four different instances. A web link containing the survey was sent across to the identified respondents directly by the HR department. The mail body contained an expression of interest of the survey and request to complete the survey at an earliest convenient time. Respondents were given time of 30 calendar-days to complete the survey. Seven reminders were sent at frequent intervals.

3.14 Techniques of Data Analysis

The data collected was verified and analyzed in July and August 2015. To test the goodness measures, especially the factor analysis and reliability value, Statistical Package of Social Sciences (SPSS) version 21 was employed. To evaluate the confirmatory factor analysis through variable level measurement models and also to test the hypotheses through multiple regressions, Analysis of Moment Structure (AMOS) version 18 was used. AMOS allows the researcher to perform moderation and mediation analysis (based on Baron & Kenney procedure) as well as combined models such as mediated moderation and moderated mediation. In order to ascertain the effect size of the mediator, the difference of adjusted ΔR^2 was calculated and the f-value was determined. In order to further ratify the moderation and mediation test from AMOS, a computational tool developed by Hayes (2012) called Process Macro was used. Bootstrapping runs the regression models a large number of times in order to get a stable estimate of the standard error and confidence intervals of the indirect effects. The indirect effect refers to the effects of the independent variable on the dependent variable through another variable (e.g., mediator). For the moderator hypotheses, AMOS automatically creates the interaction term with the independent variables.

3.14.1 Descriptive analysis

According to Johnson and Christensen (2000), descriptive analysis is the method of describing, organizing, displaying and explaining the characteristics of the sample in a tabular and graphic form to provide a summarized measure. Descriptive analysis helps in providing a summarized form of examine data collected. The process of explaining the phenomena of interest is referred to as descriptive analysis. The descriptive analysis provides and analyzed of how many times a particular phenomenon occurs (frequency). It will also explain the average score or mean and the standard deviation. The main reason for using descriptive analysis is to explain the sample characteristics that were used in the study. For the purpose of the descriptive analysis, various statistical techniques were employed to initially quantitatively summarize the data. That is, the descriptive statistics involved analyzing the mean, median, standard deviation and the graphical data description.

3.14.2 Inferential analysis

Multivariate analysis will be used to check assumptions of normality and outliers. The confirmatory factor tests were conducted separately for the variables of organizational health, competence adequacy, technology disruption; innovation capacity and competence building have correlation among these variables. This study employed various procedures to test the crucial assumptions of multivariate analysis. Some of the followed procedures are:

1. Normality testing through Skewness, Kurtosis, Kolmogrov-Sminrov test and normal probability plots.
2. Outlier Detection through examining Mahalanobis distances.
3. Homoscedasticity and linearity check through Scatterplots.
4. Detecting and tackling Multicollinearity employing Variance Inflation Factor (VIF).
5. Using AMOS to test the measurement model and to prove convergent and discriminant validity of the measure used.

3.14.3 Multiple regressions

Multiple regressions were used to determine the relationship between the independent variable (IV) and the dependent variable (DV). According to Neuman (2005) multiple regression analysis is used for two main purposes, which are calculating the R-Squared and contribution of each variables. R-Squared explain the extent to which IV explain the DV. The use of this analysis technique helps in explaining the nature and direction of the IV (Technology Disruption, Competence

Adequacy, Innovation Capacity and Competence Building) and DV (Organizational Health and Competence Adequacy) relationship.

3.15 Summary

This chapter presented the methodology that is used for this research study. The research questions and their associated hypotheses, along with information regarding the target population, research design, and instrumentation, operationalization of the variables, data collection method, and data analysis methods of the study have been presented. In addition, the methodologies for collecting quantitative data and analyzing in connection with the research questions identified in Chapter II were presented. Moreover, this chapter provided some elaborations on the population, sampling frame and the justification of the choice of the unit of analysis as being the individuals as managers. Additionally, this chapter used the data collected from 123 employees from the identified telecommunication companies to conduct the Pilot study. Pilot test was mainly conducted to ensure the validity and reliability of the measures and to ensure high quality data during the real data collection phase.

The next chapter will include detailed analysis and interpretation of the data soon after the data collection exercise is over. In this chapter, the researcher will incorporate the descriptive statistics like percentages of sample population, application of measures of central tendency such as mean and standard deviation and also correlation, regression and hierarchical regression. Further, based on the table availability, the researcher will interpret the quantitative data into finding, discussion, and implication of the findings.

CHAPTER FOUR

SIGNIFICANT FINDINGS AND RESULTS

4.1 Introduction

This chapter presents the statistical data analysis and reports the findings of this study. The Chapter is divided into four major sections for easy segregation of data analysis results. Section 4.2 covers the overview of the data collection and demographic profile of respondents based on company, gender and total years of experience. Section 4.3 reports the goodness of the measure through construct validity. Construct validity includes convergent validity and discriminant validity.

Section 4.4 discusses the confirmatory factor analysis through the measurement models of the variables. Section 4.5 reports the hypotheses testing procedures using AMOS and SPSS. Finally, section 4.6 summarizes the results and section 4.7 concludes the chapter.

4.2 Overview of Data Collection

Table 4.1 depicts the distribution of respondents according to the company they belong. For the purpose of confidentiality promised to the participating companies, the names of the companies are not mentioned in the tables. Instead, a reference of Company 1, Company 2, Company 3 and Company 4 is maintained throughout this presentation. A report of total number of managers were requested from the HR department of each participating company in April 2015. As can be seen in Table 4.1, a total of 22% (915/4156) of the intended population (managers) was covered with this survey. Out of the 2081 sample size identified and the online survey links sent, a response rate of 44% with 915 responses. The response rate during the period between the reminders is given in the Table 4.1.

Table 4.1
Summary of responses received from the pilot and main survey

Schedule	Date	Response in period	Cumulative Response
First reminder	08-May-15	276	276
Second reminder	12-May-15	157	433
Third reminder	22-May-15	145	578
Fourth reminder	04-Jun-15	121	699
Fifth reminder	16-Jun-15	98	797
Sixth reminder	26-Jun-15	67	864
Final reminder	07-Jul-15	51	915

Eventhough there expected a lower response rate, with aggressive follow up with the sample population through the HR department of the companies, the survey could fetch an above average response rate of 44%.

4.3 Test of Non-Response Bias

Since there was a gap of eleven weeks between the first day of the survey reponse (27th April 2015) and the last day of response (9th July 2015), there was a concern with the 'non-response bias'. Non-response bias refers to a situation in which people tend to respond to the same type of questions with different answers due to the pressure exerted on them by the researcher to complete the test within time. The standard way to test for non-response bias is to compare the responses of those who return the first mailing of a questionnaire to those who return after the the last reminder. In order to assess the non-response bias, a T-test was carried out to compare the responses of the early and late respondents. Following the suggestions of Armstrong and Overton (1977) and Kannan *et al*. (1999), if differences between late and early respondent were found to be significant, they may indicate the underlying differences between respondents and non-respondents. Those who return the last questionnaire are, in effect, a sample of non-respondents (before the first reminder) and we assume that they are representative of that group. In this survey, there were 276 people responded before the first reminder and 51 responded after the last reminder. This study carried out T-test to test the differences between the first 25 early and the late 25 respondents.

Table 4.2
T-test result for Non-Response bias

Variable	**T-Value**	**Significance**
Technology Disruption	-1.513	0.135
Competence Adequacy	-2.119	0.037
Organisational Health	-2.475	0.016
Competence Building	-2.148	0.035
Innovation Capacity	-2.059	0.043

**P<0.01

The test took into account all the variables included in the study. However, the results in Table 4.2 showed that there were no significant differences between late and early respondents across all the variables.

4.4 Demographic Profile of Respondents

Table 4.3 shows that out of the total 2081 sample size selected, female managers comprised only one third of it (1454 that is 34%). This could be due to the nature of work in Telecommunication companies.

Table 4.3
Summary of responses received from the pilot and main survey

Company	Managers	Sample	Female	Male	Actual response	Female	Male
Company 1	823	412	109	303	176	46	130
Company 2	916	459	176	283	190	44	146
Company 3	1312	657	201	456	307	55	252
Company 4	1105	553	242	311	242	14	228
	4156	2081	1454	2702	915	159	756

Source: Data provided by the HR department of participating companies

Figure 4.1 describes the gender distribution of respondents as against the total participation. The lower response from the female sample was unexpected by the researcher. India being a male dominated society, it is natural to accept such low response from female category of respondents. Female respondents are careful and calculative before attending to any such academic or dipstick surveys. Moreover, they are also skeptical about openly opiniating about a phenomenon from their company and industry. It is presumed that females respond to such questionnaire only after making sure the unknown consequences of their opinions. However, the scope of this study did not separate the influence of response based on gender and hence it was decided to ignore this lower rate of response.

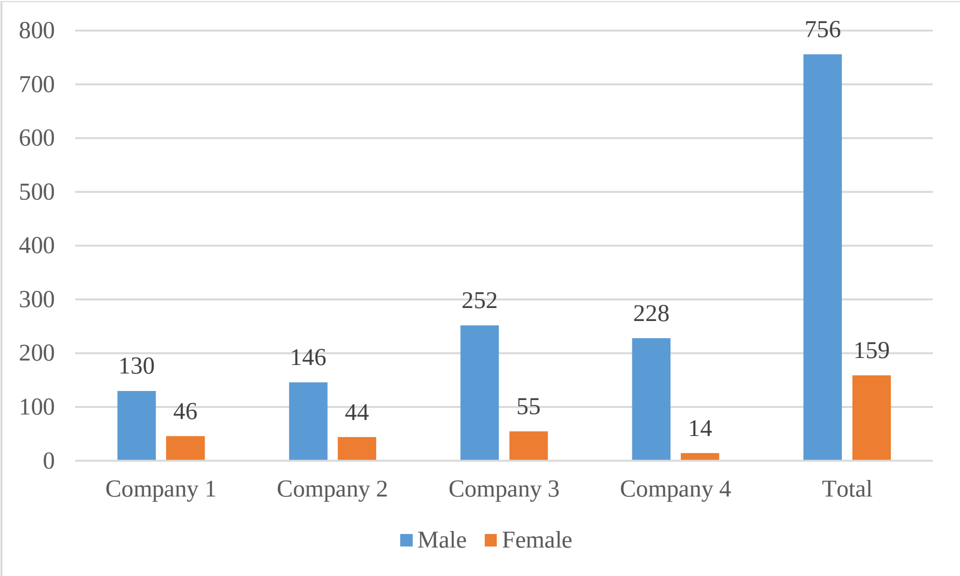

Figure 4.1
Distribution of gender in the main survey
Source: Own illustration

Due to the varied designation structure followed in different companies, the number of respondents from each role is not proportionate in companies. However, roles like manager, senior manager, specialist etc. were found to be common designations among the participant companies. Table 4.4 represents the distribution of designations among the respondent managers. All of them had at least one year of work with the current company. This condition was the screening criteria given to the HR department while selecting the sample population.

Table 4.4
Distribution of designations in main survey

	Company 1	Company 2	Company 3	Company 4	Grand Total
Assistant Manager	36	5		21	62
Principal Engineer			19	39	58
Engineer	21	23	20		64
Executive	11	8	12		31
General Manager	3	4	12	23	42
Manager	47	59	91	76	273
Project Manager	3	4			7

Senior Engineer	2	17	32	16	67
Senior Executive	19	3	44		66
Senior Manager	11	28	51	47	137
Senior Specialist	6	35	5	20	66
Senior Technician			21		21
Specialist	17	4			21
	176	190	307	242	**915**

The main survey respondents were meant to be managers with industry experience. The sample was pre-selected with these criteria; hence, all the respondents necessarily were managers. However to see the experience level the data was analysed for the range of service 8-10 years, 10-12 years, 12-15 years and 15 years & above respectively. From the Figure 4.2 it is evident that the major part of the respondents (46%) falls into the service range of 10-12 years followed by 12-15 years and by 8-10 years. Only 64 respondents (7%) have above 15 years of experience.

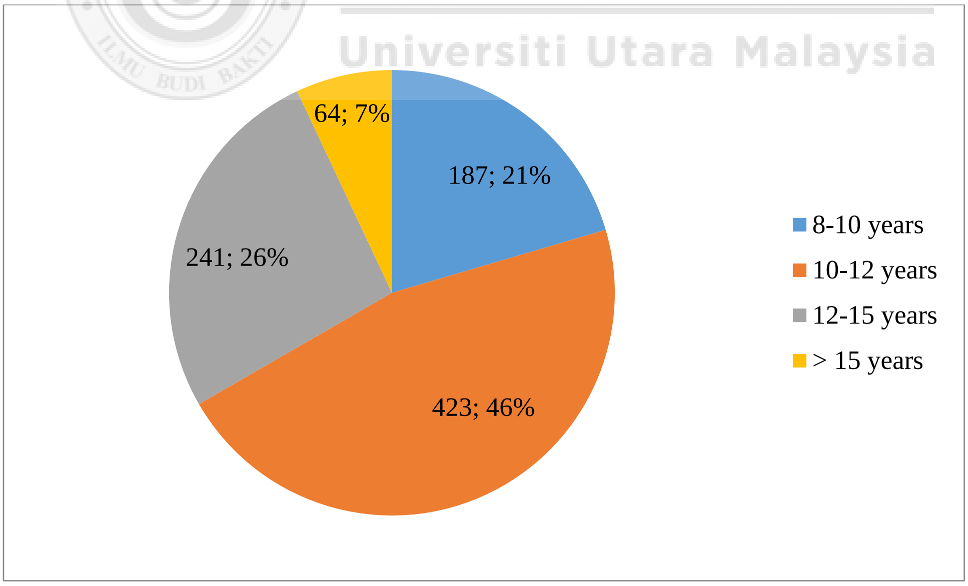

Figure 4.2
Distribution of length of service in main survey
Source: Own illustration

The main survey fetched 915 responses with 44% response rate, which was more than the required sample size (848) for the study.

4.5 Data Coding and Screening

For every response item a unique code was allocated (Malhotra, 1996) to facilitate identification of items when the data is transferred from the survey output to SPSS. De Vaus (1995) suggests that such coding can be done to the questions either before the survey is administered (pre-coding) or after the response is received (post-coding). For this research, all the questions were coded with alphanumeric values after the responses were received. For example, second question in the third dimension of the IC variable is coded as IC32 and first question of second dimension in OH variable named as OH21. To confirm all data entered is correct as per survey, a crosscheck was carried out with between the downloaded data and the survey raw data. There was no extreme values detected as the survey answer options were limitd to numeric scales.

Before undertaking any analysis, the preliminary data was screened to identify any outliers, missing values and assess normality of the data. It is essential to do preliminary data screening to ensure the data is correctly entered into SPSS and the data collected follows a normalized curve (Coakes & Clarkes, 2006).

4.6 Goodness of Measure

To ensure valid and reliable results and conclusions, this study followed rigorous steps to test the goodness of the measure. Testing the goodness of measure employed in this study was performed by employing the Confirmatory Factor Analysis techniques (CFA) using AMOS version 18. However, this study started by examining the goodness of fit of the measurement models before proceeding to test the construct validity of the measure. Model specification establishes a model that captures and measures all the expected relationships among indicators and their respective multilevel constructs (MacKenzie, Podsakoff, & Podsakoff, 2011). In the proposed model, all the constructs are built upon the reflective indicators whose dimensions comprise manifestations of the constructs, such that changing or deleting any may not necessarily alter the underlying meaning of the construct (MacKenzie et al., 2011). It is necessary to understand the elements of the construct dimensionality so as to adapt appropriate analysis techniques to enhance validity. Consistent with prior literature, all variables in the propose research model are constructed reflectively.

4.7 Factor Analysis

In order to identify a set of parsimonious, distinct, and non-overlapping variables underlying the items of each construct, Confirmatory Factor Analysis (CFA) technique was employed. Hence, CFA was performed to extract the dimensions of Technology Disruption (TD), Competence Adequacy (CA), Organisational Health (OH), Innovation Capacity (IC), and Competence Building (CB). In fact, CFA approach has been used in organizational studies especially when the relationships between the latent variables are not ascertained (Sureshchandar, Rajendran, & Ananthraraman, 2001). Before undertaking the CFA of the data, this study checked the factorability of the dimensions. The factorability of the data can be determined through the measure of sampling adequacy, Kaiser-Meyer-Olkin (KMO), and the Bartlett's test of sphericity. Both measure the existence of correlation among items and test that the correlation matrix among items whether it is is significantly different from the identity matrix. The data to have an acceptable level of multicollinearity among items, KMO had to be more than 0.5 (Hair et al., 2006) and the Bartlett's test of sphericity had to be significant (sig. <0.05). In fact, many recommendations have been made on how to identify the acceptable KMO. For example, 0.5 – 0.7 is considered mediocre, 0.7-0.8 is good, and 0.8-0.9 is superb as recommended by Nunnally (1978). Since the KMO for all the constructs of the study ranged between 0.907 and 0.967 as illustrated in Table 4.5 to Table 4.9, this study proceeded to the factor analysis as reported in the following section.

4.7.1 Factor Analysis of Technology Disruption construct

This field set out to capture the dimensions of TD with a varimax rotation based principal component analysis (PCA). Nonetheless, initially TD had 15 items to measure the construct, which were loaded on three factors with a greater eigenvalue (>1) and CVE (cumulative variance extracted) of nearly 82 %, as illustrated in Table 4.5.

Table 4.5 depicts the three factors underlying the TD items. According to the factor loadings, the factors identified were labeled as, Technological Capability (TC), Market Turbulence (MT) and Technological Turbulence (TT).

Table 4.5
Principal component analysis of TD

Item code	Factors		
	Technological Capability	Market Turbulence	Technological Turbulence
TDTC1	.93		
TDTC2	.89		
TDTC3	.84		
TDTC4	.88		
TDTC5	.90		
TDTC6	.88		
TDTC7	.78		
TDTC8	.87		
TDTC9	.90		
TDMT1			.88
TDMT2			.87
TDMT3			.90
TDTT1		.91	
TDTT2		.92	
TDTT3		.93	

Eigen-Value	7.91	2.82	1.70
VE%	47.38	18.24	17.28
Cumulative VE	82.91		
Cronbach's Alpha	0.96	0.90	0.93
KMO	0.93		
Chi-Square	14415		
Significance	0.000		

The Cronbach alpha values of factors under TD ranged between 0.907 and 0.967 showing high internal reliability of the instrument. All the items in the TD construct under three identified factors were retained, thus, this study proceeded to the hypothesis analysis with three factors and 15 items.

4.7.2 Factor Analysis of Competence Adequacy construct

Similarly, a CFA was undertaken to capture the dimensions underlying the CA construct. It was found that KMO was 0.938, which exceeded the recommended limit of 0.5, and Bartlett's test indicated significant values to be acceptable for EFA (Table 4.5). The factor loadings of the points on factors extracted confirmed that three components were to be extracted. These three factors explained 64.79 % of the overall variance in the CA construct. Therefore, the underlying factors of CA construct were found to be same as the measure adopted from the literature that encompasses three dimensions namely, Marketing Competence (MC), Technological Competence (TC), and Integrative Competence (IC). Table 4.6 illustrates the results of factor analysis of the CA construct.

Table 4.6
Principal component analysis of CA

Item Code	Factors		
	Marketing Competence	Technological Competence	Integrative Competence
CAMC1	.62		
CAMC2	.63		
CAMC3	.61		
CAMC4	.71		
CAMC5	.65		
CAMC6	.64		
CAMC7	.65		
CAMC8	.48		
CATC1		.60	
CATC2		.71	
CATC3		.73	
CATC4		.76	
CATC5		.77	
CATC6		.78	
CATC7		.74	
CATC8		.60	
CAIC1			.65
CAIC2			.63
CAIC3			.71
CAIC4			.67
CAIC5			.63
CAIC6			.72
CAIC7			.70
CAIC8			.61
CAIC9			.57
Eigen-Value	9.40	3.11	2.61
VE%	23.56	19.68	13.44
Cumulative VE	64.79		
Cronbach's Alpha	0.86	0.95	0.89
KMO	0.93		
Chi-Square	14301		
Significance	0.000		

The factors under CA indicated high reliability with Cronbach alpha values above 0.869. The factor analysis results of CA construct were satisfactory to proceed further with the measurement model and path analysis in AMOS.

4.7.3 Factor Analysis of Organisational Health construct

To figure out the underlying factors, the items measuring OH construct were put through an exploratory factor analysis (EFA) process. With a significant value of Bartlett's test, the EFA showed a KMO value of 0.942, which exceeded the minimum required value of 0.5 as per Hair et al., (2011). The outcomes uncovered that there were three components of the organizational health (OH) construct utilized as a part of the measure of this study. As illustrated in Table 4.7, items CC1 to CC10 loaded on the first factor whereas CA1 to CA7 highly loaded on the second factor and GA1 to GA12 loaded on the third factor. Based on the common content of the items grouped to each factor, the three factors were labeled (Hair et al., 2011). The first factor is labelled as Change capacity talked about the willingness of the organization to adapt change. The second factor is labelled as Competitive advantage intended to measure the items of value, rarity, inability, and non-substitutability of competence within the organization. The third factor, Goal alignment measured the strategic objective alignment of the organization. Table 4.7 shows that the three factors had high Cronbach alpha reliabilities of 0.94, 0.81, and 0.92 respectively indicating high internal consistency among their items.

Table 4.7
Principal component analysis of OH

Item Code	Factors		
	Change capacity	Competitive Advantage	Goal Alignment
OHCC1	.71		
OHCC2	.77		
OHCC3	.71		
OHCC4	.74		
OHCC5	.69		
OHCC6	.74		
OHCC7	.74		
OHCC8	.68		
OHCC9	.70		
OHCC10	.65		
OHCA1		.58	
OHCA2		.64	

OHCA3		.54	
OHCA4		.49	
OHCA5		.39	
OHCA6		.45	
OHCA7		.55	
OHGA1			.72
OHGA2			.73
OHGA3			.72
OHGA4			.74
OHGA5			.66
OHGA6			.71
OHGA7			.66
OHGA8			.71
OHGA9			.73
OHGA10			.73
OHGA11			.70
OHGA12			.68
Eigen-Value	11.22	3.47	2.06
VE%	23.02	22.39	10.01
Cumulative VE	61.35		
Cronbach's Alpha	0.94	0.81	0.92
KMO	0.94		
Chi-Square	16370		
Significance	0.000		

The values under the factor analysis were significant with high Chi square value and KMO score showing higher than the recommended value. The model thus was considered fit to proceed with further analysis.

4.7.4 Factor analysis of Innovation Capacity construct

To identify the factors leading to Innovation Capacity (IC) construct, all the 23 items were put through an exploratory factor analysis. Obviously all the items stacked on five components in the wake of passing KMO (0.907) and critical Bartlett's tests. In addition, the items clarified around 65% of the variance in the construct and demonstrated high internal reliability of 0.791 to 0.93.

Table 4.8
Principal component analysis of IC

tem Code	Factors				
	Innovation	Innovation	Innovation	Innovation	Information and

	Support	Task	Behavior	Integration	Communication
ICIS1	.78				
ICIS2	.52				
ICIS3	.76				
ICIS4	.79				
ICIS5	.80				
ICIS6	.74				
ICIS7	.80				
ICIT1		.79			
ICIT2		.72			
ICIT3		.73			
ICIT4		.77			
ICIB1			.74		
ICIB2			.59		
ICIB3			.78		
ICIB4			.75		
ICII1				.54	
ICII2				.58	
ICII3				.74	
ICII4				.65	
ICIC1					.86
ICIC2					.82
ICIC3					.78
ICIC4					.86
Eigen-Value	7.62	3.91	1.70	1.69	1.18
VE%	21.66	20.7	11.86	10.70	8.73
Cumulative VE	64.94				
Cronbach Alpha	0.93	0.79	0.85	0.83	0.81
KMO	0.90				
Chi-Square	12335				
Significance	0.000				

Internal consistency alpha values of IC construct factors showed comparatively lower than the other constructs. However, the values were satisfactory and above the recommended value of 0.70 with minimum score of 0.79 on Innovation task. The model thus was considered suitable for further analysis in the study.

4.7.5 Factor analysis of Competence Building construct

Competence Building (CB) construct had 15 items. The factorization of this construct was as expected to be in four distinct factors. This result show a very high KMO value (0.95) and the factors recorded very high reliability scores of 0.85, 0.88, 0.83, and 0.73 respectively. The four factors in this construct together explained a cumulative variance of 61%.

Table 4.9
Principal component analysis of CB

Item Code	Factors			
	Professional KSAO	Update Motivation	Update Activities	Individual Expertise
CBPK1	.71			
CBPK2	.68			
CBPK3	.70			
CBUM1		.74		
CBUM2		.65		
CBUM3		.75		
CBUM4		.72		
CBUM5		.70		
CBUA1			.56	
CBUA2			.49	
CBUA3			.59	
CBUA4			.49	
CBIE1				.71
CBIE2				.80
CBIE3				.83
Eigenvalue	7.91	5.24	3.85	1.22
VE%	32.91	27.96	18.47	12.3
Cumulative VE	60.88			
Cronbach Alpha	0.85	0.88	0.83	0.73
KMO	0.95			
Chi-Square	7973			
Significance	0.000			

None of the items were deleted from CB construct as well and the readings of factor analysis showed satisfactory results.

After employing the factor analysis techniques to identify the factor underlying each construct, the next step was to test the overall measurement model to validate and test the reliability of the measures before undertaking the regression analysis to test the hypotheses of the study.

4.8 Descriptive Statistics

To get an initial summary of the data, a descriptive analysis was conducted to describe the general situation of Organisational health (OH), Competence adequacy (CA), Technology disruption (TD), Innovation Capacity (IC), and Competence building (CB) in Telecommunication sector in India. As can be seen in Table 4.10, the mean, standard deviation, maximum and minimum of the constructs were reported. These results reflected the level of implementation of each factor, OH, TD, CA, IC & CB. Moreover, these results showed the perceived level of organizational health of Telecommunication companies in India.

Table 4.10
Descriptive statistics of the constructs (n-915)

Construct	Minimum	Maximum	Mean	Std. Deviation	Skewness	Kurtosis
Technology Disruption	1.00	7.00	3.84	1.25	.02	-.73
Technological Capability	1.00	7.00	2.31	1.29	1.61	2.01
Market Turbulence	1.00	7.00	4.91	1.72	-.82	-.64
Technological Turbulence	1.00	7.00	4.31	2.07	-.04	-1.59
Competence Adequacy	1.38	6.71	4.35	1.02	-.42	-.54
Marketing Competence	1.00	7.00	4.04	1.20	-.03	-.84
Technological Competence	1.00	7.00	4.71	1.54	-.62	-.82
Integrative Competence	1.11	6.78	4.31	1.19	-.30	-.80
Organisational Health	1.10	6.49	4.00	1.09	-.12	-.56
Change capacity	1.00	7.00	4.16	1.44	-.37	-.50
Competitive Advantage	1.00	6.71	3.96	1.18	-.35	-.28
Goal Alignment	1.00	7.00	3.88	1.41	.09	-.78
Innovation Capacity	1.38	5.97	2.99	.83	.54	-.24
Innovation Support	1.00	6.71	3.03	1.20	.61	-.31
Innovation Task	1.00	7.00	2.89	1.19	.74	-.04
Innovation Behaviour	1.00	6.25	3.02	1.27	.46	-.68

Innovation Integration	1.00	6.25	2.89	1.02	.34	-.17
Information & Communication	1.00	6.75	3.12	1.16	.52	-.65
Competence Building	1.25	5.96	3.23	1.15	.15	-1.32
Professional KSAO	1.00	6.33	3.19	1.45	.14	-1.18
Update Motivation	1.00	6.60	3.42	1.22	.21	-.68
Update Activities	1.00	6.75	3.12	1.29	.33	-.97
Individual Expertise	1.00	6.67	3.18	1.32	.23	-.95

As tabulated in Table 4.10, the minimum value of most of the constructs was 1.00 and the maximum value of few constructs was 7.0, which are the minimum and maximum levels in the Likert scale used in this study. In addition to that, the same data revealed that Market Turbulence had the maximum mean value (4.91) among the factors with second highest standard deviation (1.72). These results indicated that among all the variables Market turbulence has the maximum contribution to the Technology Disruption. The standard deviation value showed that the managers have a difference of opinion when it comes to understanding turbulence in the telecommunication market and its impact on Technology disruption.

Interestingly, the results in Table 4.10 revealed that the factor with lowest mean value also feature in Technology Disruption construct with Technological capability scoring 2.31 with standard deviation of 1.29. Innovation Task factor was reported to have the second lowest mean value with 2.890. In other words, these results provided evidence that Technology Disruption causes great damage to the Competence Adequacy and Organisational Health in Telecommunication companies in India.

4.9 Uni-Dimensionality

If the items under measure achieve acceptable factor loadings, it is said to have achieved the uni-dimensionality for the respective latent construct (Hatcher, 1994). Such items with lower factor ladings need to be deleted to ensure uni-dimensionality.

The factor loading of 0.5 and above is acceptable if the scale is newly developed and at the same time, for existing and tested scales, a factor loading of minimum 0.60 is desirable (Hair, Ringle, & Sarstedt, 2011, Zainudin, 2012).

Checking the uni-dimensionality was the first step to ensure the appropriateness of the measure of the study. Therefore, it was necessary to ensure that all the items designed to measure one construct must be consistent in measuring that construct. In other words, there should be only one factor underlying a set of measured variables. If this is satisfied, then the next step is to assess the reliability of the construct (Dunn, Seaker, &Waller, 1994). Unidimensionality of a set of measured variables can be examined using various procedures such as Item-total correlation and Cronbach alpha coefficient (Lin, 2007). The formula to calculate the alpha value is given below:

$$\frac{K}{K-1}\left(1-\frac{\sum_{i=1}^{K}\sigma_{Yi}^{2}}{\sigma_{X}^{2}}\right)$$

Where K is the number of items, σ_{Yi}^{2} the variance of item i for the current usable responses and σ_{X}^{2} is the variance of the summated scores of the factors.

To measure the internal consistency of items measuring their respective factors, the coefficient of alpha of all factors should be higher than 0.7 (Nunnally, 1978). Moreover, Hair et al. (2011) suggested that the minimum acceptable limit for internal consistency is Cronbach alpha coefficient of 0.6. However, the data in Table 4.9 showed that Cronbach alpha coefficient for all the factors ranged between 0.64 and 0.92 providing a substantial evidence of unidimensionality and high internal consistency.

In general, reliability and validity tests directed on the estimation model are attractive. All tests are affirmed and this is a pointer that the estimation model for this study is legitimate and fit to be utilized to gauge parameters in the structural model.

4.10 Tests for Reliability and Validity

The capacity of an instrument to gauge what is expected to be measured from a variable is termed as validity. Validity is comprised of parts to be specific, construct validity, convergent validity, discriminant validity, and criterion, or face validity. As explained in the earlier sections, validity and reliability analysis can be initiated once the unidimensionality has been established for the construct (Dunn et. al., 1994; Hair et. al., 1996). According to Bollen (1989), uni-dimensionality expresses a concept, which is specific yet closely integrated among the items of measurement. Even though a measure can be predictable (strong) it could be inaccurate (fit to goodness). Furthermore, a measure could be correct, however not solid (Holmes-Smith et. al., 2006). Alternatively, an instrument could be accepted on the off chance that it quantifies what it expected to measure, and dependable on the off chance that it is reliable and valid (Sekaran, 2000). Hence, to ensure quality of the findings and to arrive at a predictable conclusion of this research, both validity and reliability measures were incorporated. While for the validity measures, this research administered criterion, content and construct parameters, for reliability measures Cronbach Alpha, Average Variance Extracted (AVE), and Construct Reliability (CR) were employed.

4.10.1 Internal reliability

Reliability measures propose the extent to which the measuring instrument can be reliable. Zikmund (2003) described reliability as the degree to which the measure gives out random errors when repeatedly used at different contexts. However, Malhotra (2003) charecterises reliability as the consistency of results and the measures being free from irregular errors. Punch (1998) explained that there is a correlation between reliability and measurement errors such that smaller errors depict higher reliability of the measure. Yin, (1994) confirms that the role of reliability measure is to reduce the measurement errors in research.

Sekaran (2000) and Nunnally (1978) confirm that Cronbach alpha scores are the most widely used measure for reliability, especially in a social research with multipoint Likert rating scale as used in this research. Given the multiple variables in the research framework and the scale items for each construct Cronbach alpha scores were measured for each of these constructs separately. Accordingly, variables TD, CA, OH, IC and CB were liable to such measurements (see section 4.18 onwards). Different scholars suggested the acceptable alpha measures differently. However, Nunnally (1978) suggested a satisfactory result of alpha values between 0.50 and 0.60. Nonetheless, subsequently in a book released on psychology, he further expanded the standard of alpha values to 0.70. Bernstein and Nunnally (1994) suggested that while for newly developed scales, an alpha value of 0.60 is sufficient an established scale should minimum show up Cronbach alpha at 0.70. Few other social scientists even suggested stricter alpha measure at a minimum consistency value of 0.80 (Carmines & Zeller, 1979). While there exists different and distinct perspectives about the reliability measure, threshold value of 0.70 looks likes an evenly accepted norm. Hence, for this research this value is adopted as the minimum acceptable value to check reliability of each constructs.

While Cronbach alpha measures indeed are the acceptable reliability measures, some scholars suggested exploratory and confirmatory factor analysis to check unidimensionality of the scale items (Churchill, 1979, Peter, 1979, Gerbing & Anderson, 1988, Steenkamp & Van Trijp, 1991, Hinkin, 1995). Additionally, Hair et. al. (1995) and Hinkin (1995) suggested CFA as a superior measure of reliability. As suggested by Bollen (1989), to assess internal consistency as part of the reliability estimate. This study deployed confirmatory factor analysis (CFA). Reliability measurement using CFA was done with the criterion suggested by Fornell and Lacker (1981), using average variance extracted (AVE) and construct reliability (CR). Using the estimate of the research model parameters, construct reliability allows indication of a set of dimensions measuring a latent variable (Holmes-Smith et. al., 2006). Average variance extracted, on the other hand explains the presence of shared variance within the construct. As AMOS outputs do not indicate direct values of CR and AVE, both the measures were calculated separately in this research. As recommended by Bagozzi and Yi (1998), CR and AVE threshold values were taken as 0.60 and 0.50 respectively in this study.

4.10.2 Construct validity

Hair et. al. (2011) explains construct validity as the extent to which a combination of measurement dimensions theoretically explain a latent variable they originally intended to measure. If the measures of Goodness of Fit Index (GFI) and Comparative Fit Index (CFI) are more than or equal to 0.90, Root Mean Square Error Approximation (RMSEA) reads less than or equal to 0.08 and the Chi square ratio is less than 5.0, the construct validity is said to have been achieved. The preliminary data analysis of this research employed these measures to confirm the construct validity of all the variables in the model.

4.10.3 Convergent validity

According to Hair et. al. (2011), if the measurable dimensions of the construct share a high proportion of common variance, the construct is said to be convergent. Moreover, it refers, according to Churchill (1979), to the extent to which different means of data collection produce the same results. There are several related methods to check the convergent validity among items of a construct such as testing factor loading of items on the respective construct, examining the variance extracted (AVE) to be ≥ 0.50 (Hair et al., 2011).

To overcome some of the limitations of using Cronbach alpha, the Composite Reliability was suggested in the Structural Equation Modeling (SEM) literature (Anderson & Gerbing, 1988). Composite reliability refers to the consistent representation of the intended construct by the measurement items throughout the latent variable (Hair et al., 2011). Composite Reliability can be calculated using the formula, according to Hair et al., (2006).

$$CR = \frac{(\sum_{i=1}^{n} standardised\ loadings)^2}{(\sum_{i=1}^{n} standardised\ loadings)^2 + (\sum_{i=1}^{n} \in i)}$$

Where, $\in$ is the error variance of each construct. AMOS output invariably gives the standardized factor loadings of each item and the error variance represent the remainder from subtracting the squared standardized loadings from one (1).

As indicated earlier, Fornell and Larcker (1981) put forward AVE (average variance extracted) as an indicative measure of convergent validity, which represents the percentage of the variance averaged and extracted commonly from the observed variables of a construct. Hair et. al. (2011) recommended the following formula to calculate the AVE.

$$AVE = \frac{\sum_{I=1}^{n} \gamma_i^2}{n}$$

Where is γ_i^2 is the standardized loading of the i^{th} item and n is total number of measurement items in the construct. According to Hair et al. (2011), AVE of 0.5 or higher can suggest a good convergence. However, if the AVE is less than 0.5, this indicates on average that the construct explains less variance in the items than that remains (in error) unexplained. As indicated in the formula, AVE is the average value of the squared factor loadings of all the items in a factors and to obtain an AVE value of more than 0.5 it is necessary to have average factors loadings more than 0.7.

4.10.4 Criterion validity

In general, Criterion-related validity refers to the significant relationship between the independent variables and the criterion they are used to measure. That is the extent to which independent variables are related to the dependent variable of the undertaken study (Badri, Davis & Davis, 1995; Flynn et al., 1994). Following the common methodology in examining the criterion validity (e.g. Ahire et al., 1996; Hair et al., 2011), this study examined the criterion-related validity by testing the correlation among the constructs. Based on the results reported in Table 4.9, all the constructs in this study were highly correlated with the criterion variable supporting the criterion-related validity. In other words, all the constructs used in the model were significantly correlated among one another at 0.01 level of significance. These results supported the existence of criterion-related validity of the measure.

4.10.5 Discriminant validity

An estimation model should have discriminant validity when the square root of the AVE surpasses the relationships between the measures and every single other measure, and the item loadings are higher against their individual construct contrasted with different constructs. For evaluating the discriminant validity, this study adopted the cross loadings and the Fornell and Larcker (1981) criterion. In order to assess the discriminant validity of the evaluation model, the above-mentioned formula was used to calculate the AVE of every construct by extracting the factor loadings of every item. Further square root of AVE is also calculated manually.

Based on the results as shown in Table 4.11, the square root of AVE of each construct surpassed the value in the corresponding line vertically and horizontally. The bolded components in Table 4.11 are the square root of the AVE and non-bolded values are the correlations between the constructs. The dimensions in Technology Disruption construct is represented as TDTC, TDMT, and TDTT. In addition, three dimensions of Competence Adequacy construct are represented by CAMC, CATC and CAIC. Similarly, OH construct dimensions are OHCC, OHCA and OHGA. Innovation Capacity construct had five dimensions such as ICIS, ICIT, ICIB, ICII and ICIC. Lastly, four dimensions of Competence Building constructs in the table were depicted with CBPK, CBUM, CBUA, and CBIE. As the off diagonal values are all lower than the diagonal values of AVE as in Table 4.11, it can be concluded that the data confirmed to the Fornell and Larker's criterion. This study hence infers that the estimation models confirm to the discriminant validity criteria.

Table 4.11
Cross loading of constructs (Fornell & Larcker criterion)

	TDTC	TDMT	TDTT	CAMC	CATC	CAIC	OHCC	OHCA	OHGA	ICIS	ICIT	ICIB	ICII	ICIC	CBPK	CBUM	CBUA	CBIE
TDTC	**0.873**																	
TDMT	.326**	**0.877**																
TDTT	.255**	.339**	**0.910**															
CAMC	-.368**	-.113**	-.337**	**0.781**														
CATC	-.480**	-.340**	-.607**	.389**	**0.846**													
CAIC	-.441**	-.296**	-.516**	.327**	.514**	**0.740**												
OHCC	-.137**	-.154**	.013	.138**	.118**	.119**	**0.823**											
OHCA	-.075*	-.118**	.004	.201**	.100**	.100**	.462**	**0.744**										
OHGA	-.170**	-.228**	.105**	.175**	.115**	.119**	.489**	.511**	**0.760**									
ICIS	-.060	-.158**	-.015	.128**	.095**	.099**	.434**	.369**	.464**	**0.782**								
ICIT	-.133**	-.225**	-.022	.208**	.148**	.135**	.400**	.313**	.457**	.229**	**0.713**							
ICIB	-.074*	-.195**	-.003	.138**	.100**	.071*	.379**	.279**	.416**	.311**	.376**	**0.726**						
ICII	-.092**	-.153**	.038	.145**	.080*	.083*	.435**	.358**	.476**	.202**	.433**	.454**	**0.738**					
ICIC	-.092**	-.136**	.015	.184**	.138**	.116**	.435**	.328**	.462**	.243**	.410**	.456**	.721**	**0.719**				
CBPK	-.383**	-.471**	-.536**	.244**	.543**	.405**	.090**	.083*	.144**	.143**	.078*	.076*	.017	.057	**0.790**			
CBUM	-.414**	-.463**	-.517**	.201**	.507**	.389**	.163**	.116**	.155**	.126**	.115**	.094**	.064	.082*	.649**	**0.757**		
CBUA	-.327**	-.474**	-.527**	.153**	.500**	.381**	.111**	.091**	.123**	.074*	.087**	.065*	.054	.048	.668**	.731**	**0.739**	
CBIE	-.309**	-.396**	-.526**	.258**	.505**	.366**	.098**	.120**	.137**	.131**	.117**	.088**	.049	.077*	.736**	.592**	.643**	**0.750**

4.11 Preparing Data for Multiple Linear Regression Analysis

A suggested by Hair et. al. (2011), the ideal ratio between the number of variables in the model and number of observations is more than 1:20 and in no case should be less than 1:5. The survey response of this study generated 915 observations and the structural model had 18 variables making the ratio 1:50 which is higher than the ideal minimum ratio suggested. In addition, Green (1991) in deciding the minimum responses, considered the force level sought, level of significance and number of indicators. Hence, he recommended the accompanying equation to determine the size required ($N \geq 50 + 8m$, where m = number of autonomous variables). Along these lines, this study had a satisfactory number of confirmations to analyse multiple regressions.

Before continuing to complete the multiple regression analysis, the intervention of multicollinearity and outlier were analyzed. The data analysis revealed no serious issues around outlier data and multicollinearity and the data set was found to be fit for further regression analysis. The following sub sections elaborate on each of the data analysis results in detail.

4.11.1 Test of normality

An exploratory data analysis was conducted using SPSS with complete data set to check the normality, outliers, homoscedasticity and multi colleniarity. From a host of techniques available to test the normality of the data, insiginificant values of skewness and kurtosis gives confirmation to normality. As per Hair et. al. (2006), even a little deviation from normality will be significant in case of large number of of observations like 200 observations and above. As per Tabachnick and Fidell (2001), in larger sample, a significant value of skewness and kurtosis may not indicate a substantive deviation from normality and such indications will not affect the quality of the data analysis.

The assumption of normality was examined using the typical likelihood plots of the residuals. The histogram and the normal probability plot (Q-Q Plots) were drawn out of the total response data (n=915) with the frequency distribution of observed values against their frequency. As can be found in Figure 4.3, the frequency distribution of the data in histogram gives a visual confirmation of the normality of the data. The plot represents a virtual curve closer to a bell shape gives indication of normality. Subsequently, it can be presumed that the data roughly taken after normal dispersion.

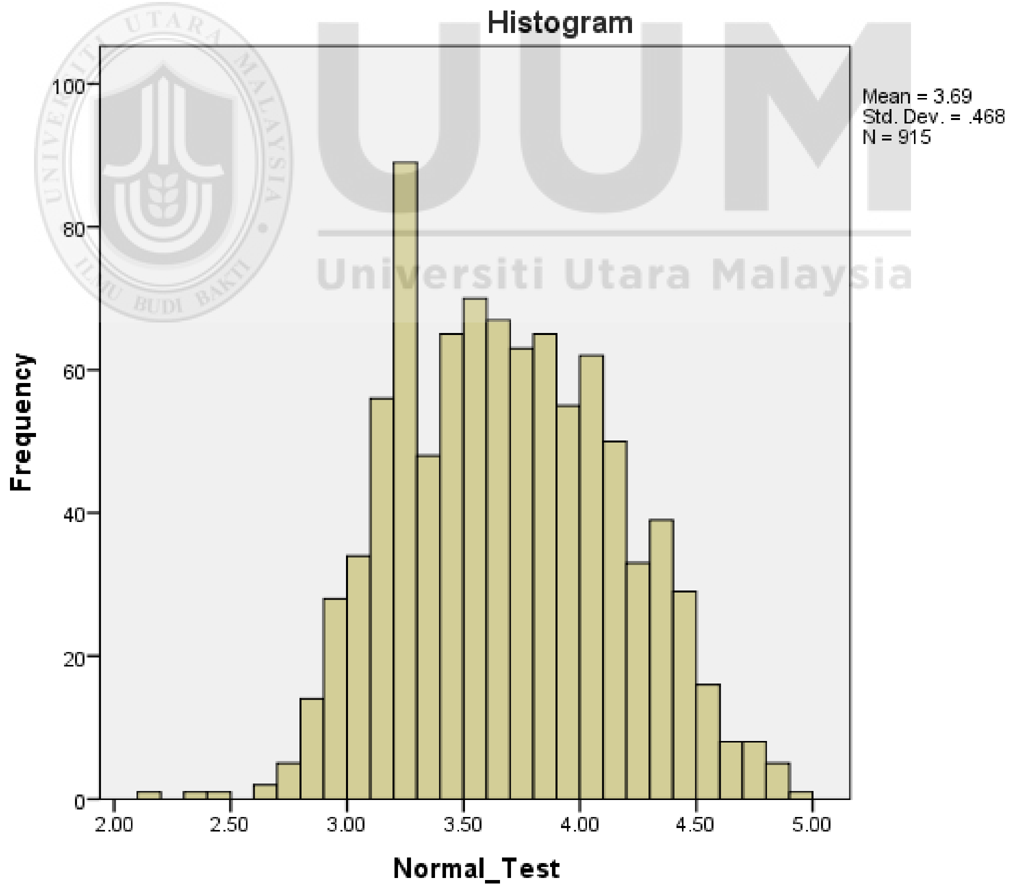

Figure 4.3
Histogram of the regression residuals

The estimations around skewness and kurtosis were checked. If the value of skewness is between -1 and +1 and value of kurtosis between -2 and +2, the data is said to be normal (Coakes & Steed, 2007). Additionally Hair et. al. (2011) and Bryne (2010) suggested higher skew values ranging from - 2 upto +2 and value of kurtosis with a 14 point range from -7 upto +7. Kline (2007) suggested a affirmative outer skewness of +3 and kurtosis value of +10 are considered as normal The measures with an estimation of kurtosis file less than 10.0 in absolute value may suggest an issue and values higher than 20.0 may demonstrate a more genuine one. In this manner, the norms suggested by Kline, (2005) were adopted to check skewness and kurtosis with a maximum value of 3 and 10 respectively.

Table 4.12
Normality test of the residuals

			Statistic	Std. Error
Normal_Test	Mean		3.68	.01
	95% Confidence Interval for Mean	Lower Bound	3.65	
		Upper Bound	3.71	
	5% Trimmed Mean		3.68	
	Median		3.65	
	Variance		.21	
	Std. Deviation		.46	
	Minimum		2.18	
	Maximum		4.95	
	Range		2.77	
	Interquartile Range		.74	
	Skewness		.16	.08
	Kurtosis		-.55	.16

The calculation by dividing the respective standard error values with skewness and kurtosis showed the z values at 0.48 and -0. 29 (Table 4.12) which are found to be between the suggested range between -1.96 and +1.96. With these indicators, the normalcy of the survey data has been confirmed.

For much larger sample sizes, it is appropriate to visually inspect the normality plots to to assess the obvious deviations from normality (Hair et al., 2006). The plots as indicated in the figures below suggested minimal deviation from the best-fit line of the normality data. The Q-Q plot in Figure 4.4 and the box plot in Figure 4.5 suggest the normal distribution of the complete data consisting all variables. Since the data did not digress from normality, it was not required to make any changes, for example, change of the data (Tabachnick and Fidell, 2001).

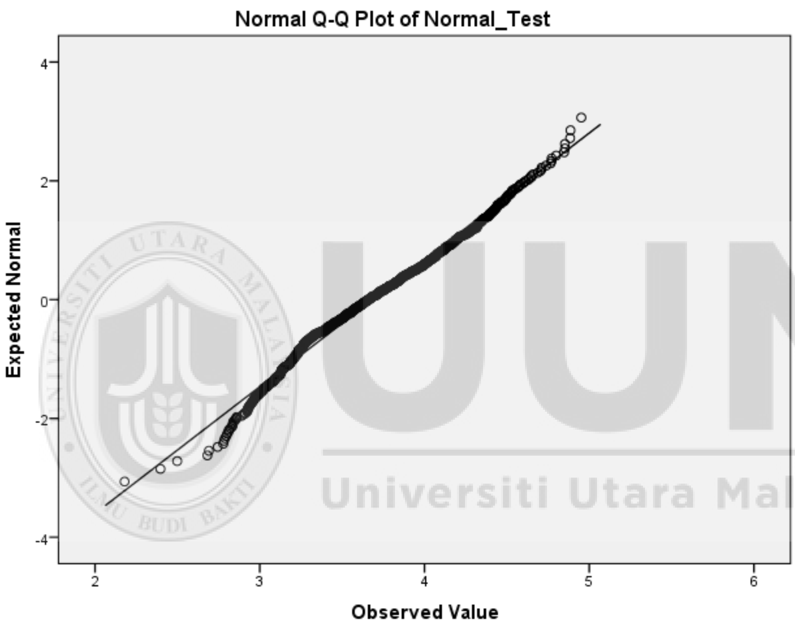

Figure 4.4
Testing normality using Q-Q plot

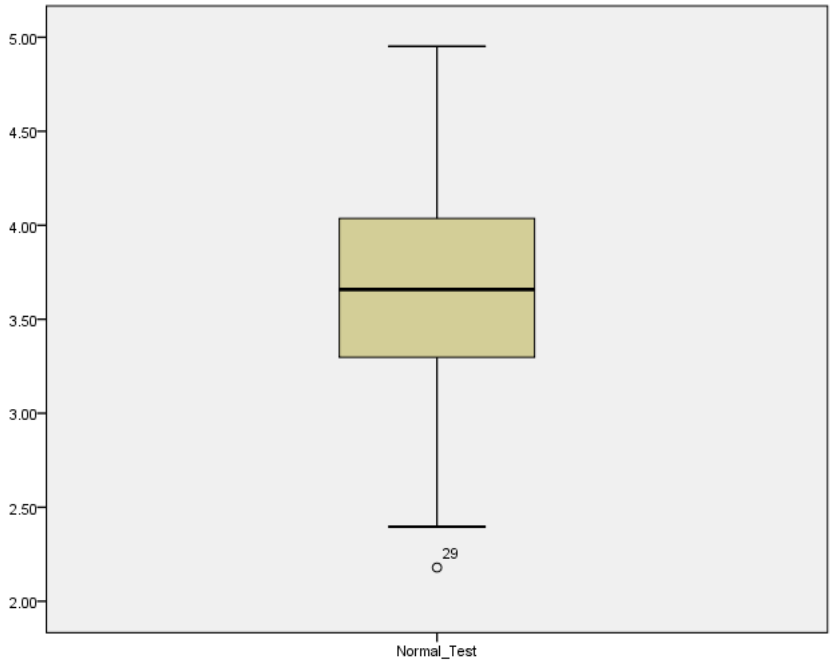

Figure 4.5
Testing normality using Box plot

In addition to the Table 4.12, the descriptive statistics of each of the dimension for all variables are shown in the Appendix. The skewness and kurtosis for all the dimensions read less than the threshold limit as suggested above. Hence it confirms normality for the variables. The above tables and data measurement values confirmed existence of normality of the survey data. After having affirmed the normality, the study further proceeded to check the data for linearity, independence of errors and homoscedasticty which are being discussed the following sections.

4.11.2 Detecting outliers

Outliers are characterized to be the perceptions that have extraordinary attributes and contrast particularly from the remaining part of the data (Hair et al., 2011). In addition, exceptions can be detected by administering different data analysis procedures like univariate, bivariate and multivariate techniques. One of the commonly utilized techniques to distinguish data outliers is the measure of Mahanalobis distance. Putting data in a multi-dimensional spectrum, this method evaluates the distance of each observation from the mean focal point of all observations put together. Outlier observations were carried out by drawing the critical values from chi square distribution table and comparing the same with Mahalanobis distance values. The study results showed observations with Mahalanobis distance values ranging from 0.54 and 51.96. From the distribution table with five degrees of freedom and a 0.001 significance level, the critical value observed was 19.53. Keeping in mind the end goal to distinguish the outliers, a subsequent analysis of SPSS data results of Mahalanobis distance was compared with the estimation of 19.53. The result of this examination shows, Mahalanobis values with eighteen observations spread somewhere around 20.63 and 51.96 and these were considered as exceptions. Among 915 perceptions, just eighteen perceptions were considered as anomalies referring to a little proportion. Coakes and Steed (2003) suggested that if the outliers are significant large number, an intervention need to be initiated by eliminating the farthest outliers. From the list of Mahalanobis distance values, it was found that very few observations crossed the distance value beyond the critical value of 19.53 indicating absence of outliers.

4.11.3 Multicollinearity test

Referring to Hair et al., (2011), an indicative impact in one variable due to an observed variance in another variable in the model may be deemed as multicollinearity. To detect the presence of multicollinearity, Tolerance and Variance Inflation Factor (VIF) were examined and results can be seen in Table 4.12. While the VIF represents the reciprocal of tolerance, according to Hair et. al. (2011), Tolerance is the extent of variance present in a variable, which is not explained by any other variable in the model.

In Table 4.13, the values ranged between 0.36 and 0.95 in case of tolerance and for VIF for every dimension extended between 1.05 to 2.71. The threshold of tolerance is minimum 0.1 and that of VIF is maximum 10 (Hair et. al., 2011). Table 4.13 shows all the dimensions exhibited tolerance values of more than 0.1 and the VIF values less than 10. Hence, the data is devoid of any multicollinearity issues as the test values of tolerance and VIF were within the required levels. Hence, non-existence of multicollinearity is affirmed with this.

Table 4.13
Test of multicollinearity

Variable	With Technology Disruption	
	Tolerance	VIF
Competence Adequacy (CA)	.65	1.51
Organisational Health (OH)	.50	1.98
Innovation Capacity (IC)	.50	1.99
Competence Building (CB)	.67	1.47
	With Competence Adequacy	
	Tolerance	VIF
Organisational Health (OH)	.50	1.99
Innovation Capacity (IC)	.50	1.98
Competence Building (CB)	.48	2.07
Technology Disruption (TD)	.48	2.06
	With Organisational Health	
	Tolerance	VIF
Innovation Capacity (IC)	.95	1.05
Competence Building (CB)	.48	2.07
Technology Disruption (TD)	.37	2.69
Competence Adequacy (CA)	.50	1.99
	With Innovation Capacity	
	Tolerance	VIF
Competence Building (CB)	.47	2.09
Technology Disruption (TD)	.36	2.71
Competence Adequacy (CA)	.50	1.99
Organisational Health (OH)	.94	1.05
	With Competence Building	
	Tolerance	VIF
Technology Disruption (TD)	.52	1.91

Competence Adequacy (CA)	.50	1.97
Organisational Health (OH)	.50	1.97
Innovation Capacity (IC)	.50	1.98

Generally, it can be presumed that this study had no outlier observations furthermore; the multicollinearity was not an issue. Before stepping into the hypothesis based regression analysis, the pre requisites tests to assess linearity, independence of error items and homoscedasticity were analysed. The analysis and description of these tests are presented in the subsequent sections.

4.11.4 Homoscedasticity, independence of errors and linearity

Linearity assumptions were analysed through the scatterplots of each independent variable with the corresponding dependent variable (see Annexure 7). The partial correlation plot showed linear pattern between TD & CA and shows a liner pattern between TD and OH. Similarly, it establishes the linearity between CA and OH, exhibiting linearity between IC and OH. Finally, no non-linear pattern was observed between CB and OH. Since the partial correlation plots between the variables showed linear pattern, they have substantiated the assumption of linearity, homoscedasticity and the independence of residuals (Hair et al., 2011).

In the previous sections of this study, various aspects of the construct validity of the measure have been established. More specifically, the measures of this study were reported to assess the convergent and discriminant validity. In addition to that, the Criterion-related validity also was examined. As discussed in section 4.10, the face or content validity of the measure has been taken care of through the process of measure development. However, in the following sections, the focus will be on testing the hypotheses of the study using Pearson correlation and Multiple Linear Regression Analysis.

4.12 Testing Measurement Model

To run the confirmatory factor analysis using AMOS, two separate methods can be deployed. First, by putting each construct through an independent CFA procedure and the second to combine all the constructs into a single model to run the CFA. The second method is known as the pooled measured model. This procedure joins every single construct in a single estimation model to run the measurement model CFA. The procedure also followed the suggestions of Zainudin, (2012) to eliminate items, which do not meet the measurement model requirements, or the items, which cause measurement errors in the model. Such elimination process re-specifies the pooled model each time and the CFA is run again until the model reaches the measurement criteria as set out.

In structural equation model, there are specific fitness indices suggested with respective threshold values to see the appropriate fitness of the data in the model. These fitness classes also indicate the multilevel structural requirements at error terms, items, dimensions and construct level. Scholars proficient in SEM techniques suggested use of at least three such fitness classes to be incorporated in the measurement model analysis (see Holmes-Smith, Coote & Cunningham, 2006; Hair et. al., 2011). Hair, Anderson, Tatham, and Black (1995), of the opinion that for each fitness index, there has to be at least one fitness index to be included. Table 4.14 outlined the classes or categories of fitness such as absolute, incremental, and parsimonious fitness with respective indices and acceptable threshold values as suggested by the above-mentioned scholars, against each fit model.

Table 4.14
Criteria for measurement model fit indices

Fitness class	Index	Index Full Name	Level of Acceptance

Absolute Fit	ChiSq	Discrepancy Chi Square	P > 0.5
	RMSEA	Root Mean Square Error Approximation	RMSEA < 0.08
	GFI	Goodness of Fit Index	GFI > 0.9
Incremental Fit	AGFI	Adjusted Goodness of Fit	AGFI > 0.9
	CFI	Comparative Fit Index	CFI > 0.9
	TLI	Tucker-Lewis Index	TLI > 0.9
	NFI	Normed Fit Index	NFI > 0.9
Parsimonious Fit	ChiSq/DF	Chi-Square/Degrees of Freedom	ChiSq/DF < 5.0

Source: Zainudin (2012)

4.12.1 Measurement model of Tchnology Disruption

To assess the model fitness of TD construct, AMOS graphic was employed to create the measurement model with dimensions and constructs. The items of the dimensions were then loaded with survey data directly linked with SPSS. Each latent dimension of the TD construct was joined together in one pooled model (Arbuckle, 2005; Zainudin, 2012). As depicted in Figure 4.6, the TD construct included three distinct dimensions called Technology Turbulence, Technology capability and Market turbulence that are represented as latent construct in the smaller circles. Each of these dimensions are measured through the items (3, 9 & 3) as represented by the directional arrows and the small rectangles. Further, the estimated measurement errors of these items are represented by the smallest circles pointing to the rectangles. The model went through multiple analysis to check the fitness classes, factor loadings and measurement indices. Respective structural re specifications were done, until the model reached the level of acceptance in terms of the fitness indices.

In total, fifteen items used to measure Technology Disruption (TD) as given in Figure 4.6. TD is a second order reflective construct with three dimensions together measuring the quantity of TD. As a measuring dimension, technological turbulence causes disruption and if the respondents score this dimension high, the impact of the TD will also be higher. Similarly, higher ratings (towards strongly agree) to the items in the dimension means higher degrees of TD. On the contrary, technological capability as a reflective dimension explain the ability and readiness of the firm to face turbulane in the technological area. The higher the ability of the firm to nullify the effect of changes the lower the impact of TD. There are few items in the technological capabi;ity dimensions which are negatively relected which were reverse coded later in SPSS to standardize the measurement scales. Market turbulence as a reflective dimension acts as an enhancer to TD. Even though the standardized estimates of the parameters in the model were significant at P<0.001, the CFA results showed that the estimation model as given in Figure 4.6 needs respecification. To derive confirmation to convergent validity as per Hair et al. (2011) the majority of the standardised loading values ought to be higher than 0.60 (Anderson & Gerbing, 1988), for which the TD estimation model has achieved it. However, the fit indices showed that RMSEA (0.086), AGFI (0.866), and ChiSq/df (7.765) did not meet the fitness requirements (Zainudin, 2012).

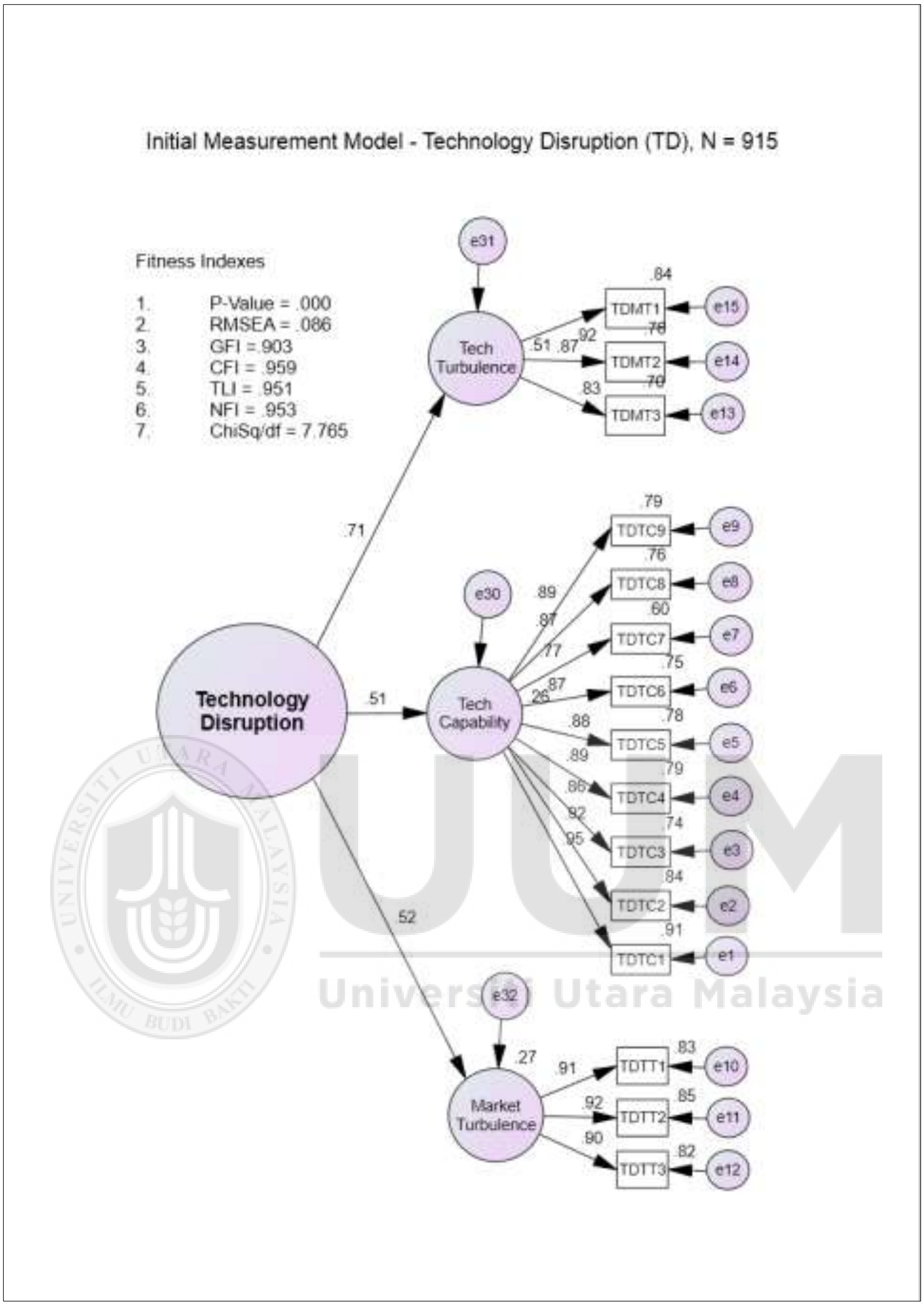

Figure 4.6
Initial Measurement model of TD

Table 4.15 shows the modification index for errors of the constructs which were higher than 15.0. The modifications index should be deleted to improve the Fitness Index. There are two options; Option 1, is to delete one of these redundant items and, Option 2, is to set these errors to be free from parameter estimate by pairing these error items and specify the measurement model (Zainudin, 2012). In this case, the error items showing highest modification indices were paired in stages. As such e1<->e4 and e9<-> e5 were paired and the measurement model was run again.

Residual Covariance: (TD - Default model)

Table 4.15
Modification Indices of TD measurement model

Residual pairs			M.I.	Par Change
e1	<-->	e4	60.26	0.08
e2	<-->	e1	59.84	0.07
e3	<-->	e32	40.41	0.30
e5	<-->	e1	46.41	-0.07
e6	<-->	e1	35.54	-0.07
e6	<-->	e5	30.70	0.09
e9	<-->	e5	202.01	0.24

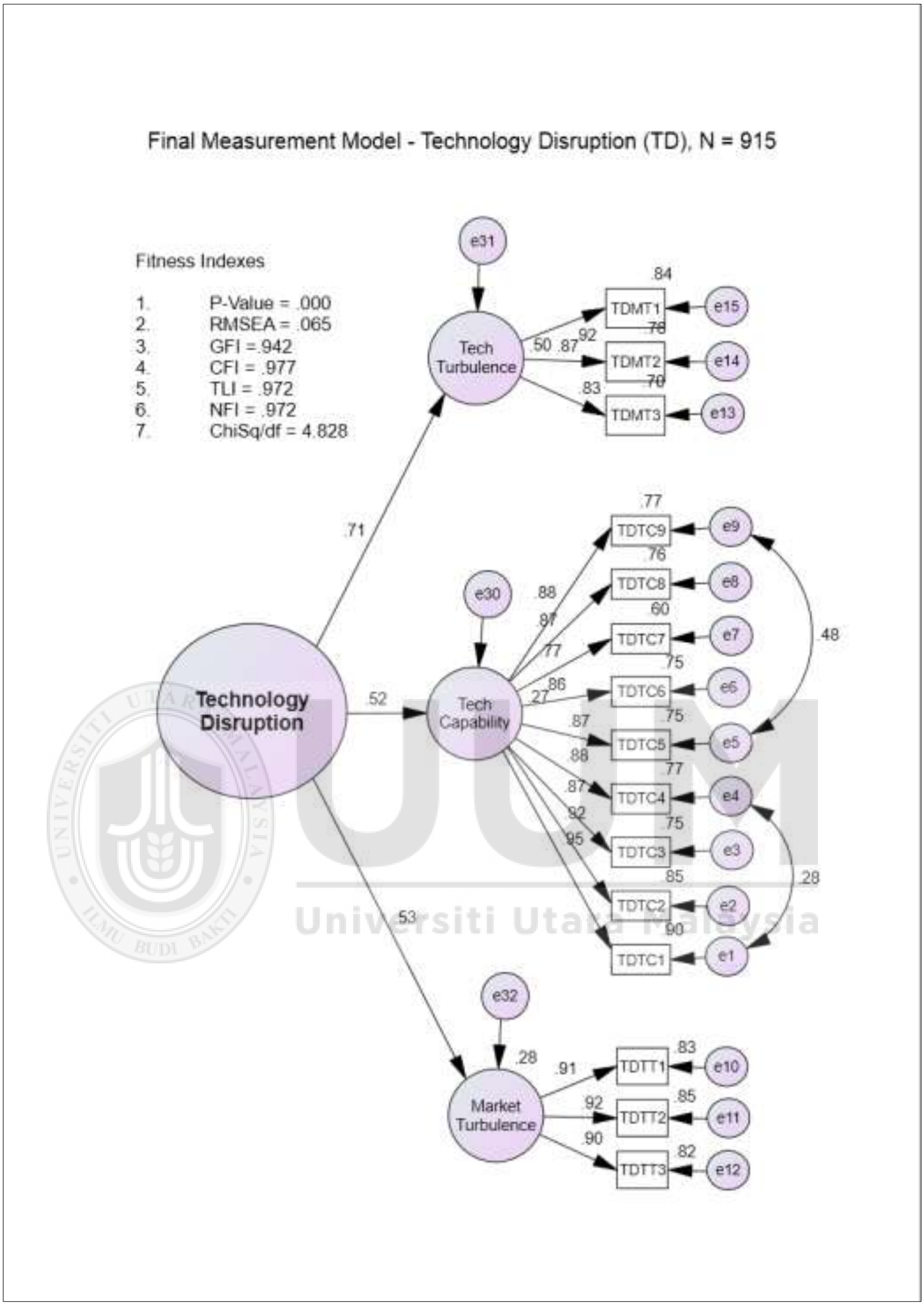

Figure 4.7
Respecified measurement model of TD

From the above factor analysis test it was evident that the estimation model exhibited all the required measurement specifications with all the item factor loadings recorded more than 0.60. Consequently giving confirmation to convergent validity (Anderson & Gerbing, 1988; Hair et al., 2011). The final model of measurement as an output of

AMOS graphic depicted in Figure 4.7. The model achieved absolute, incremental, and parsimonious fit levels.

Table 4.16
Measurement fit indices of respecified TD

Category	Index	Index Value	Level of Acceptance
Absolute Fit	RMSEA	0.06	Required level achieved
Incremental Fit	CFI	0.97	Required level achieved
Parsimonious Fit	ChiSq/df	4.82	Required level achieved

Table 4.16 indicates that the model achieved all the required fitness indices to be accepted in the structural model for further hypothesis testing. The evaluation results of the estimation model for the dimensions of Technology Turbulence, Technology Capability, and Market Turbulence for TD construct showed confirmation of uni-dimensionality, reliability, and validity. The reference of the threshold values was drawn from the suggestions from Hair, Black, Babin, Anderson, and Tatham, (2006). As discussed earlier on, the reliability measures were done by checking the Cronbach alpha score and for validity at construct and convergent level CR and AVE confirmed to the threshold level.

With respect to Cronbach coefficient alpha, Table 4.17 demonstrates that every one of the construct surpasses the proposed level (0.7) suggested by Nunnally (1978) as the reference standard followed in this research. As indicated in section 4.8, the formula for composite reliability (CR) and average variance extracted (AVE), (Fornell & Larcker, 1981; Zainudin, 2012) were used to compute these two values of validity measures. Bagozzi and Yi (1988) and Zainudin (2012) and Bagozzi and Yi (1988) prescribed that the composite reliability value should be more than 0.6 for a reasonable construct validity and at the same time the AVE should score more than 0.5 for desirable convergent validity. Table 4.17 explains that the respective items in each of the dimension of TD achieved the unidimensionality requirements (factor loading more than 0.6) and each dimension separately achieved the requirement of internal reliability values at recommended threshold (Cronbach alpha more than 0.7), convergent validity of the construct also achieved at required level (AVE more than 0.5) and finally the construct reliability at adequate level (CR more than 0.6). As such, CFA also evaluated the construct validity requirements as suggested by Bagozzi and Yi (1988) as an important prerequisite for hypothesis testing. Construct validity values are given in Table 4.17 as the goodness of fit measure in terms of RMSEA, CFI and ChiSq/df (Hsieh and Hiang, 2004). The estimation results confirmed that the TD model achieved all the requirements for reliability and validity and thus is for further examination as part of the model.

Table 4.17
Validity & Reliability indices of TD measurement model

Factor	**No. of items**	**Item Code**	**Loading**	**Alpha**	**AVE**	**CR**
Technological Capability	9	TDTC1	.88	0.96	0.76	0.96
		TDTC2	.87			
		TDTC3	.77			
		TDTC4	.86			
		TDTC5	.87			
		TDTC6	.88			
		TDTC7	.87			
		TDTC8	.92			
		TDTC9	.95			
Market Turbulence	3	TDMT1	.92	0.90	0.76	0.90
		TDMT2	.87			
		TDMT3	.83			
Technological Turbulence	3	TDTT1	.91	0.93	0.82	0.93
		TDTT2	.92			
		TDTT3	.90			

Table 4.17 shows CFA Results for all constructs in this estimation model for Technological capability, Technology turbulence and Market turbulence yielded high composite reliability values (lowest being 0.907), surpassing the proposal of Bagozzi and Yi (1988) for a threshold score of 0.60. Convergent validity score extricated was

more prominent than 0.76 for all the three dimensions of TD, which again surpassed the proposed threshold of 0.50 (Fornell & Larcker, 1981; Hair et. al. 2006). To confirm the internal reliability measures, the Cronbach alpha values scored more than 0.78, which stood significantly higher than the proposed minimum value of 0.7 as put forward by Gerbing and Anderson, (1988) and Hair et al., (2011). As the estimation model for TD stands fit from reliability and validity perspective, the researcher proceeded to do the CFA for the next construct in the model, which is CA.

4.12.2 Measurement model of Competence Adequacy

In total, there were twenty-five items used to measure Competence Adequacy with Technological Competence (eight items), Marketing Competence (eight items) and Integrative Competence (9 items). An initial measure of latent constructs has been given in Figure 4.8. Competence adequacy is a second order reflective construct with three dimensions and 25 items. The three dimensions explain the measure of competence available in the firm in terms of technology, market and interative elements. Higher mean ratings of these items under the three dimensions will reflect higher order of Competence adequacy. A firm with adequate technology competence, market competence and integrative competence reflectively will have competence adequacy.

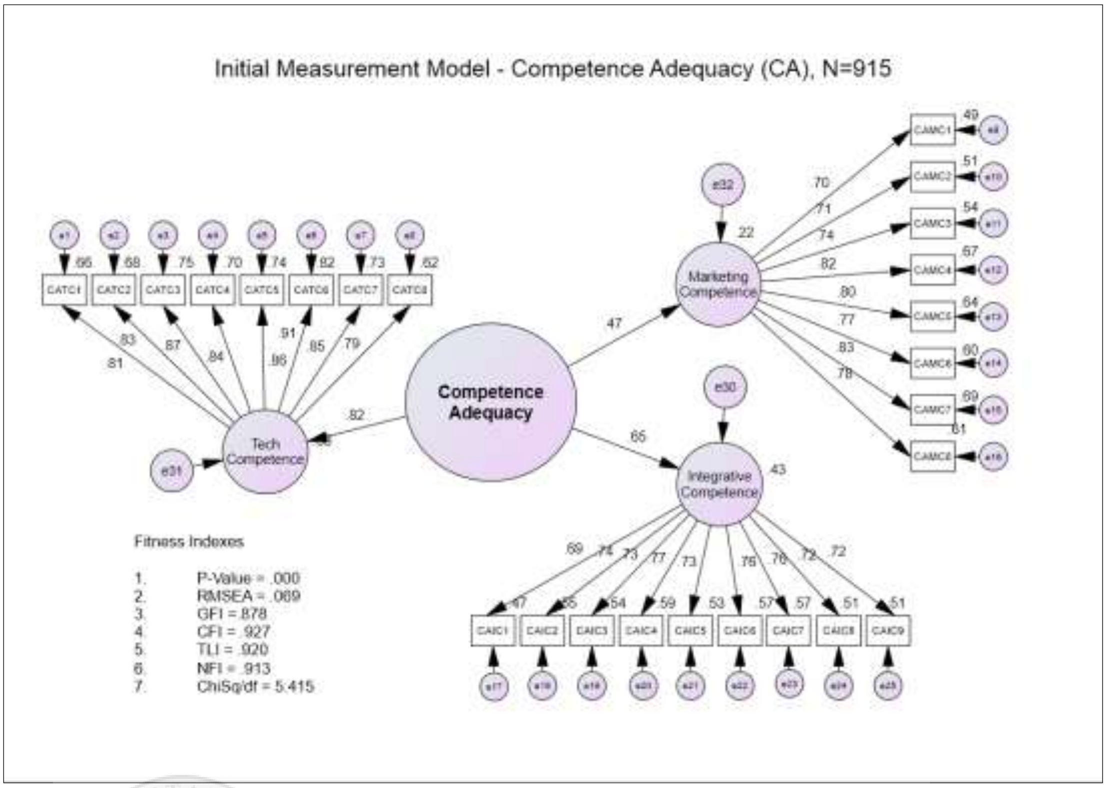

Figure 4.8
Initial measurement model of CA

The introductory CFA for Competence Adequacy demonstrated that the fitness indices did not reach up to the required level. The measures of ChiSq/df (5.415) and GFI (0.878) did not achieve the adequate level. As these two fitness measures did not achieve the level, point-by-point evaluation was performed to alter the model and make it more parsimonious. As a first step of re-specifying the model, an inspection of modification index values of the residual errors were checked (Schumacher & Lomax, 1996; Hair et al., 2006). The difference between the observed covariance and estimated covariance is referred here as the standardized residual for which a value of 2.58 and above will mean a specification error in the model (Joreskog & Sorbom, 1996; Holmes-Smith et al. 2006). Whereas, modification index (MI) refers to the non-estimated relationship as calculated for the specified model. Modification index of an absolute value 15 and above indicate that the specified residuals are redundant for measure and they need to be paired to make both the error items as one (Hair et.

al. 2006; Holmes-Smith et. al. 2006). Table 4.18 indicates the modification index for errors of the constructs which were higher than 15.

Table 4.18
Modification Indices of CA initial model

Residual pairs			M.I.	Par Change
e24	<-->	e23	26.39	0.22
e12	<-->	e15	32.88	0.19
e12	<-->	e13	19.26	0.15
e11	<-->	e15	23.14	-0.19
e11	<-->	e14	25.23	0.21
e11	<-->	e12	60.75	-0.32
e10	<-->	e13	34.92	-0.21
e10	<-->	e11	92.83	0.41
e9	<-->	e15	21.35	-0.17
e9	<-->	e14	34.18	-0.23
e9	<-->	e10	192.78	0.57
e8	<-->	e9	21.64	0.21
e1	<-->	e6	31.18	-0.16
e1	<-->	e2	31.97	0.20

To improve the model fit, error terms with MIs more than 15 as suggested by Li (2006) were paired in stages and the model run again twice, i.e. firstly, after pairing e9 & e10 and then e10 & e11. As indicated in the AMOS graphic output (Figure 4.9), the model was then successfully run for all the fitness indices.

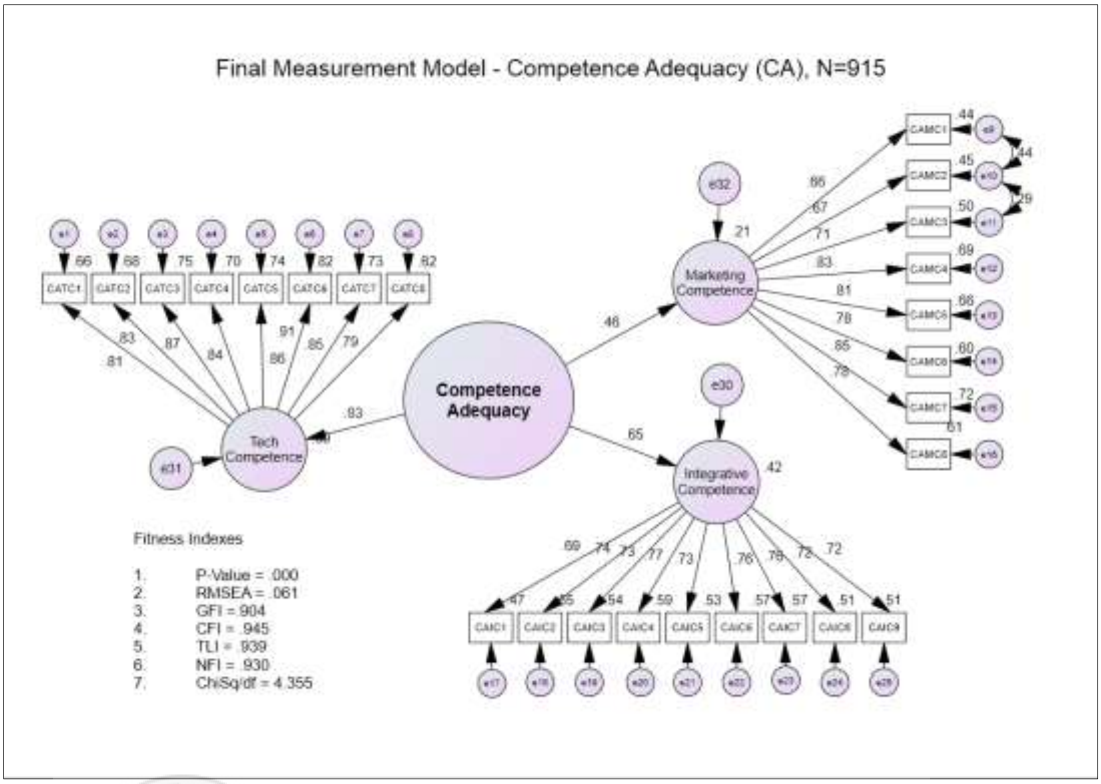

Figure 4.9
Respecified measurement model of CA

From factor analysis test it was evident that the estimation model exhibited all the required measurement specifications with all the item's factor loadings recorded more than 0.60, confirming to convergent validity (Anderson and Gerbing, 1988; Hair et al., 2011). The final model of measurement as an output of AMOS graphic is depicted in Figure 4.9. The model achieved absolute, incremental, and parsimonious fit levels as the values given in Table 4.19.

Table 4.19
Measurement fit indices of CA respecified model

Category	Index	Index Value	Level of Acceptance
Absolute Fit	RMSEA	0.06	Required level achieved
Incremental Fit	CFI	0.94	Required level achieved
Parsimonious Fit	ChiSq/df	4.35	Required level achieved

The accompanying Table 4.20 shows CFA Results for CA construct in this estimation model for Marketing competence, Technological competence and

Integrative competence yielded high composite reliability values (lowest being 0.91), surpassing the proposal of Bagozzi and Yi (1988) for a threshold score of 0.60. Convergent validity score extricated was more prominent than 0.54 for all the three dimensions of CA, which again surpassed the proposed threshold of 0.50 (Fornell & Larcker, 1981; Hair et al., 2006). To confirm the internal reliability measures, the Cronbach alpha values scored more than 0.86, which stood significantly higher than the proposed minimum value of 0.7 as put forward by Gerbing and Anderson, (1988) and Hair et al., (2011).

Table 4.20
Reliability and Validity values of CA respecified model

Factor	No. of items	Item Code	Loading	Alpha	AVE	CR
Marketing Competence	8	CAMC1	.66	0.86	0.58	0.91
		CAMC2	.67			
		CAMC3	.71			
		CAMC4	.83			
		CAMC5	.81			
		CAMC6	.78			
		CAMC7	.85			
		CAMC8	.78			
Technological Competence	8	CATC1	.81	0.94	0.71	0.95
		CATC2	.83			
		CATC3	.87			
		CATC4	.84			
		CATC5	.85			
		CATC6	.91			
		CATC7	.85			
		CATC8	.79			
Integrative Competence	9	CAIC1	.69	0.89	0.54	0.91
		CAIC2	.74			
		CAIC3	.73			
		CAIC4	.77			
		CAIC5	.73			
		CAIC6	.76			
		CAIC7	.76			
		CAIC8	.72			
		CAIC9	.72			

The construct of Competence Adequacy has crossed the threshold suggested values of all fit indices. In addition, the model also exhibited high factor loading, construct reliability, and validity. As the estimation model for CA is fit for reliability and validity perspective, the researcher proceeded to do the CFA for the next construct in the model, which is OH.

4.12.3 Measurement model of Organisational Health

In a second order latent construct model, Organisational Health had 29 items in total under three distinct dimensions of Change capacity (10 items), Competitive Advantage (7 items) and Goal alignment (12 items). The initial Examination of the model in AMOS graphic (Figure 4.10) showed that one of the indices in absolute fit category (GFI) indicated a value of 0.87, which was less than the recommended value (0.9). As a first step to re-specify the model, the measurement indices of the error terms were examined for redundancy values. Organisational halth is built on the second order reflective construct with three dimensions. Each of the dimensions have reflective items which measure the level of organizational health. Change capacity, Goal alignment and Competitive advantage together will add the level of organizational health. The variance in organizational health is hypothesized to be the reflection of these three dimensions. All the items in the OH construct are positive to give direct mean score of the OH as a construct.

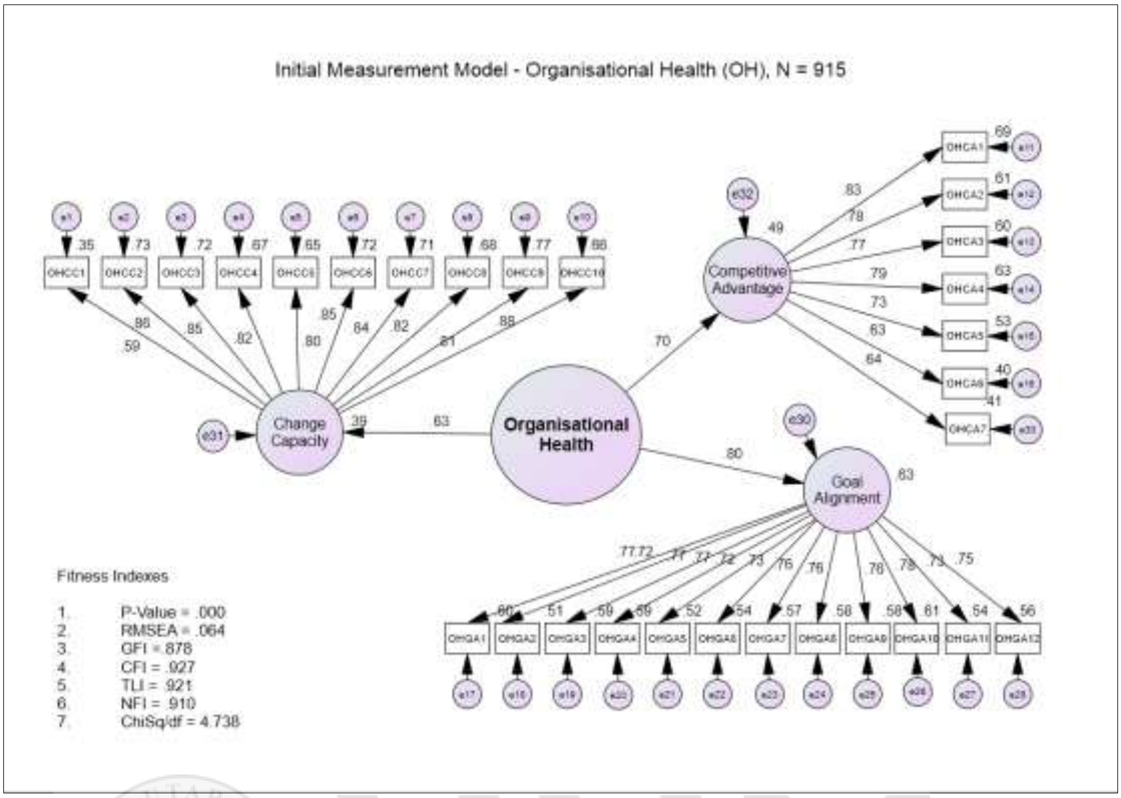

Figure 4.6
Initial measurement model of OH

Table 4.21 shows the modification indices of the residual pairs, which indicated higher values of more than 15.

Table 4.21
Modification indices of OH measurement model

Residual pairs			M.I.	Par Change
e18	<-->	e26	20.24	-0.23
e18	<-->	e17	35.37	0.31
e19	<-->	e23	34.42	-0.28
e19	<-->	e20	24.81	0.24
e19	<-->	e18	41.59	0.33
e21	<-->	e20	45.47	0.36
e21	<-->	e18	16.37	-0.23
e24	<-->	e23	27.50	-0.26
e24	<-->	e19	55.17	0.36
e24	<-->	e21	21.35	-0.25
e25	<-->	e26	32.46	0.28
e25	<-->	e23	34.65	0.30
e25	<-->	e19	27.10	-0.26
e27	<-->	e17	27.48	-0.28

e28	<-->	e27	28.99	0.28
e16	<-->	e33	56.72	0.41
e12	<-->	e13	68.25	0.28
e11	<-->	e14	23.85	0.16
e8	<-->	e9	19.44	0.13
e6	<-->	e7	33.92	0.18
e5	<-->	e28	18.01	0.18
e5	<-->	e8	31.71	0.19
e5	<-->	e7	20.36	-0.15
e2	<-->	e3	39.71	0.18

When the model fit indices are not up to the recommended value level, model modification is required. It has been recommended by the literature that low standardized factor loadings, high normal residuals, and higher modification indices are the indicators of problematic items that cause the lack of the fit of the model. However, problematic items should be deleted to achieve an acceptable model fit. More specifically, in assessing the model, the standardized item factor loading should be greater than 0.63 so that the factor could explain 40 % of its variance (Tabachnick & Fidell, 2007). Therefore, the items with factor loadings less than 0.63 should be eliminated (Hair et al., 2011).

In stages, the items showing highest MI in descending order were paired to run the model all over again. After pairing 14 items in seven stages, the model indicated higher GFI value (0.90) which showed that the model is fit with all other indices above the required level.

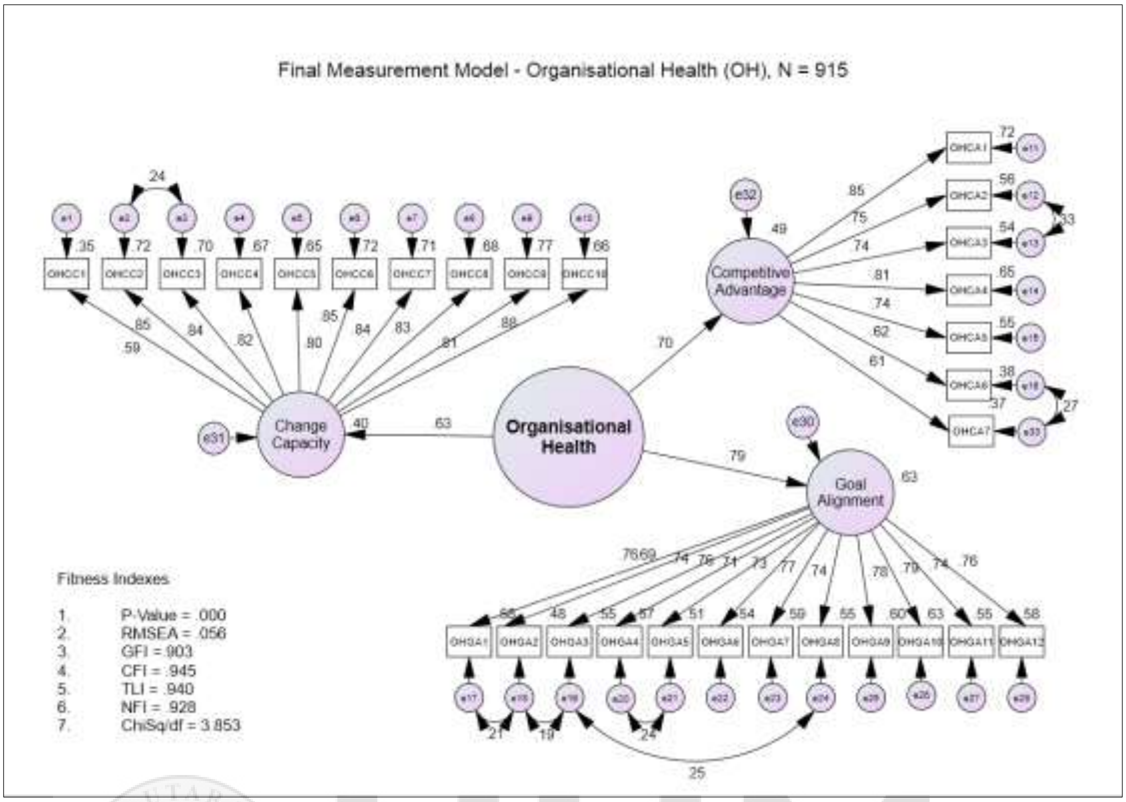

Figure 4.7
Respecified measurement model of OH

From factor analysis test it was evident that the estimation model exhibited all the required measurement specifications with all the item factor loadings recorded more than 0.60, confirmning convergent validity (Anderson and Gerbing, 1988; Hair et al., 2011). The final model of measurement as an output of AMOS graphic is depicted in Figure 4.11. The model achieved absolute, incremental, and parsimonious fit levels as the values given in Table 4.22.

Table 4.10
Fit indices of respecified model of OH

Category	Index	Index Value	Level of Acceptance
Absolute Fit	RMSEA	0.05	Required level achieved
Incremental Fit	CFI	0.94	Required level achieved
Parsimonious Fit	ChiSq/df	3.85	Required level achieved

Table 4.23 shows CFA results for OH construct combined in this estimation model for Change capacity, Competitive advantage and Goal alignment yielded high

composite reliability values (lowest being 0.89), surpassing the proposal of Bagozzi and Yi (1988) for a threshold score of 0.60. Convergent validity score extricated was more prominent than 0.54 for all the three dimensions of CA, which again surpassed the proposed threshold of 0.50 (Fornell & Larcker, 1981; Hair et al., 2006). To confirm the internal reliability measures, Cronbach alpha values scored more than 0.819, which is higher than the proposed minimum value of 0.7 as put forward by Gerbing and Anderson, (1988) and Hair et al., (2011).

Table 4.11
Reliability and validity statistics of OH measurement model

Factor	No. of items	Item Code	Loading	Alpha	AVE	CR
Change capacity	10	OHCC1	.59	0.94	0.66	0.95
		OHCC2	.85			
		OHCC3	.84			
		OHCC4	.82			
		OHCC5	.80			
		OHCC6	.85			
		OHCC7	.84			
		OHCC8	.83			
		OHCC9	.81			
		OHCC10	.88			
Competitive Advantage	7	OHCA1	.85	0.81	0.54	0.89
		OHCA2	.75			
		OHCA3	.74			
		OHCA4	.81			
		OHCA5	.74			
		OHCA6	.62			
		OHCA7	.61			
Goal Alignment	12	OHGA1	.76	0.92	0.56	0.93
		OHGA2	.69			
		OHGA3	.74			
		OHGA4	.76			
		OHGA5	.71			
		OHGA6	.73			
		OHGA7	.77			
		OHGA8	.74			
		OHGA9	.78			
		OHGA10	.79			
		OHGA11	.74			
		OHGA12	.76			

The reliability and validity scores as shown in Table 4.23 in the model shows sufficient estimation properties and qualified to continue for further examinations.

4.12.4 Measurement model of Innovation Capacity

Innovation capacity had a total of 23 items under the second order reflective construct with five distinct dimensions of Innovation support (7 items), Innovation behavior (4 items), Innovation task (4 items), Innovation integration (4 items) and finally, Information & communication with 4 items. The aggregation of scores from the reflective items with the dimensions will add up the total mean score of IC. Higher mean ratings (6,7) of dimensions mean higher capacity of innovation.

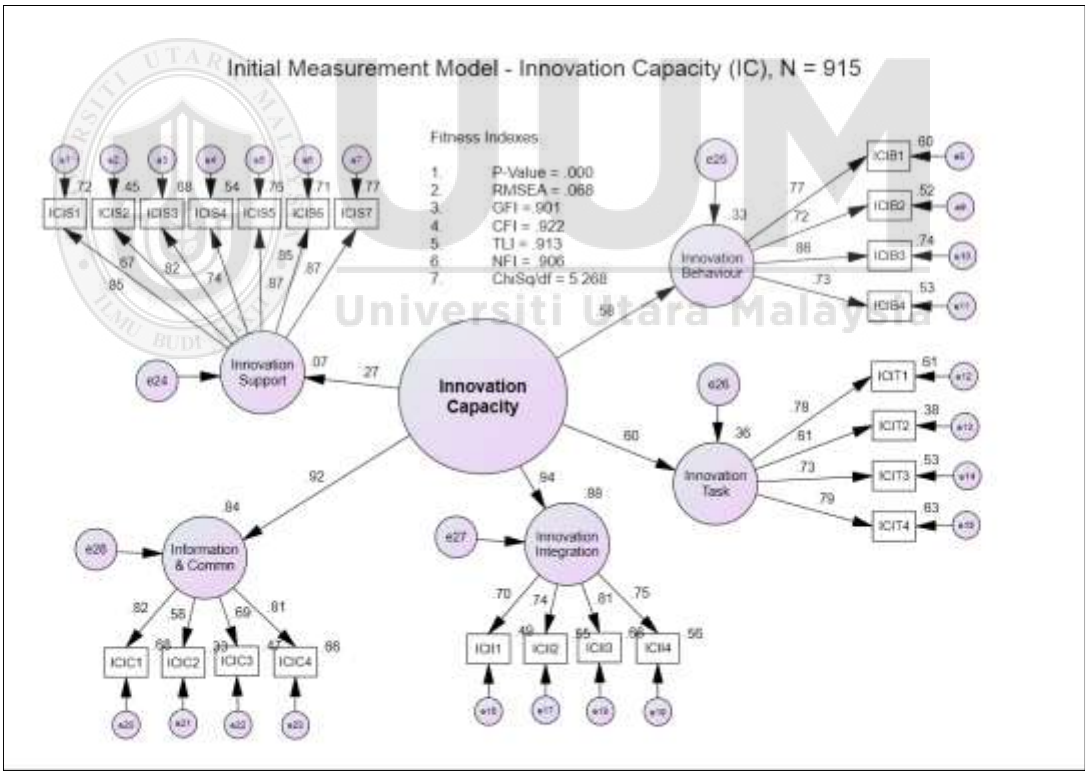

Figure 4.8
Initial measurement model of IC

Table 4.24 shows the modification index of the residual pairs, which indicates a higher value of more than 15.

Table 4.12
Modification indices of initial measurement model of IC

Residual pairs			M.I.	Par Change
e17	<-->	e16	23.02	-0.12
e19	<-->	e17	30.21	0.16
e19	<-->	e18	21.42	-0.12
e14	<-->	e17	17.63	-0.15
e12	<-->	e13	19.49	0.20
e11	<-->	e12	21.34	0.21
e5	<-->	e7	28.10	0.09
e4	<-->	e5	26.57	-0.13
e3	<-->	e11	19.94	0.16
e2	<-->	e7	20.82	-0.12
e2	<-->	e6	49.48	0.20
e1	<-->	e6	18.93	-0.10

Since MIs are chi square distributed, some suggested that MI should be at least 3.84 and other suggested that MI should exceed. Besides that, the matrix of standardized residual covariance between pairs of residuals should be examined to identify items that have significant standardized residuals (i.e., t-value > 1.96 at p < .05 or 2.58 at p < .01). However, these items should be deleted (Joreskog & Sorbom, 1984; Schumacker & Lomax, 1996). Other researchers such as Joreskog and Sorbom (1984) suggested that all the entries of standardized residual matrix should be less than the absolute value of two to achieve a good fit specification.

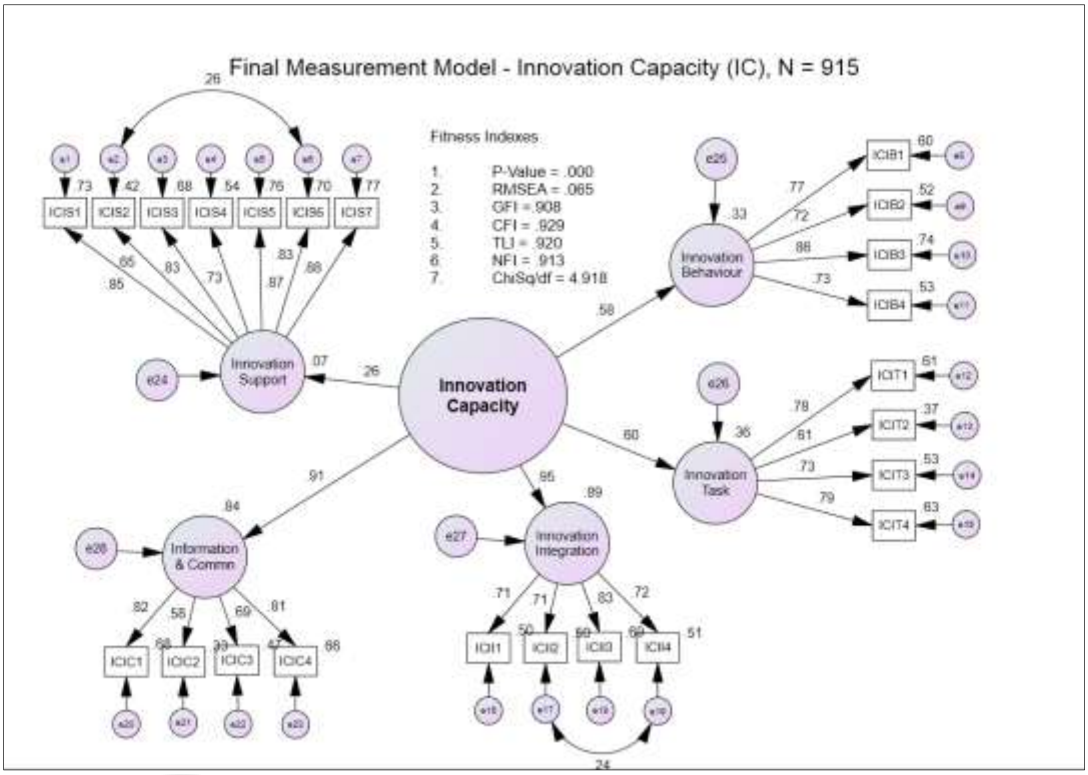

Figure 4.9
Respecified measurement model of IC

The final model of measurement as an output of AMOS graphic is depicted in Figure 4.13. Some of the problematic items were paired at the residual error level for the ones showing higher MI values and then the model was re-specified for re-estimation. Table 4.25 summarized the absolute, incremental, and parsimonious fitness indices of the IC measurement construct of this study. From the above factor analysis test it was evident that the estimation model exhibited all the required measurement specifications with all the item factor loadings recorded more than 0.60, consequently giving confirmation to convergent validity (Anderson & Gerbing, 1988; Hair et al., 2011). The model achieved absolute, incremental and parsimonious fit levels as the values given in Table 4.25.

Table 4.13
Fitness indices of re-specified model of IC

Category	Index	Index Value	Level of Acceptance
Absolute Fit	RMSEA	0.06	Required level achieved

Incremental Fit	CFI	0.92	Required level achieved
Parsimonious Fit	ChiSq/df	4.91	Required level achieved

Table 4.26 shows CFA results for IC construct combined in this estimation model for Innovation support, Innovation task, Innovation behavior, Innovation integration and Information and communication yielded high composite reliability values (lowest being 0.81), surpassing the proposal of Bagozzi and Yi (1988) for a threshold score of 0.60. Convergent validity score extricated was more prominent than 0.53 for all the three dimensions of CA, which again surpassed the proposed threshold of 0.50 (Fornell & Larcker, 1981; Hair et al., 2006). To confirm the internal reliability measures, the Cronbach alpha values scored more than 0.79, which stood significantly higher than the proposed minimum value of 0.70 as put forward by Gerbing and Anderson, (1988) and Hair et al., (2011).

Table 4.26
Reliability and validity statistics of IC measurement model

Factor	No. of items	Item Code	Loading	Alpha	AVE	CR
Innovation Support	7	ICIS1	.85	0.93	0.65	0.92
		ICIS2	.65			
		ICIS3	.83			
		ICIS4	.73			
		ICIS5	.87			
		ICIS6	.83			
		ICIS7	.88			
Innovation Task	4	ICIT1	.78	0.79	0.53	0.82
		ICIT2	.61			
		ICIT3	.73			
		ICIT4	.79			
Innovation Behaviour	4	ICIB1	.77	0.85	0.59	0.85
		ICIB2	.72			
		ICIB3	.86			
		ICIB4	.73			
Innovation Integration	4	ICII1	.71	0.83	0.55	0.83
		ICII2	.71			
		ICII3	.83			
		ICII4	.72			
Information and Communication	4	ICIC1	.82	0.81	0.53	0.81
		ICIC2	.58			
		ICIC3	.69			
		ICIC4	.81			

The reliability and validity scores as acknowledged in Table 4.26 above in the model showed sufficient estimation properties and is hence qualified to continue for further examinations.

4.12.5 Measurement model of Competence Building

Competence building (CB) was a second order reflective construct with 15 items in total covering four dimensions of Professional KSAOs (3 items), Update motivation (5 items), Update activities (4 items) and Individual expertise (3 items). All the questions in the dimensions are positively reflected to directly measure CB.

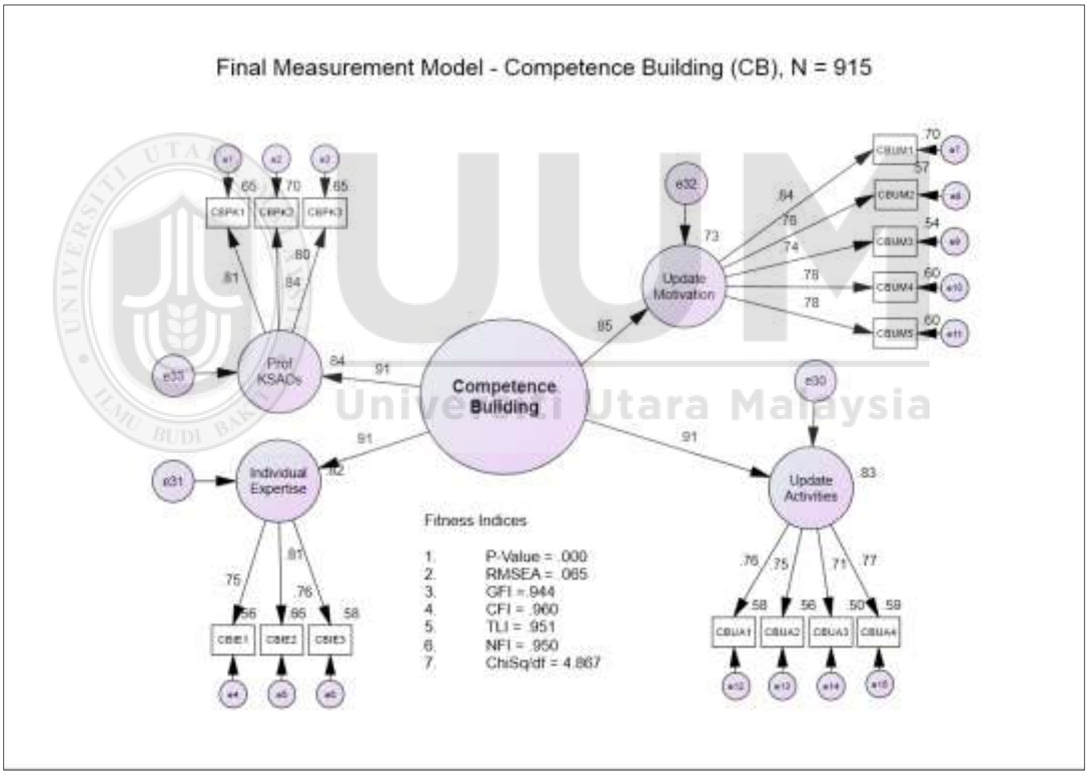

Figure 4.10
Measurement model of CB

Table 4.27 illustrates the Fitness Indices and proposed the estimation model, which suggests a satisfactory fit to the research data.

Table 4.14
Fitness indices of CB measurement model

Category	Index	Index Value	Level of Acceptance
Absolute Fit	RMSEA	0.06	Required level achieved
Incremental Fit	CFI	0.96	Required level achieved
Parsimonious Fit	ChiSq/df	4.86	Required level achieved

The estimation model for CB was found to have achieved the fitness level with all the indices showing above the suggested values. The model was thus not re-specified. Table 4.28 indicates the reliability and validity statistics of the model.

Table 4.15
Reliability and validity statistics of CB measurement model

Factor	No. of items	Item Code	Loading	Alpha	AVE	CR
Professional KSAO	3	CBPK1	.81	0.85	0.66	0.85
		CBPK2	.84			
		CBPK3	.80			
Update Motivation	5	CBUM1	.84	0.88	0.61	0.88
		CBUM2	.76			
		CBUM3	.74			
		CBUM4	.78			
		CBUM5	.78			
Update Activities	4	CBUA1	.76	0.83	0.55	0.83
		CBUA2	.75			
		CBUA3	.71			
		CBUA4	.77			
Individual Expertise	3	CBIE1	.75	0.73	0.55	0.81
		CBIE2	.81			
		CBIE3	.76			

Table 4.28 shows CFA results for CB construct combined in this estimation model for Professional KSAO, Update motivation, Update activities, and Individual expertise yielded high composite reliability values (lowest being 0.81), surpassing the proposal of Bagozzi and Yi (1988) for a threshold score of 0.60. Convergent validity score extricated was higher than 0.55 for all the three dimensions of CA, which again surpassed the proposed threshold of 0.50 (Fornell & Larcker, 1981; Hair et al., 2006). To confirm the internal reliability measures, the Cronbach alpha values

scored more than 0.73, which stood significantly higher than the proposed minimum value of 0.7 as put forward by Gerbing and Anderson, (1988) and Hair et al., (2011). Obviously, the model has satisfactory estimation properties and is accordingly qualified to continue for further investigations.

4.13 Hypotheses Restatement

The results obtained from factor analysis using SPSS and Confirmatory Factor Analysis using AMOS, the number of items and factors in each construct was found to be fit for further hypothesis analysis. Subsequently, the primary objective of the structural model proposed in this study is to test the variable relationships confirming the theories underlining such relationship keeping in mind the aim to answer the research questions put forward in Chapter I. These hypotheses were established in eight ways (H1, H2, H3, H4, H5, H6, H7, and H8) to decide the relationship among the variables under this study. As proposed in the model supported by underpinning theory explained in Chapter III, the variables were grouped mainly into endogenous (if the relationships are directed to the variable) and exogenous variable (if the relationship is generated from the variable). As can be seen in the model the endogenous variables are CA and OH and the exogenous variables are TD, IC, and CB. As such, the relationship hypotheses are re-stated here.

- Hypothesis 1 (H1): There is a significant relationship between Competence adequacy and Organisational health.
- Hypothesis 2 (H2): Technology disruption has relationship on the Competence adequacy.
- Hypothesis 3 (H3): Technology disruption is related to Organisational health.
- Hypothesis 4 (H4): Competence building has relationship with Organisational health.

- Hypothesis 5 (H5): Innovation capacity has a relationship to Organisational health.
- Hypothesis 6 (H6): Competence adequacy mediates the relationship between Technology disruption and Organizational Health.
- Hypothesis 7 (H7): Competence building moderates the relationship between Technology disruption and Competence adequacy.
- Hypothesis 8 (H8): The relationship between Technology disruption and Competence adequacy is moderated by Innovation Capacity.

Once the regression assumptions were checked and confirmed for its existence, this study further put the variables through regression path analysis with AMOG graphic between the hypothesized variables to examine the predictive power of CA, TD, IC, and CB respectively on their dependent variables. In addition, the regression was confirmed again using the SPSS regression analysis. As it were, the fundamental reason for the multiple regression analysis was to decide the prescient force of every independent variable towards the dependent variable.

4.14 Hypotheses Testing Procedure

In its procedures to test the hypotheses in order to achieve the research objectives, this study started with Pearson Correlation analysis before, undertaking the Hierarchical Regression Analysis techniques. Pearson correlation analysis was used to get an initial picture of the association relationships between the dimensions of OH, CA, TD, IC and CB. To test the direct hypotheses of this study, the multiple regression analysis techniques were employed. As an additional test method other than AMOS, in order to examine the moderating effect of CB and IC on the relationships between TD and CA, hierarchical regression analysis was employed. In other words, the use of hierarchical linear regression helped in the examination of the moderating effect of CB and IC on the relationships between TD and CA. It is worth mentioning that all the subsequent analysis in this study used the variables resulted from the refined model through the measurement model fit processes as detailed in section 5.5.2. In the following, the results of Pearson correlation and regression analysis were reported.

4.14.1 Pearson correlation analysis

To illustrate the relationships among OH, CA, TD, IC and CB, the Pearson correlation analysis was conducted. As illustrated in Table 4.28, all the relationships among OH, CA, TD, IC and CB of Indian telecommunication companies were found to be existing and significant at a statistical level of 0.01. Referring to the strength of the relationship among variables, Hair et. al. (2011) opined that a correlation coefficient of 0 shows no relationship existing, whereas a correlation value of ±1 indicate a perfect relationship. In deciphering, the relationship strengths, Cohen (1988) suggested that an absolute value between 0.1 and 0.29 predicts presence of relationship with little strength, while the absolute R-value lying between 0.3 and 0.49 depicts medium relationship, the relationship is considered as medium. Cohen's standard further reiterates that an absolute coefficient value above 0.5 shoes a strong relationship.

Table 4.29
Pearson correlation statistics among the variables

Construct		TD	CA	OH	IC	CB
TD	Pearson Correlation	1				
	Sig. (2-tailed)					
	N	91				
CA	Pearson Correlation	$-.69^{**}$	1			
	Sig. (2-tailed)	.00				
	N	915	915			
OH	Pearson Correlation	$-.12^{**}$	$.24^{**}$	1		
	Sig. (2-tailed)	.00	.00			
	N	915	915	915		
IC	Pearson Correlation	$-.15^{**}$	$.22^{**}$	$.70^{**}$	1	

	Sig. (2-tailed)	.00	.00	.00		
	N	915	915	915	915	
CB	Pearson Correlation	-.73**	.56**	.16**	.13**	1
	Sig. (2-tailed)	.00	.00	.00	.00	
	N	915	915	915	915	915

**. Correlation is significant at the 0.01 level (2-tailed).

Based on the results in Table 4.29, all the Pearson correlation coefficients were found to be significant at the 0.01 level. The R-value between CA and OH is .20 (Table 4.28) shows significant relationship and the positive value shows that the relationship is positive. In addition, the correlation between TD and CA shows -.69, which indicates a significant negative relationship between these variables. The value -.12 between TD and OH provides evidence of a negative relationship between these two variables. Between IC and OH shows .70 R-value, which shows a significant positive relationship. Similarly, R-value of .16 between CB and OH signifies a positive relationship. In other words, data of this study supported the existence of significant relationships among OH, CA, TD, IC, and CB in Indian telecommunication companies. Table 4.30 in the following provided the summary of the obtained results.

Table 4.30
Summary of correlation for the hypotheses

Relationship	Pearson Correlation	Result
There is significant positive relationship between Competence Adequacy and Organisational health	.20**	Significant
There is significant negative relationship between Technology Disruption and Competence Adequacy	-.69**	Significant
There is significant negative relationship between Technology Disruption and Organisational health	-.12**	Significant
There is significant positive relationship between Innovation Capacity and Organisational health	.70**	Significant
There is significant positive relationship between Competence Building and Organisational health	.16**	Significant

4.14.2 Regression analysis

Hair et. al. (2011) confirm that regression analysis is a widely accepted measurable method as a part of statistics among the vast majority of the disciplines including sociology and science. Multiple regression measures the variance of relationship among a number of variables within a hypothetical model.

The survey data was put through a rigorous test to confirm the multivariate assumptions to ensure reliability of the data for multiple regression analysis. Reliability, validity, non-existence of multicollinearity, independence of error items and homoscedasticity are the essential prerequisites of a regression analysis. Such tests were carried out and the appropriate results were presented in the earlier part of this chapter.

4.15 SEM Path Analysis

In SEM, a causal or correlational relationship can be represented through a linear path diagram. Latent variables as referred from the theory are outlined in SEM diagram as ovals (Figure 4.14), estimation errors as small circles, and arrowheads representing connections between the variables. For instance, constructs, CA and OH are displayed as ovals (unobserved or latent variables). Measured items inside of the construct are exhibited as rectangles.

Directional single headed arrows in the SEM diagram show the causal relationship between the variables. For example, the relationship between competence adequacy and organizational health is represented through a connected single headed directional arrow between these two variables. In the pooled model as in Figure 4.15, if there is no arrow between two variables infers that there is no immediate relationship hypothesized between these two in this study. Existence of any correlation or covariance between the variables is represented in AMOS graphic as double headed arrows as found in the relationship in the middle of CA1 and CA2. Such covariance confirms existence of a relationship; however, no causal path can be estimated from this. Measurement estimation errors and item residual errors are depicted with big and small circles respectively in the model and are represented by the letter ‘e’.

In SEM, there are progressions of goodness-of-fit indices, which recognize whether the model fits the data or not. There are numerous indicators given by SEM scholars, despite the fact that no singular concept is accepted as a norm by the researchers. Anderson and Gerbing (1988) for instance proposed that one or more goodness of fit indices might be sufficient to confirm how well the data fits into the hypothesized model. However, Kline (1998) prescribes no less than four, such as from among NFI, GFI, CFI, SRMR or NNFI. In order to reflect the best model fit criteria, Bollen and Long (1993) suggested at least three fitness indices to be satisfied. In line with this suggestion, Hair et. al. (1995) and Jaccard and Wan (1996), also recommended no less than three criteria by incorporating one in each absolute fit, incremental fit and parsimonious fit, of model (these are presented at appropriate sections below).

4.15.1 Path analysis of Competence Adequacy – Organisational Health

As stated in Chapter III, the first hypothesis in the study was that Competence Adequacy (CA) has positive significant effect on Organisational health (OH). The hypothesis is thus restated as below:

Hypothesis 1: There is a significant relationship between Competence adequacy and Organisational health.

To test this hypothesis the variables CA and OH were parceled into first order latent constructs in AMOS graphic and the regression analysis run on the path model as depicted in Figure 4.15. Before looking at the standardized estimate values, the model fit statistics were confirmed. Although the items in the model loaded highly on the latent constructs the model fit indices showed that the Chi square/df value was higher at 5.64. To bring the fitness indices within the permissible limits, error items with higher modification indices were examined and identified e5 and e6 pairs with highest MI value. These two items were paired to make them free from estimate and the respecified model was run again. The respecified model achieved the fitness indices as depicted in Figure 4.15.

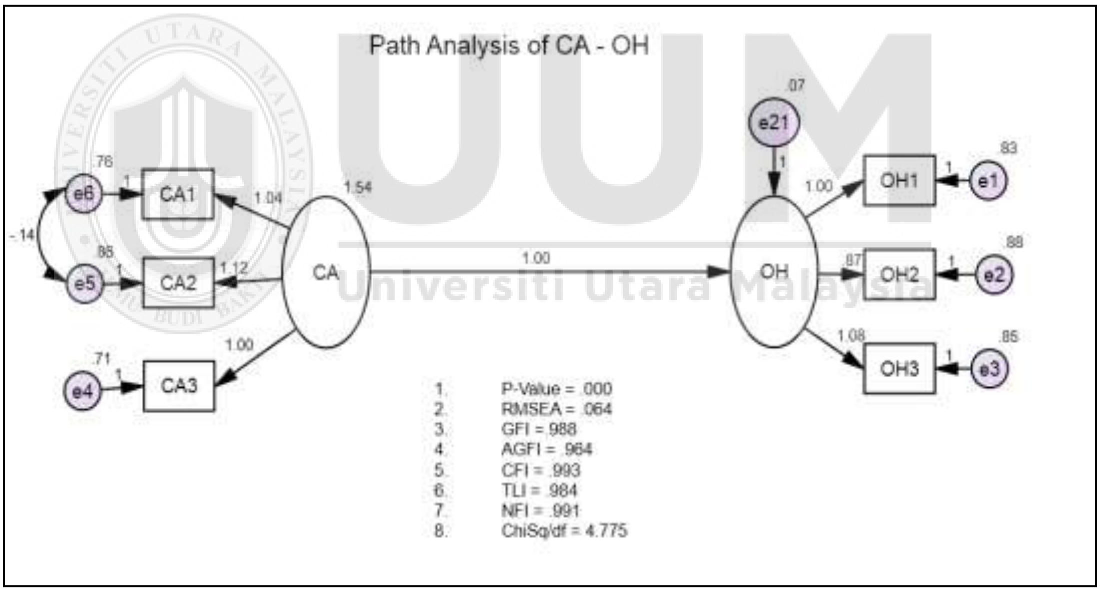

Figure 4.15
AMOS structural model on relationship between CA and OH

As indicated in Table 4.31 the structural model was evaluated for the prescribed measurement fit indices to confirm the goodness of fit criteria. If it did not fit the model, the prerequisite was to re-determine the model until one was accomplished that showed both adequate factual fit and demonstrated a hypothetically significant representation of the data (Hair et. al. 1995; Tabachnick & Fidell, 2001; Kline, 2005).

Table 4.16

Fitness indices of the structural model between CA and OH

Category	Index	Index Value	Level of Acceptance
Absolute Fit	RMSEA	0.06	Achieved required level
Incremental Fit	CFI	0.99	Achieved required level
Parsimonious Fit	ChiSq/df	4.77	Achieved required level

The relationship path diagram between CA and OH showed reasonable model fit with the required fitness indices (Table 4.32) reaching to the required level. Firstly, the Root Mean Square Error Approximation showed a value of 0.06 indicating an absolute fit of the data. According to Browne and Cudeck (1993), RMSEA should be less than 0.08. As indicative of the incremental fitness, the comparative fit index read 0.99 recording the value above the required level (0.9) as suggested by Bentler (1990) and finally, for the parsimonious fit index value of 4.77 for chiSq/df, also recorded within the specified limit (<5.0) as put forth by Marsh & Hocevar (1985).

Table 4.17

Regression analysis between CA and OH

Regression			Estimate	S.E.	C.R.	P	Result
OH	<---	CA	0.99	0.03	27.46	***	Significant

Regression covariance estimate from the SEM predicts an indicative covariance of 0.99 in OH with every unit increase of CA. The model is significant with a p-value at 0.01 level and critical ratio at 27.46.

Table 4.18

Model summary of path analysis between CA and OH

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.20[a]	.04	.04	1.07

a. Predictors: (Constant), CA

The model summary from SPSS shows an R^2 of 4.2% variance explained by the CA on OH. Adjusted R^2 recorded at 4.1%. Standard error of the estimate is at 1.07.

Table 4.19

ANOVA summary of path analysis between CA and OH

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	45.63	1	45.63	39.71	.000[b]
	Residual	1049.14	913	1.14		
	Total	1094.78	914			

a. Dependent Variable: OH
b. Predictors: (Constant), CA

Further, ANOVA summary of the path analysis shows a mean square of 45.63 with one degree of freedom indicating an F value of 39.71 which is significant and p value 0.01.

Table 4.20
Summary of coefficients on the path analysis between CA and OH

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	β		
1	(Constant)	3.05	.15		19.83	.000
	CA	.21	.03	.204	6.30	.000

a. Dependent Variable: OH

According to the regression performed and its results reported in Table 4.35, it can be concluded that Competence Adequacy (CA) has significant positive impact on the Organizational Health (OH) at the 0.001 level with the indicators (β=0.204, t=6.30, p<0.01) The probability of getting a critical ratio as large as 27.46 in absolute value is less than 0.001. In other words, the regression weight for CA in the prediction of OH is significantly different from zero at the 0.001 level (two-tailed). This result thus supported the hypothesis H1 in which the impact of CA on OH was claimed to be positive and significant.

4.15.2 Path analysis of Technology Disruption – Competence Adequacy

As stated in Chapter III, the second hypothesis in the study was that Technology Disruption (TD) has negative significant effect on Competence Adequacy (CA). The hypothesis is thus restated as below:

Hypothesis 2: Technology disruption has a relationship on the Competence adequacy.

To test this hypothesis the variables TD and CA were parceled into first order latent constructs in AMOS graphic and the regression analysis run on the path model as depicted in Figure 4.15. Before looking at the standardized estimate values, the model fit statistics were confirmed. Although the items in the model loaded highly on the latent constructs, the parsimonious and absolute fit indices were above the permissible limits with Chisquare/df value higher at 9.33 and RMSEA at 0.09. To bring the fitness indices within the permissible limits, error items with higher modification indices were examined and identified e7 and e8 pairs with highest MI value (15.78). These two items were paired to make them free from estimate, and the respecified model was run again. The respecified model achieved the fitness indices as depicted in Figure 4.16.

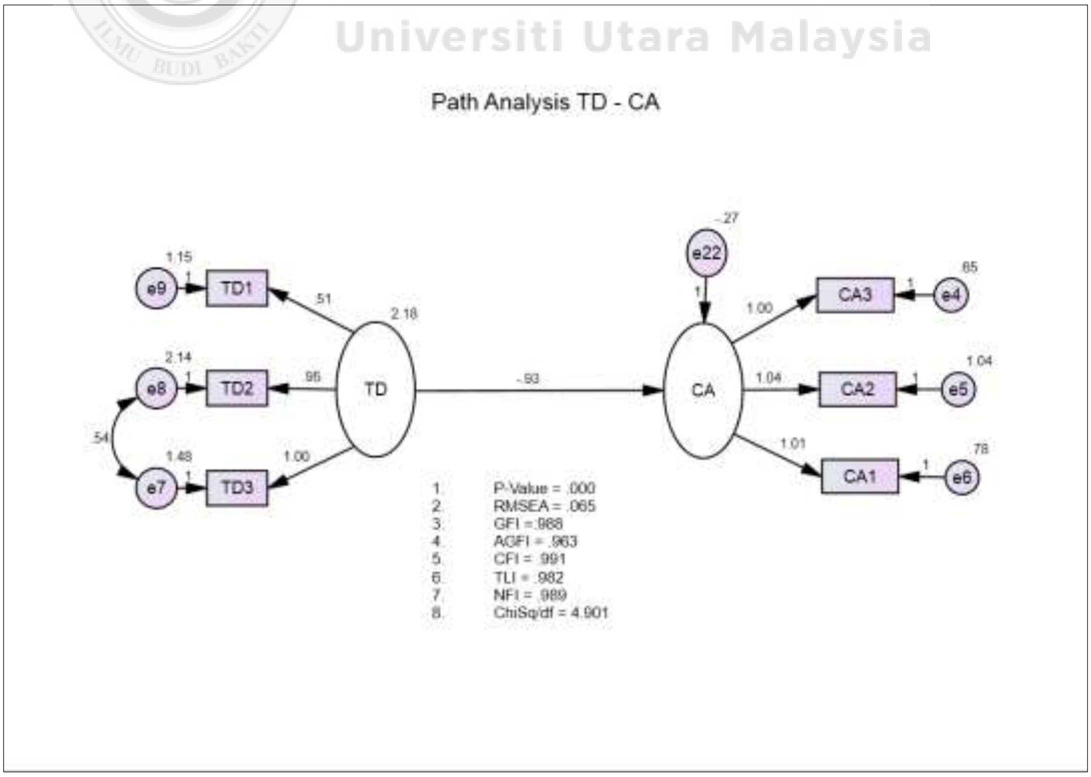

Figure 4.11
AMOS structural model on relationship between TD and CA

As indicated in Table 4.36 the structural model was evaluated for the prescribed measurement fit indices to confirm the goodness of fit criteria. If it did not fit the model, the prerequisite was to re-determine the model until one was accomplished that showed both adequate factual fit and demonstrated a hypothetically significant representation of the data (Hair et. al., 1995; Tabachnick & Fidell, 2001; Kline, 2005).

Table 4.21
Summary of definitions on innovation capacity

Category	Index	Index Value	Level of Acceptance
Absolute fit	RMSEA	0.06	Required level achieved
Incremental fit	CFI	0.99	Required level achieved
Parsimonious fit	ChiSq/df	4.90	Required level achieved

The indices of Fitness as indicated in Table 4.36 confirm that the model after appropriate modification fits the data. The ChiSq score representing the Parsimonious fit was 4.90, RSMEA = 0.06 and CFI = 0.99. The structural model represented by the given data is thus proved to be fit. Table 4.37 shows the regression weight as an indicator of the hypothesis to be confirmed in this research.

Table 4.22
Regression analysis between TD and CA

Regression			Estimate	S.E.	C.R.	P	Result
CA	<---	TD	-0.77	0.02	-29.06	***	Significant

Regression covariance estimate from the SEM predicts an indicative covariance of -0.77 in CA with every unit variance of TD. The model is significant with a p-value at 0.01 level and critical ratio at -29.06.

Table 4.23
Model summary of path analysis between TD and CA

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.69[a]	.47	.47	.74

a. Predictors: (Constant), TD

The model summary from SPSS shows an R^2 of 47% variance explained by the TD on CA. Adjusted R^2 also recorded at 47%. Standard error of the estimate is at 0.74.

Table 4.39
ANOVA summary of path analysis between TD and CA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	460.49	1	460.49	828.95	.000[b]
	Residual	507.18	913	.556		
	Total	967.67	914			

a. Dependent Variable: CA
b. Predictors: (Constant), TD

Further, ANOVA summary of the path analysis shows a mean square of 460.49 with one degree of freedom indicating an F value of 828.95 which is significant and p value 0.01.

Table 4.40
Summary of coefficients on the path analysis between CA and TD

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	β		
1	(Constant)	6.52	.079		82.29	.000
	TD	-.56	.020	-.69	-28.79	.000

a. Dependent Variable: CA

According to the regression test performed and the output tabulated in Table 4.40, shows that Technology Disruption (TD) has significant negative impact on the Competence Adequacy (CA) with 0.001 significance level and the indicators showing (β= -0.69, t= -28.79, $p<0.01$) To get a critical ratio of 29.06 in absolute value the probability is less than 0.001. As such, the weight of regression as recorded for TD for predicting CA seems different from zero significantly the level of 0.001 (in two tailed test). Thus, this result supports the hypothesis H2 in which the impact of TD on CA was claimed to be negative and significant.

4.15.3 Path analysis of Technology Disruption – Organisational Health

As stated earlier, the third hypothesis in the study was that Technology Disruption (TD) has negative significant effect on Organisational Health (OH). The hypothesis is re-stated as below:

Hypothesis 3: Technology disruption relates to Organisational health.

To test this hypothesis the variables TD and OH were parceled into first order latent constructs in AMOS graphic and the regression analysis run on the path model as depicted in Figure 4.17. Before looking at the standardized estimate values, the model fit statistics were confirmed. All the items in the model loaded highly on the latent constructs and the parsimonious and absolute fit indices were also within the permissible limits.

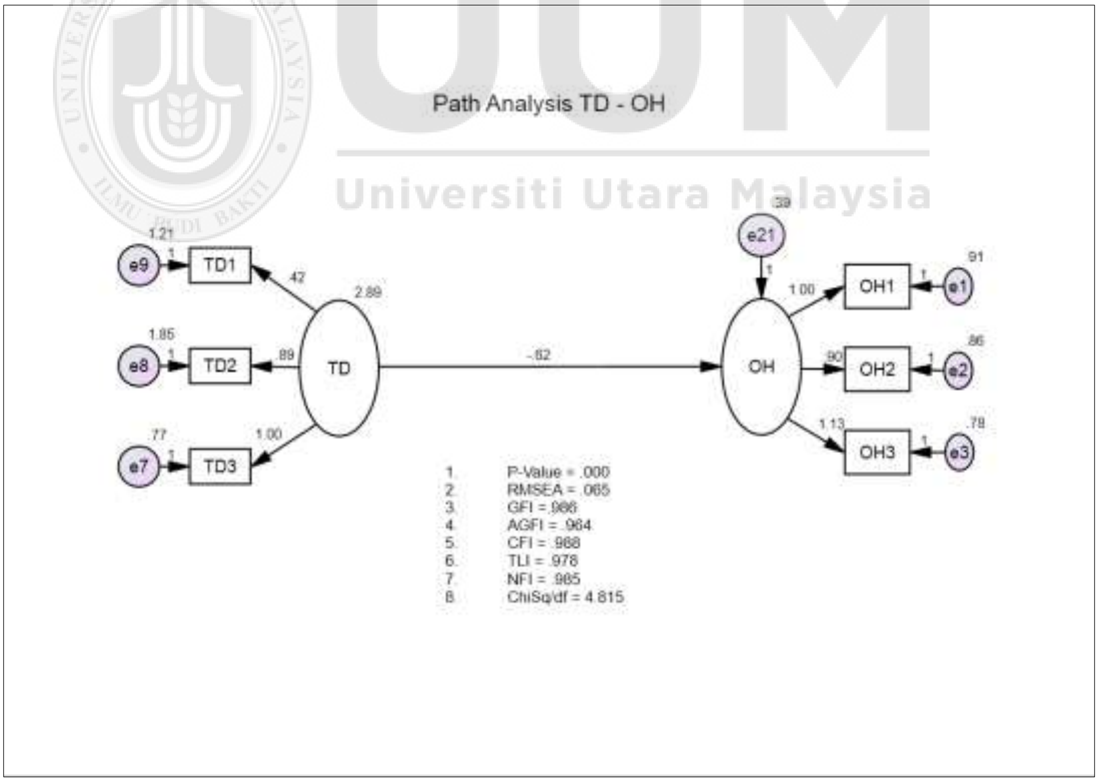

Figure 4.17
AMOS structural model on relationship between TD and OH

As indicated in Table 4.41, the structural model was evaluated for the prescribed measurement fit indices to confirm the goodness of fit criteria. If it did not fit the model, the prerequisite was to re-determine the model until one was accomplished that showed both adequate factual fit and demonstrated a hypothetically significant representation of the data (Hair et. al., 1995; Tabachnick & Fidell, 2001; Kline, 2005).

Table 4.24
Fitness indices of structural model TD and OH

Category	Index	Index Value	Level of Acceptance
Absolute fit	RMSEA	0.06	Required level achieved
Incremental fit	CFI	0.96	Required level achieved
Parsimonious fit	ChiSq/df	4.81	Required level achieved

The indices of Fitness as indicated in Table 4.41 confirm that the model after appropriate modification fits the data. The ChiSq score representing the Parsimonious fit was 4.81, RSMEA = 0.06 and CFI = 0.96. The structural model represented by the given data is thus proved to be fit. Table 4.42 shows the regression weight as an indicator of the hypothesis to be confirmed in this research.

Table 4.25
Regression analysis between TD and OH

Regression			Estimate	S.E.	C.R.	P	Result
OH	<---	TD	-0.62	0.02	-21.90	***	Significant

Regression covariance estimate from the SEM predicts an indicative covariance of -0.62 in OH with every unit variance of TD. The model is significant with a p-value at 0.01 level and critical ratio at -21.90.

Table 4.43
Model summary of path analysis between TD and OH

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.12[a]	.01	.01	1.08

a. Predictors: (Constant), TD

The model summary from SPSS shows an R^2 of 1% variance explained by the TD on OH. Adjusted R^2 also recorded at 1%. Standard error of the estimate is at 1.08.

Table 4.26
ANOVA summary of path analysis between TD and OH

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	16.18	1	16.18	13.70	.000[b]
	Residual	1078.59	913	1.18		
	Total	1094.78	914			

a. Dependent Variable: OH
b. Predictors: (Constant), TD

Further, ANOVA summary of the path analysis shows a mean square of 16.18 with one degree of freedom indicating an F value of 13.70 which is significant and p value 0.01. According to the regression test performed and the output tabulated in Table 4.45, it shows that Technology Disruption (TD) has significant negative impact on the Organisational Health (OH) with 0.001 significance level and the indicators showing (β= -0.122, t= -51.234, p<0.01).

Table 4.27
Summary of coefficients on the path analysis between TD and OH

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	β		
1	(Constant)	4.41	.11		38.14	.000
	TD	-.10	.02	-.122	-3.70	.000

a. Dependent Variable: OH

To get a critical ratio as large as 21.908 in absolute value, the probability is less than 0.001. Putting differently, the weight of regression as recorded for TD for predicting OH seems different form zero significantly the level of 0.001 (in two tailed test). This this result support the hypothesis H3 in which the impact of TD on OH was claimed to be negative and significant.

4.15.4 Path analysis of Competence Building – Organisational Health

As stated earlier, the fourth hypothesis in the study was that Competence Building (CB) has positive significant effect on Organisational Health (OH). The hypothesis is re-stated as below:

Hypothesis 4: Competence building has a relationship with Organisational health.

To test this hypothesis the variables CB and OH were parceled into first order latent constructs in AMOS graphic and the regression analysis run on the path model as depicted in Figure 4.18. Before looking at the standardized estimate values, the model fit statistics were confirmed. All the items in the model loaded highly on the latent constructs and the parsimonious and absolute fit indices were within the permissible limits.

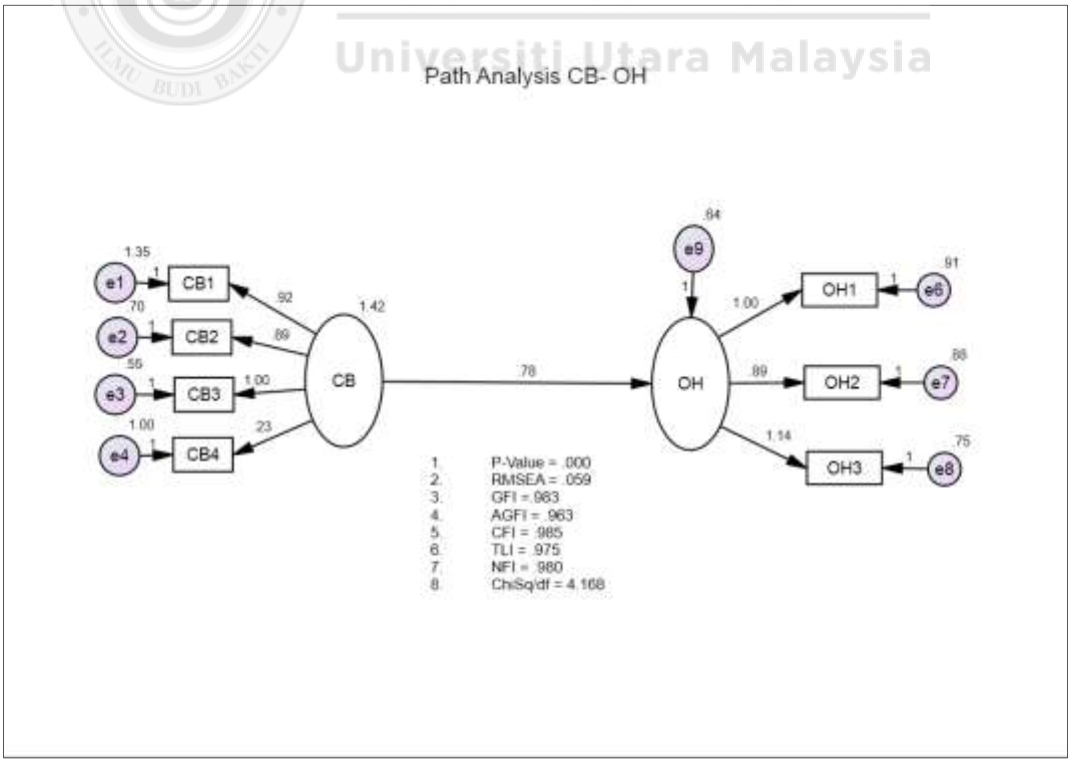

Figure 4.18
AMOS structural model on relationship between CB and OH

Table 4.28

Fitness indices of structural model CB-OH

Category	Index	Index Value	Level of Acceptance
Absolute fit	RMSEA	0.05	Required level achieved
Incremental fit	CFI	0.98	Required level achieved
Parsimonious fit	ChiSq/df	4.16	Required level achieved

The indices of Fitness as indicated in Table 4.46 confirm that the model after appropriate modification fits the data. The ChiSq score representing the Parsimonious fit was 4.168, RSMEA = 0.059 and CFI = 0.985. The structural model represented by the given data is proved to be fit. Table 4.47 shows the regression weight as an indicator of the hypothesis to be confirmed in this research.

Table 4.29

Regression weights of the relationship between CB and OH

Regression			Estimate	S.E.	C.R.	P	Result
OH	<---	CB	0.78	0.04	19.04	***	Significant

Regression covariance estimate from the SEM predicts an indicative covariance of 0.78 in OH with every unit variance of CB. The model is significant with a p-value at 0.01 level and critical ratio at 19.04.

Table 4.30

Model summary of CB and OH

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.16[a]	.029	.02	1.07

a. Predictors: (Constant), CB

The model summary from SPSS shows an R^2 of 2.9% variance explained by the CB on OH. Adjusted R^2 recorded at 2.8%. Standard error of the estimate is at 1.07.

Table 4.49

ANOVA summary of path analysis between CB and OH

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	31.44	1	31.44	26.97	.000[b]
	Residual	1063.36	913	1.15		
	Total	1094.78	914			

a. Dependent Variable: OH

b. Predictors: (Constant), CB

Further, ANOVA summary of the path analysis shows a mean square of 31.44 with one degree of freedom indicating an F value of 26.97 which is significant and p value 0.01.

Table 4.50
Summary of coefficients on the path analysis between CB and OH

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	β		
1	(Constant)	3.48	.10		32.83	.000
	CB	.16	.03	.169	5.19	.000

a. Dependent Variable: OH

According to the regression test performed and the output tabulated in Table 4.50, shows that Technology Disruption (TD) has significant positive impact on the Competence Building (CB) with 0.001 significance level and the indicators showing (β= 0.16, t= 5.19, p<0.01). To get a critical ratio as large as 19.04 in absolute value, the probability is less than 0.001. In other words, the weight of regression as recorded for TD for predicting CB seems different form zero significantly the level of 0.001 (in two tailed test). This result supports the hypothesis H4 in which the impact of CB on OH was claimed to be positive and significant.

4.15.5 Path analysis of Innovation Capacity – Organisational Health

As stated earlier, the fourth hypothesis in the study was that Innovation Capacity (IC) has positive significant effect on Organisational Health (OH). The hypothesis is thus restated as below

Hypothesis 5: Innovation capacity has a relationship to Organisational health.

To test this hypothesis the variables IC and OH were parceled into first order latent constructs in AMOS graphic and the regression analysis run on the path model as depicted in Figure 4.19. Before looking at the standardized estimate values, the model fit statistics were confirmed. All the items in the model loaded highly on the latent constructs and the parsimonious and absolute fit indices were also within the permissible limits

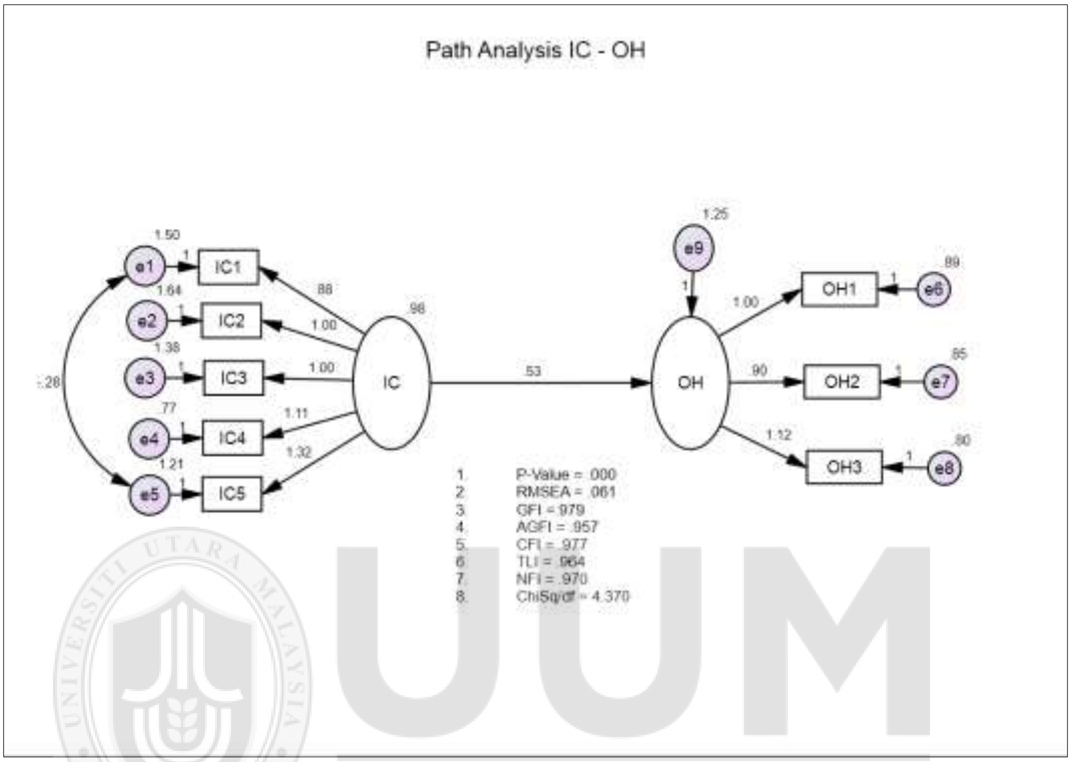

Figure 4.19
AMOS structural model on relationship between IC and OH

Table 4.31
Fitness indices of the structural model of IC and OH

Category	Index	Index Value	Level of Acceptance
Absolute fit	RMSEA	0.06	Required level achieved
Incremental fit	CFI	0.97	Required level achieved
Parsimonious fit	ChiSq/df	4.37	Required level achieved

The indices of Fitness as indicated in Table 4.51 confirm that the model after appropriate modification fits the data. The ChiSq score representing the Parsimonious fit was 4.370, RSMEA = 0.061 and CFI = 0.977. The structural model represented by the given data is thus proved to be fit. Table 4.52 shows the regression weight as an indicator of the hypothesis to be confirmed in this research.

Table 4.32
Regression weights of the relationship between IC and OH

Regression			Estimate	S.E.	C.R.	P	Result
OH	<---	IC	0.53	0.05	10.11	***	Significant

Regression covariance estimate from the SEM predicts an indicative covariance of 0.53 in OH with every unit variance of IC. The model is significant with a p-value at 0.01 level and critical ratio at 10.11.

Table 4.33
Model summary of regression result of IC on OH

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.70[a]	.49	.48	.78

a. Predictors: (Constant), IC

The model summary from SPSS shows an R^2 of 49% variance explained by the IC on OH. Adjusted R^2 recorded at 48%. Standard error of the estimate is at 0.78

Table 4.34
ANOVA summary of path analysis between IC and OH

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	536.01	1	536.01	875.83	.000[b]
	Residual	558.76	913	.612		
	Total	1094.78	914			

a. Dependent Variable: OH
b. Predictors: (Constant), IC

Further, ANOVA summary of the path analysis shows a mean square of 536.01 with one degree of freedom indicating an F value of 875.83 which is significant and p value 0.01.

Table 4.35
Summary of coefficients on the path analysis between IC and OH

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	β		
1	(Constant)	1.24	.09		12.88	.000
	IC	.92	.03	.700	29.59	.000

a. Dependent Variable: OH

According to the regression test performed and the output tabulated in Table 4.55, shows that Innovation Capacity (IC) has significant positive impact on the

Organisational Health (OH) with 0.001 significance level and the indicators showing (β= 0.700, t= 25.59, p<0.01). To get a critical ratio as large as 10.11 in absolute value, the probability is less than 0.001. As such, the weight of regression as recorded for IC for predicting OH seems different from zero significantly the level of 0.001 (in two tailed test). Thus, this result support the hypothesis H5 in which the impact of IC on OH was claimed to be positive and significant.

4.16 Mediation Analysis of Competence Adequacy

Baron and Kenny (1986) explained that mediator is a continuous intervening variable that helps to understand how the independent and dependent variables are related to each other. The concepts behind this narrates that the independent variable first forms the mediator and which in turn predicts the dependent variable.

Investigations of mediation (M) analyze diverse proof based inquiries concerning the procedures, or systems, through which X and Y relationship happens. In a competency-based exploration, this is the "how" of general skill level change. Human asset experts might need to comprehend what components of an intervention are in charge of competence adequacy, for example, whether impacts brought about by Technology disruption really bring about decreased Organizational health or if sustenance of fitness results in lowered effect of Technology disruption on Organizational health. Such inquiries lead to enhanced methods for treatment by distinguishing techniques destined to deliver a positive result. Mediators are measurably interceding variables. Hypothetical establishments consolidated with appropriate temporal order will then recognize a mediator from only an option or extra reason for a X to Y affiliation (Kazdin & Nock, 2003).

Hypothesis 6: Competence adequacy mediates the relationship between Technology disruption and Organizational Health.

Researcher has adopted the most established statistical mediation method from the works of Baron and Kenny (1986). Often identified as the Causal Steps Approach and depicted as structural equation model as in Figure 4.20, a number of regression tests in sequence confirms the existence of intervening conditions.

To analyse the mediating effect, the first condition is that the direct path showing the independent variable (X) should show significant predictive power for the outcome variable Y (TD predicts OH). Secondly, the X (TD) should also predict the mediator M (CA) significantly and lastly the mediator (M) should significantly predict the outcome (OH) independent of TD. The immediate impact of TD on OH ought to be lessened or dispensed with when CA is controlled. The indirect, or intervened, impact is the distinction between the aggregate (X->M->Y) and the direct (X->Y) impacts.

Figure 4.20 as delineated in the way examination portrays the aggregate impact of the Technology disruption on Organizational health, with the path coefficient of TD on OH. This aggregate impact may be touched base at by means of an assortment of direct and indirect strengths (Hayes, 2009). In particular, in Figure 4.20, the aggregate impact of TD on OH can be communicated as the total of the direct and indirect effects, the recent being evaluated by the result of the path coefficients for each of the path in the meditational chain (Alwin & Hauser, 1975).

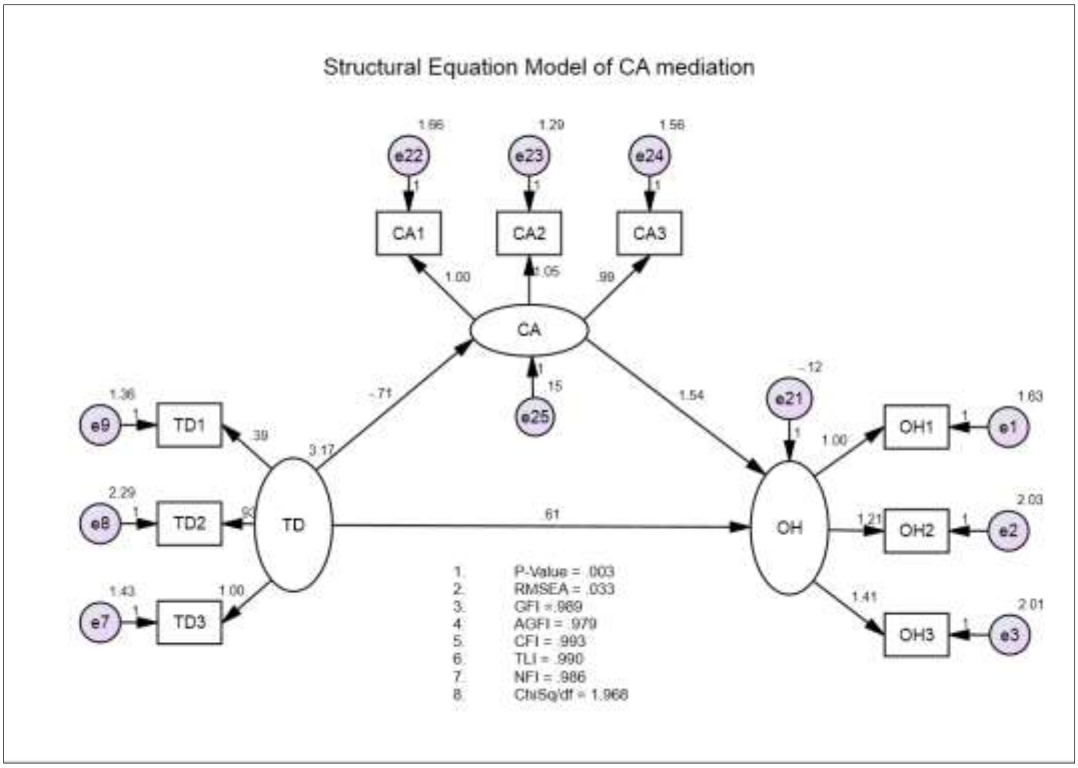

Figure 4.20
AMOS graphic output of mediation path of CA between TD and OH

Mediation statistically is exhibited by a loss (full intervention) or lessening (halfway intervention) of the X coefficient (Baron and Kenny, 1986), by a measurable test of the difference between the aggregate and direct impacts, or by a test of the joint significance of the X->M and M->Y path (Sobel, 1982; MacKinnon, Warsi, and Dwyer, 1995; MacKinnon, Lockwood, Hoffman, West, and Sheets, 2002).

Table 4.36
Multiple regression result of CA & TD on OH in the structural model

Regression			Estimate	S.E.	C.R.	P	Result
CA	<---	TD	-0.71	0.03	-20.68	***	Significant
OH	<---	CA	1.53	0.43	3.56	***	Significant
OH	<---	TD	0.61	0.31	1.93	0.05	Not Significant

The regression result (Table 4.56) drawn from the Structural Equation Model shows that for the relationship between TD and OH when CA enters the model, a probability of getting a critical ratio in absolute value is as large as 1.939, is 0.05. TD shows the regression weight in the prediction of OH when CA is present in the model at the 0.05 level is not significantly different from zero (two-tailed test). The result confirms that CA fully mediates the relationship between TD and OH.

Table 4.37
Multiple regression result of CA & TD on OH in the mediated model

Regression			Estimate	S.E.	C.R.	P	Label
CA	<---	TD	-0.97	0.01	-70.47	***	Significant
OH	<---	TD	0	0.02	-0.00	0.99	Not Significant
OH	<---	CA	0.84	0.02	32.03	***	Significant

As opposed to the moderation tests, intervention test will not yield promptly deciphered graphs of causal connections. The direction and extent of regression coefficients, nonetheless, rough impact sizes at every path of the model and in this way give significant information about the path of intervened connections (MacKinnon, Fairchild, and Fritz, 2007). The ability to distinguish the significance of mediation impacts is constantly lower than the ability to identify the noteworthiness of the principle impacts in light of the fact that the size of the main impact is limited by the individual coefficients from which it is shaped. Late research has demonstrated that causal steps tests for intervention and ordinary hypothesis point estimators of the interceded impact are underpowered (MacKinnon et al., 2002).

To confirm the mediation effect as evidenced by the regression analysis of mediated models using AMOS (Table 4.57), the researcher has used PROCESS (Hayes, 2012), a macro developed for SPSS which computes the moderation and mediation results along with the combination of such measures in an integrated conditional context. PROCESS uses path analysis framework to describe the mediation effect of the intervention terms in a model.

To analyse the mediation effect of Competence Adequacy the researcher has used the Model 4 of PROCESS as a simple mediation model (Hayes, 2012). It relates to the structural model as depicted in Figure 4.20, where Technology Disruption (TD) is the independent variable, Organisational Health (OH) is the dependent variable and Competence Adequacy (CA) is hypothesized as mediating the relationship between the formers. After running the PROCESS computational method, the output generated by the method is given in Table 4.58.

Table 4.36
Details of the mediated model in PROCESS (Hayes, 2012)

Model = 4		
Y	=	OH
X	=	TD
M	=	CA
Sample size	915	

The primary piece of the yield records all variables in the examination, demonstrating which is considered as a dependent variable (Y), which an independent variable (X) and which and mediator (M). The aggregate specimen size is additionally shown.

Table 4.39
PROCESS model summary with TD-OH (Step 1)

R	R-sq	MSE	F	df1	df2	p
0.86	0.741	0.45	2206.98	1	913	0.000

In Step 1 of the mediation model, the regression of Technology Disruption (TD) with Organisational Health (OH) as in Table 4.59, ignoring the mediator, was significant, b = -0.82, t = -46.97, p = <.001.

Table 4.40
PROCESS model results with OH as the Outcome variable (Step 1)

Model	coeff	se	t	p	LLCI	ULCI
constant	7.71	0.04	170.74	0.000	7.63	7.80
TD	-0.82	0.01	-46.97	0.000	-0.85	-0.79

Step 2 showed that the regression of the Technology disruption (TD) with Competence adequacy (CA) was also significant, b = -0.974, t = -60.59, p = <.001.

Table 4.51
PROCESS model summary with TD – CA (Step 2)

R	R-sq	MSE	F	df1	df2	p
0.91	0.84	0.33	3671.57	1	913	0.000

Step 3 of the mediation process showed that the mediator (CA), controlling for Organisational health, was significant, b = .84, t = 30.31, p = <.001.

Table 4.52
PROCESS model results with CA as the Outcome variable (Step 2)

Model	coeff	se	t	p	LLCI	ULCI
constant	7.72	0.04	183.18	0.000	7.63	7.80
TD	-0.97	0.01	-60.59	0.000	-1.00	-0.94

Then a series of regression models are fitted as given in Tables 4.59 to 4.64, first predicting the mediator variable using the independent variable (CA-OH); then the dependent variable using both the independent variable and the mediator (TD-CA-OH); and finally the dependent variable using the independent variable (TD-OH).

Table 4.53
PROCESS model summary with TD–CA-OH (Step 3 & 4)

R	R-sq	MSE	F	df1	df2	p
0.93	0.87	0.21	4415.94	2	912	0.000

Step 4 of the analysis revealed that, controlling for the mediator (CA), Technology disruption with Organisational health was not a significant, b = -0.0001, t = -0.0023, p =.99.

Table 4.54
PROCESS model results with OH as the Outcome variable (Step 3 &4)

Model	coeff	se	t	p	LLCI	ULCI
constant	1.18	0.22	5.32	0.000	0.74	1.62

CA (Step 3)	0.84	0.02	30.31	0.000	0.79	0.90
TD (Step 4)	-0.00	0.03	-0.00	0.99	-0.06	0.06

Effect size explains the magnitude of variance in the model contributed by all the relational path to the dependent variable. The researcher might be interested to know the contribution by individual path in relation to each other in the mediation model, especially the effect of a mediator on the dependent variable. The researcher could assess the effect size for every path in the model, and also the mediated effect of the mediator variable itself. The value ranges of R^2 and its proportionate effect sizes were determined based on the suggestions given by Cohen (1988). The recommended R^2 values and corresponding effect sizes are given in Table 4.65.

Table 4.55
The Cohen's (1988) benchmark range of effect sizes:

Range of R^2	The Effect Size
Below 0.13	Small Range
Between 0.13-0.26	Medium Range
Above 0.26	Large Range

Table 4.66 shows the effect size of mediation of CA in the PROCESS model analysis showed 0.7419 which is at the large range as per the effect size table defined by Cohen (1988). This reconfirms that CA has a significant mediation effect on the negative relationship between TD and OH.

Table 4.56
R squared mediation effect size of CA

	Effect	Boot SE	BootLLCI	BootULCI
CA	0.74	0.01	0.71	0.77

A Sobel test was conducted to assess the extent of mediation and was evidenced a full mediation in the model ($z = -27.108$, $p < .001$) as shown in table 4.66.

Table 4.57
Sobel normal theory tests for indirect effect

Effect	se	Z	p
-0.82	0.03	-27.10	0.000

The proof is in line with the hypothesis that Competence adequacy fully mediates the relationship between Technology disruption and Organisational health. For this situation, while the independent variable (TD) was a noteworthy indicator for both the dependent (OH) and the mediating variables (CA), it is no more significant near the mediating variable; affirming the intervention impact. A measure for the indirect impact of TD on OH is additionally introduced after the regression models. For this situation the impact size was –0.82, with a 99% confidence interval which did exclude zero; that is to say the impact was essentially significant that zero at α = .00.

Effect size, f^2 is used to measure the variation of the predictor variable's determination coefficient. It exhibits the strength of independent variable's influence on determining the dependent variable (Gotz, Liehr-Gobbers, & Krafft, 2010). Effect size, f^2 can be assessed by the following formula:

$$f^2 = \frac{(R^2_{included} - R^2_{excluded})}{(1 - R^2_{included})}$$

The scope of estimations of f^2 and its relative impact size in light of definition by Cohen (1988) is given in Table 4.68.

Table 4.58
The Cohen's (1988) benchmark range of effect sizes:

Value of f^2	The Effect Size
Below 0.15	Small Range
Between 0.35-0.15	Medium Range
Above 0.35	Large Range

Previous quantitative studies on mediation models demonstrated that percentile based bootstrap and bias corrected bootstrap methods reduced the rate of type 1 errors and also it boosts the power of prediction of mediation effects. Such methods follow the re sampling and product techniques using asymmetric confidence limits (MacKinnon et al., 2002). Thus, while running the mediation analysis in this study these methods were employed while generating the values of mediation impacts.

Table 4.59
Mediation effect size calculation table

	Mediator Included	Mediator Excluded	R^2 difference	f-squared	Effect size
R-squared	0.87	0.74	0.13	1.12***	Large

*Note: Effect size of f >0.35 (large) ***, >0.15 (medium) **, >0.02 (small) * (Cohen., 1998).*

Based on the mediation test conducted as above, the calculation of r^2 and f^2 is given in the table 4.69. The f^2 value as per the formula is at 1.122 which falls in the large range as per Cohen (1998) threshold. That means Competence adequacy (CA) has significant mediation effect on the relationship between Technology disruption (TD) and Organisational health (OH). This establishes the support of the hypothesis 6 on mediation effect of CA on TD->OH.

4.17 Moderation Analysis

A variable that influences the quality of causal impacts from an independent variable to its dependent variable can be termed as a moderating variable (Aiken & West, 1991). Exploration question 6 and 7 have produced two hypotheses that require an assessment of the moderating impact of innovation capacity and competence building on the path of Technology disruption and Competence adequacy. The moderation impact of the two variables described in the model were tested using two distinct methods. First being the regression path analysis with AMOS graphic and the second being the PROCESS technique developed by Hayes, (2012). The regression analysis in AMOS is done through a hierarchy of tests with and without involving the said moderators in the relationship path. To conduct the hierarchical regression effectively, an interaction term in addition to the moderator needs to be established between the predictor and resultant variables (Hair et al., 2006). Such an interaction term is the product of moderator and the independent variable.

Since this study employed the AMOS package to establish the model fit statistics from the goodness of fit and establish the construct validity of the measure used. However, it is reasonable to explain why this study chose to use hierarchical regression method to analyse the hypotheses postulated in this study. There were two purposes of this moderation test. First, this test intended to examine the predictive power of TD on CA. Second, the test intended to examine the moderating effect of IC and CB on the relationships between TD and CA. The achievement of the objectives of this study was more reliable through conducting the regression analysis as the mean to test the hypotheses. However, the refined model obtained through the EFA and CFA processes was used to perform the hierarchical regression analyses.

On the other hand, the confirmatory factor analysis has been proposed as a proper strategy for distinguishing moderating effect (Hair et al., 2006; Zainudin, 2012). Scholars who concentrated on the systems to break down the moderating effect, found that the multi-group investigation was all the more intense in distinguishing the moderator impacts contrasted with hierarchical regression test. However, in this research, it was observed that the suggested moderating variables, Innovation Capacity, and Competence building are continuous in nature, and a seven point likert scale was used. It was noticed that due to the central tendency effect, a large number of observations (12% of total responses) were rated on the mid-point scale, which is four (4). Due to this, it was inappropriate to split the data into two halves as low and high as the mid value does not really signify the distinguishable strength. Owing to this reason, the researcher decided to do the moderator test using the method suggested by Barron and Kenny (1986) with hierarchical regression modeling. To assess the moderating effect of IC & CB, hierarchical multiple regression model was used.

While estimating the interaction effect or moderating effect of a third variable on the relationship path between the variables under this study such as TD and CA, it is crucial to demonstrate that the way of this relationship changes as the estimations of the moderating variable changes. An interaction item as the product of the TD and IC or CB was incorporated as an interaction item into the respective models to check if such an interaction is still significant it support explanation of variance between dependent and independent variables under certain conditions. In more express terms, the accompanying steps were taken after:

To begin with, every one of the variables was standardised to make elucidations simpler a while later and to keep away from multicolliniarity. Second, in the customary regression list in SPSS, the variables were coded and item terms for the predictor and moderator variables were physically made. Thirdly, a regression model was plotted foreseeing the outcome variable CA from both the predictor variable TD and the moderators IC and CB as isolated blocks). Both impacts and the model as a rule ought to be significant to demonstrate the moderating impact. At last, the interaction effect was added to the past model and checked for a noteworthy R2 change and also a huge impact by the new interaction term. On the off chance that both are significant, then the moderating effect is confirmed.

- Complete moderation happens when if the predictor and moderator are not significant after adding the interaction term into the model.
- With the addition of interaction term, if the predictor and moderator are still significant with the main effects also being significant, then there is partial moderation has occurred.

To reconfirm the presence of moderation effect another computational tool called PROCESS macro developed by Andrew F. Hayes (Hayes, 2012) was put in use, which does the centering, and interaction terms automatically. In the PROCESSS, which essentially employs Johnson-Neyman technique (Bauer & Curran, 2005; Hayes & Matthes, 2009), which infers the worth along the spread of moderator at which the impact of predictor on the dependent variable moves between statistically significant and not significant at a minimum required α level of significance

The above two methods (AMOS hierarchical regression and PROCESS macro) were analysed and the results explained below for testing the moderations of IC and CB on the path of TD-CA.

4.17.1 Moderation analysis of Competence Building

As clarified by Cohen (1983), a moderating variable is an interaction variable (M) that enhances the precision of a predefined independent (X, e.g. here Technology Disruption) to dependent Y, e.g. here Competence Adequacy) variable relationship. It is best, however not generally the situation, for M to be inconsequential with X and Y, which gives an all the more effortlessly deciphered measurement for the multiplicative association term X*M; (Baron & Kenny, 1986; Chow & Coulton, 1998; Koeske & Koeske, 1992).

To analyse the study hypotheses that the Competence adequacy is a product of multiple dependent factors , and more specifically whether Competence building initiative moderates the relationship between Technology disruption and Competence adequacy, a hierarchical multiple regression analysis was conducted. The hypothesis for moderation of CB is restated below:

Hypothesis 7: Competence building moderates the relationship between Technology disruption and Competence adequacy.

As a first step of moderation analysis, two variables were included separately into the path diagram to the dependent variable: Technology Disruption and Competence Building to Competence Adequacy. High levels of multicollinearity may cause potential issues with the interaction terms and thus to avoid this, the variables (TD, CB and CA) were centered and dummy coded. Secondly, an interaction term (see, Aiken & West, 1991) as a multiple of predictor and moderator (TD_x_CB) between Technology disruption and Competence adequacy was created in AMOS graphic. Secondly, a regression model was fitted to predict the outcome variable from both the predictor and moderator variables.

Figure 4.21 presents the path analysis of the Competence building (CB) as Moderator on the path, Technology disruption (TD) and Competence adequacy (CA). A moderator clarifies how much the degree and extent of an autonomous variable's impact on another result variable of interest relies on upon a third association variable on the path (Hayes, 2012). Diagrammed theoretically, the most straightforward moderation model shows up as delineated in Figure 4.21. As represented in the figure, TD (call it X) is portrayed to apply a causal impact on CA (call it Y), reflected by the unidirectional arrow indicating from X to Y. In any case, this impact is proposed as affected or directed by CB (call it M), thus the bolt indicating from M Y furthermore the bolt indicating from X Y. The result of X and M are delineated in the structural model as TD_x_CB. This theoretical model does not delineate the measurable model, which means how the different impacts are assessed scientifically in the data analysis.

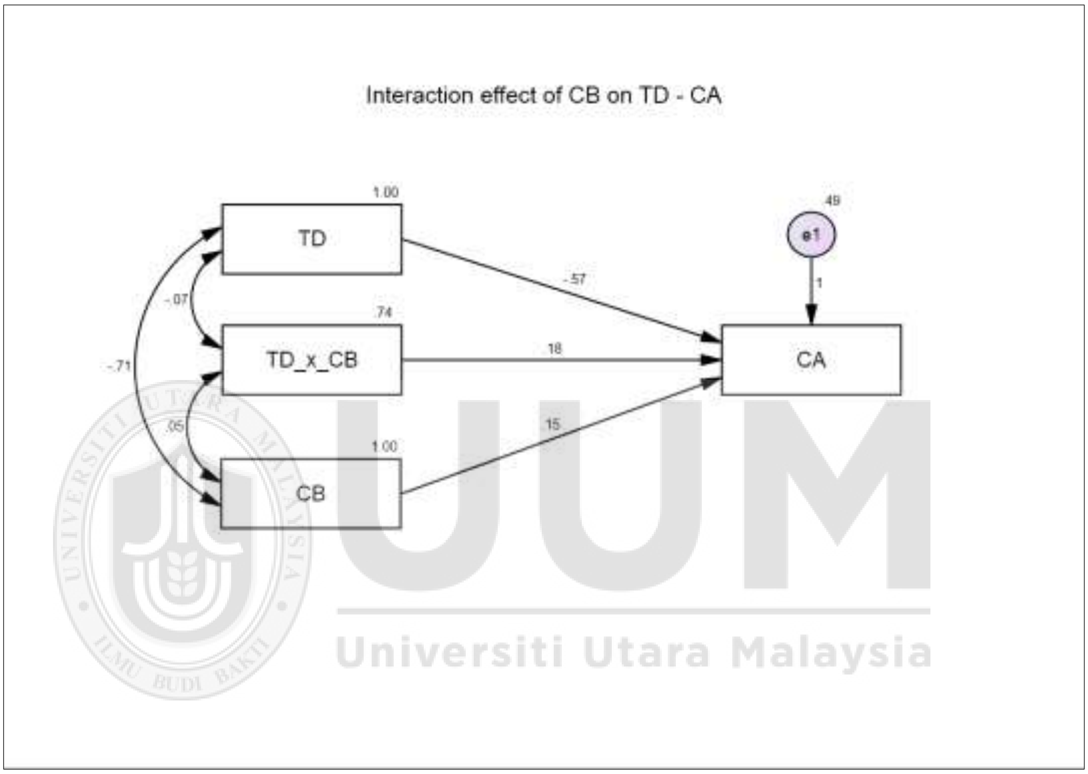

Figure 4.21
AMOS structural model on moderation of CB between TD and CA

The statistical model takes the type of a direct liner equation (Aiken and West, 1991; Jaccard and Turrisi, 2003) in which Y is assessed as a weighted capacity of X, M, and, most commonly, the result of X and M (XM), as in comparison underneath:

$Y = i + c_1X + c_2M + c_3XM + eY$

Where X is the independent variable, Y is the dependent variable, M is the moderating variable, X is the independent variable, XM is the product of independent and moderating variables, and c is the effect of the respective variable on Y. Using the variables in question here in the study, the formula can be depicted as below:

$CA = i + c_1TD + c_2CB + c_3(TD\_x\_CB) + e\ CA$

Strategies portrayed by Cohen and Cohen (1983), Baron and Kenny (1986) and Aiken and West (1991) augment the limits of the ANOVA to a straight REGRESSION structure that can suit both dichotomous (categorical) and numerical (continuous) moderating variables.

Table 4.60
Regression weights of CB moderated relationship between TD and CA

Hypothesis			Estimate	S.E.	C.R.	P Value	Result
CA	<---	TD	-0.57	0.03	-17.35	***	Significant
CA	<---	TD_x_CB	0.18	0.02	6.82	***	Significant
CA	<---	CB	0.14	0.03	4.42	***	Significant

The moderation regression result (Table 4.69) from the structural equation model showed that the probability of getting a critical ratio for the relationship between TD and CA when CB enters the model (TD_x_CB) is significant with an absolute value of 6.85. Regression coefficient value of TD in prediction of CA when CB is present in the model is significantly different from zero at the 0.01 level (two-tailed). This result confirms that CB moderates the relationship between TD and CA.

To confirm the moderation effect as evidenced by the regression analysis of moderated models using AMOS (Table 4.69), the researcher has used PROCESS (Hayes, 2012), a macro developed for SPSS which computes the moderation and mediation results along with the combination of such measures in an integrated conditional context. PROCESS uses path analysis framework to describe the moderation effect of the interaction terms in a model. In addition to estimating the coefficients of a model using OLS regression (for continuous outcomes), PROCESS generates direct and indirect effects in moderation models.

The essential center in a moderation model is the coefficient for the result of the autonomous variable (TD) and the moderator (CB) and its test of centrality. Subsequent to running the PROCESS full-scale definition code, execution of the PROCESS created the yield as given in Table 4.70. As shown in Table 4.72, the coefficient for the item, TD_x_CB is 0.1306, which is measurably not the same as zero ($p < .001$). PROCESS likewise shows the extent of the total variance in the result, extraordinarily inferable from the interaction, and in addition a test of significance.

Table 4.71
Details of the moderated model in PROCESS (Hayes, 2012)

Model = 1		
Y	=	CA
X	=	TD
M	=	CB
Sample size	915	

The interaction item model regressed using PROCESS macro is significant at p<.01with an R^2 value of 0.5115 (f=298.79) as shown in Table 4.72.

Table 4.72
PROCESS model summary with TD-CB- CA

R	R-sq	MSE	F	df1	df2	p
0.71	0.51	0.51	298.79	3	911	0.000

Table 4.72 shows that the regression values of CB and TD on CA are significant at p<.01 and more importantly the interaction item (TD_x_CB) also turned out to be significant, showing evidence of the moderation effect of CB.

Table 4.73

PROCESS model regression results with TD-CB- CA

Model	coeff	se	t	p	LLCI	ULCI
constant	4.49	0.03	134.94	0.000	4.42	4.55
CB	0.13	0.03	4.06	0.000	0.06	0.19
TD	-0.46	0.03	-15.47	0.000	-0.52	-0.40
TD_x_CB	0.13	0.02	6.26	0.000	0.08	0.17

As can be seen in Table 4.74, PROCESS offers lower, middle, and high levels of moderator as percentiles when estimating the conditional effects of moderator. The effect of TD on CA at lowest percentile of CB (-1.1536) shows at -0.6191 which decreases to -0.4685 at medium level of CB and further decreases to -0.3178 at higher percentile of CB (1.1536) with all the three effects showing p values >0.01.

Table 4.74

Conditional effect of TD on CA at values of the moderator CB

CB	Effect	se	t	p	LLCI	ULCI
-1.15	-0.61	0.04	-14.41	0.000	-0.70	-0.53
0	-0.46	0.03	-15.47	0.000	-0.52	-0.40
1.15	-0.31	0.03	-9.39	0.000	-0.38	-0.25

From the above analysis of PROCESS it is clearly evident that CB moderates the negative relationship between TD and CA, as such at lower levels of Competence Building initiatives in the firm, Technology disruption may cause higher impacts on Competence adequacy and conversely at higher levels of Competence building, the effect of Technology disruption on Competence adequacy may be much lower than otherwise.

To generate the graphical representation of the interaction effect the researcher used the two-way interaction method suggested by Aiken and West (1991) and Dawson (2013). This was done by entering the unstandardized regression coefficients of independent variable (TD = -0.57), moderating variable (CB = 0.15) and the dependent variable (CA = 0.18) into a spreadsheet devised by Dawson (2013). The model generated the graph as in Figure 4.22.

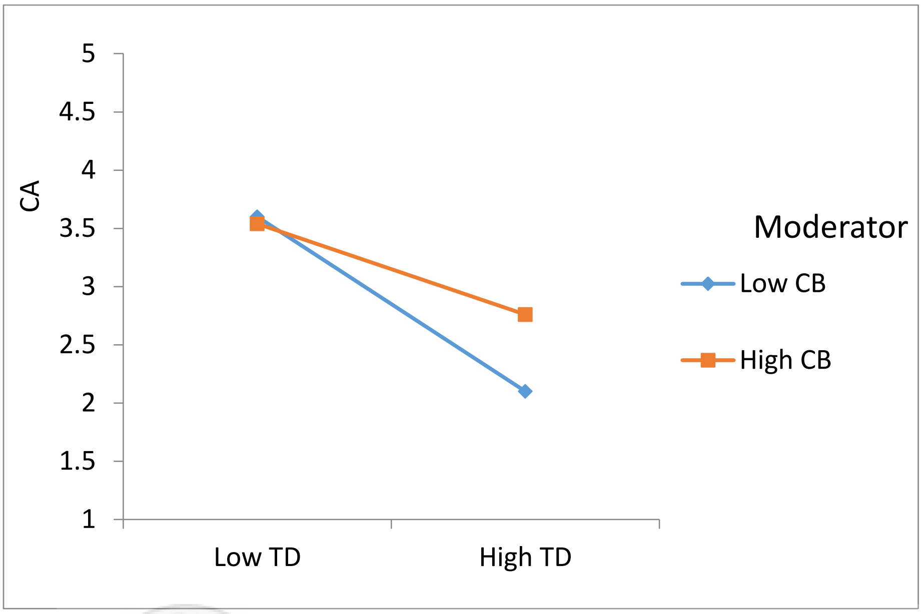

Figure 4.22
Interaction effect of CB on TD & CA

A graphical representation of the values of TD on CA as a product of CB gives a focused view of the moderating relationship of CB. Figure 4.22 shows a graphical image of continuous variable CB moderating the negative impact of Technology disruption caused on the level of Competence adequacy of the firm. A gradual slope of change can be seen between TD and CA for lower levels of competence building efforts, which leads to the inference that when efforts towards competence building in a firm reduces the impact of Technology disruption will create larger dent in the Competence adequacy. As such when sustained competence building efforts can reduce the impact of Technology disruption though the same cannot be eliminated fully. This explains that the negative relationship between Technology Disruption and Competence Adequacy is dampened by the interaction of Competence Building, which supports the hypothesis H7.

4.17.2 Moderation analysis of Innovation Capacity

The question of 'how' a change in variable leads to the change in another variable is statistically explained by mediation analysis (Judd & Kenny, 1981; Baron & Kenny, 1986; MacKinnon, Fairchild, 2009), whereas if one wants to find out 'when' such changes happen in the dependent variable is generally analysed through moderation studies (Aiken & West, 1991; Jaccard & Turrisi, 2003). As restated in this chapter, the Hypothesis 8 on moderation is as below:

Hypothesis 8: The relationship between Technology disruption and Competence adequacy is moderated by Innovation Capacity.

The above said hypothetical relationship is tested in the initial step through a hierarchical regression test in the introductory model. In the second model, a further test on specific interaction effect is conducted through a t-test. The t-test result provides the coefficient of interaction (XM) which explains the variance in the relationship between TD and IC when XM is interacts with the path (Jaccard, Turrisi & Wan, 1990; Aiken & West, 1991). Due to the presence of multiple variables in the model, often the problem of multi-collinearity arises that dampens the power of the test to accurately recognize the interaction effect (Holmbeck, 2002). To reduce this error, as an alternative, the moderating and predictor variables may be centered at their mean value (given as Xmean_Xi), creating a sample mean zero value and regression coefficients that are translated as the effect of the indicator on the slope with the other indicator held consistent at its mean (Aiken & West, 1991; Coulton & Chow, 1992).

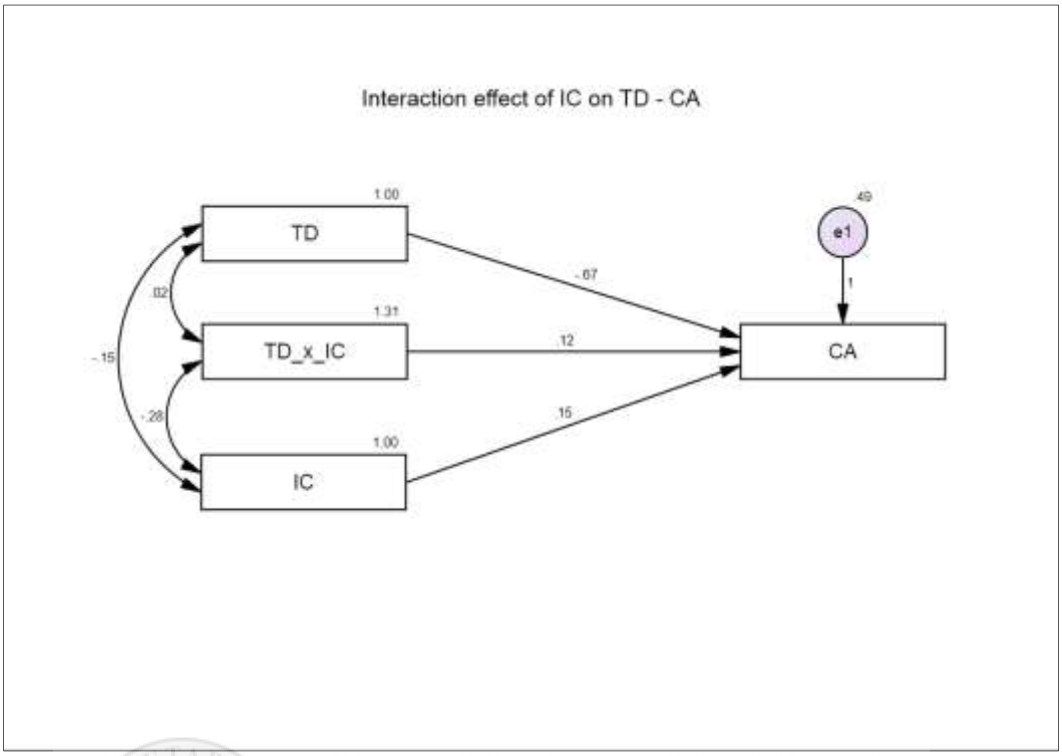

Figure 4.23
AMOS graphic path analysis for moderation effect of IC on TD and CA

Figure 4.23 presents the path analysis of the Innovation Capacity (IC) as Moderator on the path, Technology disruption (TD) and Competence adequacy (CA). Moderation explains how much the extent and magnitude of an independent effect of a variable on a different output variable is dependent on a third interaction variable in the relation path (Hayes, 2012). As depicted here, TD is represented to show a causal impact on CA with an unstandardized regression coefficient of -0.67, which means that one unit change in TD, will result in 0.67 unit reduction of CA. However, this effect may be influenced by IC, which as per the Figure 4.23 gives indication that the unstandardized regression coefficient increases to 0.12 effectively nullifying the effect of TD on CA and influencing the relationship to a positive direction. Table 4.75 is the evidence that the interaction of effect of IC on TD (TD_x_IC) is significant ($t = 5.11$, $p < 0$) at various interval values of IC.

Table 4.75

Regression weights of the moderation of IC on TD and CA

Hypothesis			Estimate	S.E.	C.R.	P	Result
CA	<---	TD	-0.66	0.02	-28.44	***	Significant
CA	<---	TD_x_IC	0.12	0.02	5.85	***	Significant
CA	<---	IC	0.15	0.02	6.33	***	Significant

The moderation regression result (Table 4.75) from the structural equation model showed that the probability of getting a critical ratio for the relationship between TD and CA when IC enters the model (TD_x_IC) to the extent of absolute value of 5.855 is .000. In other words, the regression weight for TD in the prediction of CA when IC is present in the model is significantly different from zero at the 0.01 level (two-tailed). This result confirms that IC moderates the negative relationship between TD and CA.

To confirm the moderation effect as evidenced by the regression analysis of moderated models using AMOS (Table 4.75), the researcher has used PROCESS (Hayes, 2012), a macro developed for SPSS which computes the moderation and mediation results along with the combination of such measures in an integrated conditional context. PROCESS makes use of a path framework to describe the moderation effect of the interaction terms in a model. In addition to estimating the coefficients of a model using OLS regression (for continuous outcomes), PROCESS generates direct and indirect effects in moderation models.

The essential center in a moderation model is the coefficient for the result of the autonomous variable (TD) and the moderator (IC) and its test of centrality. Subsequent to running the PROCESS full-scale definition code, execution of the PROCESS created the yield as given in Table 4.75. As can be found in Table 4.76, the coefficient for the item, TD_x_IC is 0.1204, which is measurably not the same as zero ($p < .001$). PROCESS likewise shows the extent of the total variance in the result extraordinarily inferable from the interaction and in addition a test of significance

Table 4.76
Details of the moderated model in PROCESS (Hayes, 2012)

Model = 1		
Y	=	CA
X	=	TD
M	=	IC
Sample size	915	

The interaction item model regressed using PROCESS macro is significant -at p<.01with an R2 value of 0.50 (f=322.65) as depicted in table 4.77.

Table 4.77
PROCESS model summary with TD-IC- CA

R	R-sq	MSE	F	df1	df2	p
0.7128	0.50	0.52	322.65	3	911	0.000

Table 4.78 indicates the regression values of IC and TD on CA are significant at p<.01 and more importantly the interaction item (TD_x_IC) also turned out to be significant, showing evidence of the moderation effect of IC.

Table 4.78
PROCESS model regression results with TD-IC- CA

Model	coeff	se	t	p	LLCI	ULCI
constant	4.37	0.02	176.463	0.000	4.32	4.42
CB	.19	0.03	5.12	0.000	0.11	0.26
TD	-0.54	0.02	-26.91	0.000	-0.58	-0.50
TD_x_IC	0.12	0.02	5.11	0.000	0.07	0.16

As shown in Table 4.79, PROCESS offers lower, middle and high levels of moderator as percentiles when estimating the conditional effects of moderator. The effect of TD on CA at lowest percentile of IC (-0.83) shows at -0.64 which decreases to -0.5464 at medium level of IC and further decreases to -0.4463 at higher percentile of IC (0.8310) with all the three effects showing p values >0.01.

Table 4.79
Conditional effect of TD on CA at values of the moderator IC

IC	Effect	se	t	p	LLCI	ULCI
-0.83	-0.64	0.02	-24.08	0.000	-0.69	-0.59
.00	-0.54	0.02	-26.91	0.000	-0.58	-0.50
0.83	-0.44	0.02	-15.15	0.000	-0.50	-0.38

From the above analysis of PROCESS it is clearly evident that IC moderates the negative relationship between TD and CA, as such at lower levels of Innovation capacity initiatives in the firm, Technology disruption may cause higher impacts on Competence adequacy and conversely at higher levels of Innovation capacity, the effect of Technology disruption on Competence adequacy may be much lower than otherwise.

In contrast to the visual plots generate through the ANOVA models, regression tests required deeper analysis to test and detest the presence of the moderating effect in a model. The contingent effect on X are figured at different M values (+/_1 standard deviation from the mean or at important cut points, for example, a demonstrative score) and the slopes of the regression line are plotted (Aiken & West; 1991; Cohen & Cohen, 1983). This methodology changes a continuous variable moderator into an categorical variable and yields a figure closely resembling Figure 4.24 with the exception of that it delineates an anticipated (in light of regression coefficients) instead of observed (in light of test means) slope for IC change. To generate the graphical representation of the interaction effect the researcher used the two-way interaction method suggested by Aiken and West (1991) and Dawson (2013). This was done by entering the unstandardized regression coefficients of independent variable (TD = -0.67), moderating variable (IC = 0.15) and the dependent variable (CA = 0.120) into a spreadsheet mad by Dawson (2013). The model generated the graph as in Figure 4.24.

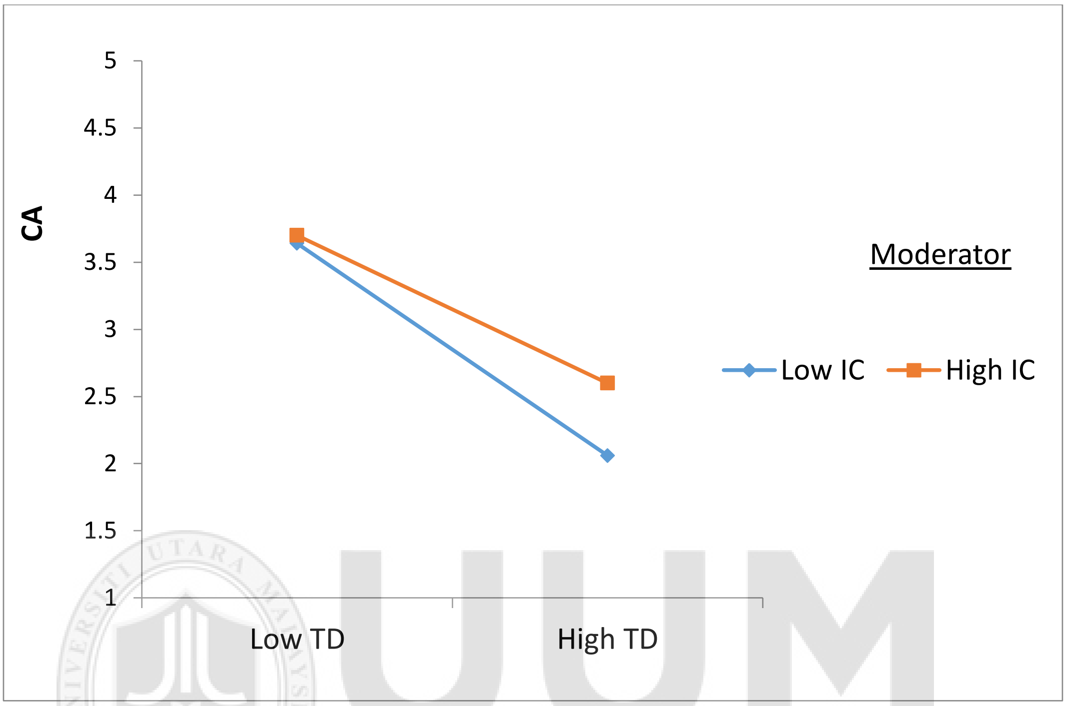

Figure 4.24
Interaction effect of IC on TD & CA

The graph is Figure 4.24 shows a sample plot of continuous variable IC moderating the negative impact of Technology disruption caused on the level of Competence adequacy of the firm. We see a higher slope of change between TD and CA for lower levels of Innovation capacity, which leads to the inference that when firm's overall innovation capacity increases, Technology disruption will have reduced impact on Competence adequacy though the same cannot be eliminated fully. As such when concentrated efforts to improve and encourage innovation behavior in firm is beneficial in the long term as it prepares the firm for unpredictable technology disruption situations. This explains that the negative relationship between Technology Disruption and Competence Adequacy is dampened by the interaction of Innovation Capacity supporting hypothesis H8.

4.18 Structural Equation Model

The initial part of this chapter elaborated the descriptive aspects of the data collected and other sections covered the inferential statistics in terms of goodness of fit measures at item, dimension and constructs levels. This section takes forward the evaluated measurement models of each construct into the theoretical model to test the hypotheses put forward in this study. Holmes-Smith, (2006) characterized the estimation model as the structure which evaluates model fit of the relationship between the items of measurement with the latent construct. The estimation model primarily examines the reliability and validity of the latent construct through the confirmatory factor analysis in a measurement model (Anderson & Gerbing, 1982). After having tested the model fitness, this section builds up the structural model to test relationship among various constructs within the same model (Schumacker and Lomax, 2004).

A structured sequence of techniques, which analyse the relationship among a group of variables in a single model whether dependent or independent and continuous or discrete, is known as Structural Equation Modelling (SEM) (Tabachnick and Fidell, 2001). SEM has become a popular statistical tool, which is widely used by researchers and academicians (Bentler, 1980; Hair et. al., 1995; Homles-Smith et. al., 2006).

SEM facilitates simultaneous assessment of relational dependencies among a set of observed or unobserved constructs defined by a number of measurement items (Hair et. al., 1995; Schumacker & Lomax, 1996). The assumption of causal relationship between two variables (X & Y) is leveraged by SEM to assess the strength and direction this relationship as changes in X causes proportionate changes in Y. In addition to effectively analyzing the causal relationship among latent constructs, Structural Equation is also efficient to measure the variance and covariance, linear regression, factor analysis and hypothesis testing (Joreskog & Sorbom, 1996). As put forth by Anderson and Gerbing (1988), SEM serves as a combination of assessment techniques where all the constructs in the model are corroborated for assessment, correction and re modification. Social scientists have found this SEM feature as extremely useful while defining and re defining models. Hence, this method is widely used across by scholars (DeWulf et. al. 2001; Wang et. al. 2006; Palmatier et. al. 2006).

Figure 4.25 explains the hypothesized relationship of variables in a structural model. The oval represents the latent variables in the model with the rectangles representing the dimensions of the variables. Within each dimension, there are response items of measurement, which are depicted in the specific measurement model of each variable as explained in the earlier sections. The shaded small circles with each dimension represent the estimated measurement error or residuals.

Single headed arrow between the variables represents the directional relationship between the respective variables. The number beside the single headed arrow to the dimensions represents the respective factor loading and the number next to the rectangle is the respective R^2 value.

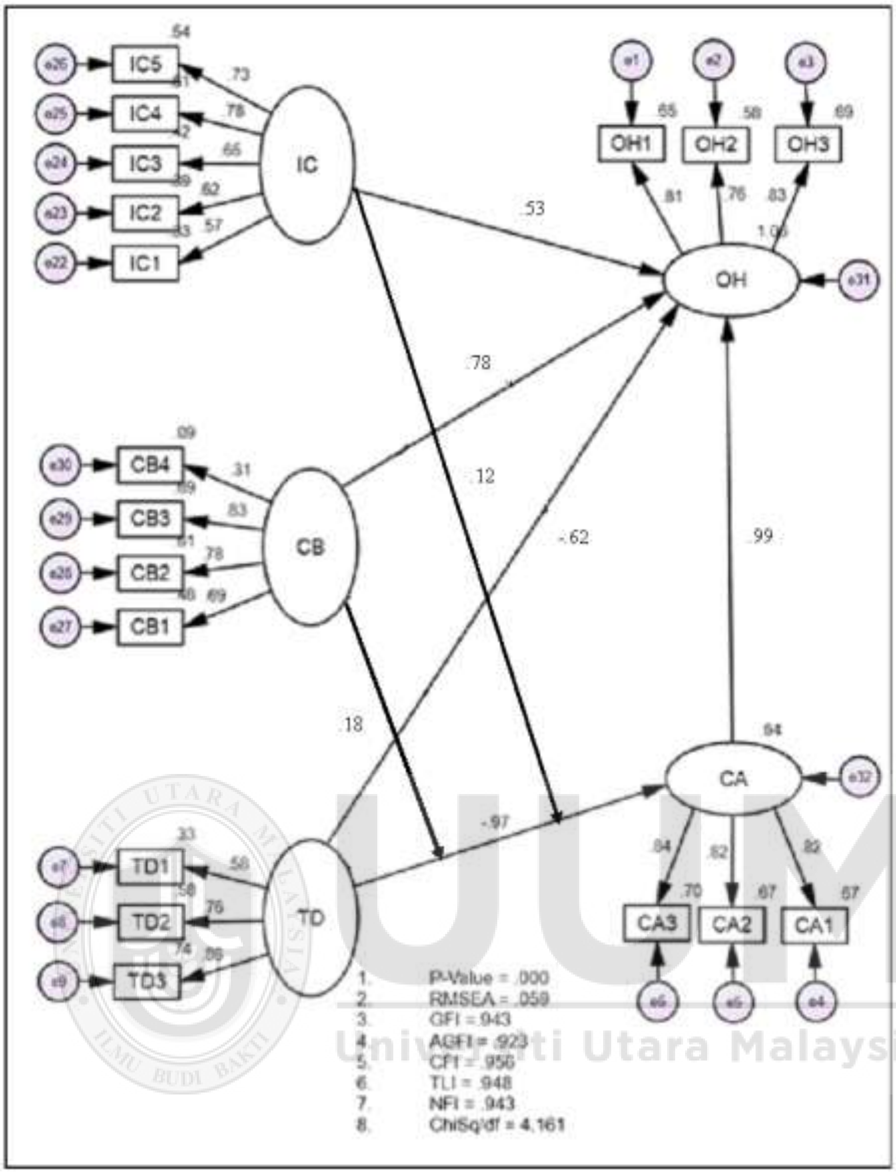

Figure 4.25
Structural model of independent and dependent variables

The number beside the single headed arrow between the constructs is the standardized beta value of the specific relationship depicted. The number beside the double-headed arrow represents the covariance between the constructs.

Table 4.80
Fitness indices of structural model

Category	Index	Index Value	Level of Acceptance
Absolute Fit	RMSEA	0.05	Required level achieved
Incremental Fit	CFI	0.95	Required level achieved
Parsimonious Fit	ChiSq/df	4.16	Required level achieved

As elaborated in the earlier sections under the measurement models, SEM, through the fitness classes and indices can examine the reliability, validity, and uni-dimensionality of the construct (Bollen, 1989, Kline, 1998, Hair et. al., 1995; Kline, 2005). Maximising the covariance among the constructs, SEM not only evaluates the overall model fit, but also appraises the individual parameters to give the best possible model fitness to the data. Leveraging the strength of confirmatory factor analysis of SEM, this study employed the methodology of Analysis of Moment Structures (AMOS) as put forward by Arbuckle (2005). AMOS statistically explores the factual relationship between elements of the variables within and among the elements of different variables, as such in this study the dependent variables (TD, CA, IC & CB) and independent variables (CA & OH). Highlighting the causal path diagram in the graphic in AMOS, the researcher further can estimate, indicate, and present the hypothesized model including all variables on a single platform. In addition, the hypothesized model with all variables included can be tested against the empirical model. As such, any path relationship, which is not suitable in the model, can be re-defined and modified for absolute and incremental fit.

The displaying procedure of SEM includes two models, to be specific, the structural model and measurement model. The order of such model testing is important as the measurement model with confirmation of factors comes first before the structural model can be estimated for fitness. The procedure of model specification and estimation includes distinguishing indicators, determining every variable and assessing every construct for uni-dimensionality, validity, and reliability. CFA was utilized to give a confirmation test of the estimation scale (Zainudin, 2012).

Path Coefficient estimates are used to check the significant relationship between constructs. So as to find out the significance of the variance, t-Statistics were calculated using Bootstrapping technique based on 1000 resampling iteration. The outcomes of the path relationship and direction are presented in Table 4.81.

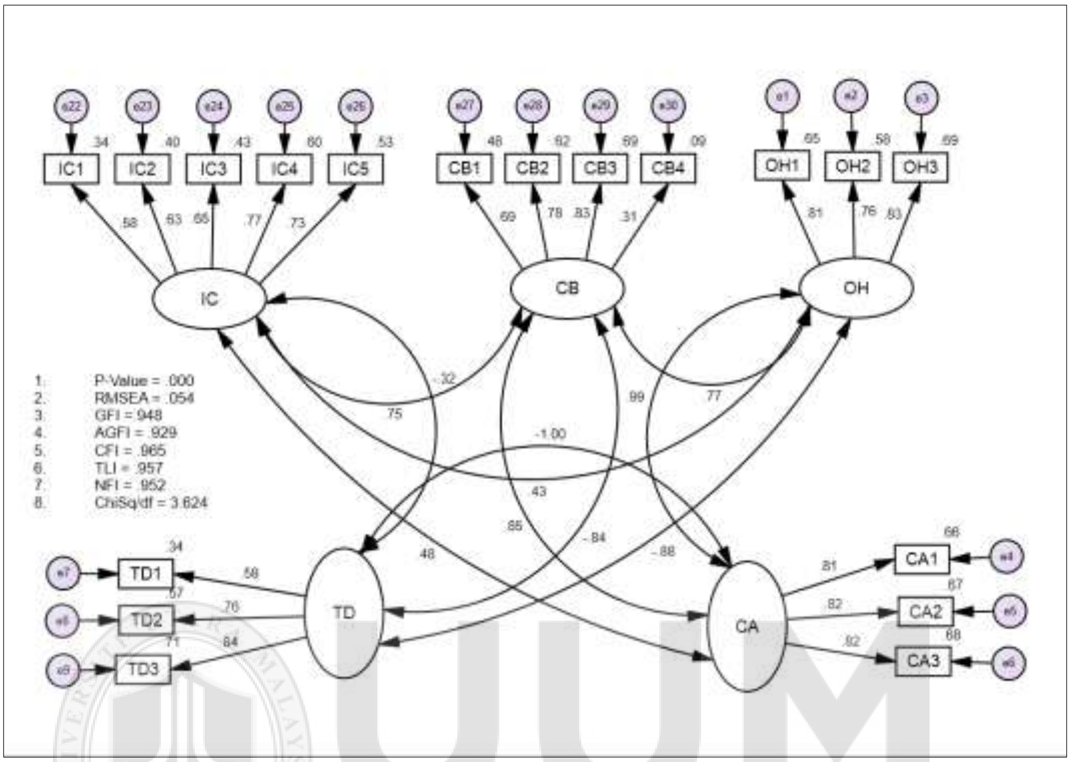

Figure 4.26
Pooled measurement model

Although in the pooled measurement, model all the variables are correlated; only five relationships were tested for significant path coefficients, which are the coefficients between the indirect and direct variables. All these paths were found to be significant with three paths (TD-OH, TD-CB and TD-CA) showing negative correlation (-.88, -.84 & -1) as expected. The fit indices of the pooled measurement model also were found at acceptable levels as per Table 4.81.

Table 4.81
Fitness indices of pooled measurement model

Category	Index	Index Value	Level of Acceptance
Absolute fit	RMSEA	0.05	Achieved specified level
Incremental fit	CFI	0.96	Achieved specified level
Parsimonious fit	ChiSq/df	3.62	Achieved specified level

It is recommended that the first stage of the model analysis, that is, the measurement model estimation, should provide adequate evidence of model fitness before the model can be put through the second and main test procedure of structural model estimation (Holmes-Smith et. al., 2006; Hair et. al., 2006; Zainudin, 2012). Consequently, the motivation behind the establishing the two stage structural model as per analysis of moment structures is to examine the set of hypotheses with a specific end goal to answer the research questions sketched out in Chapter III. The pooled structural model (Figure 4.26) was tried utilizing the AMOS (version 20.0) program with maximum likelihood estimation. To measure the correlation among the variables, the second order constructs were parceled into first order constructs to establish correlation within a structural model. The model fit indices (Table 4.80) indicated absolute, incremental and parsimonious fit of the model. In addition, the model also highlighted the correlation among the variables, for example, TD as expected is negatively correlated with CA and OH. In the same way CA, IC and CB are positively correlated with OH.

The first part of this chapter centered on building up an estimation model that fulfilled validity, reliability, and uni-dimensionality. Zainudin’s (2012) proposition of structural model is a simultaneous pool of measurement models with hypothesized causal or correlational conditions between and among the constructs on the model. The latent variables in the model are pooled into a single platform to depict the inter collation of the variables. To strictly follow the criteria set forth for the structural equation, such measures and items follow suggested standards were eliminated or modified to ensure that the model absolutely fit the requirements.

The subsequent section is a very important part in this thesis as it evaluates and presents the hypotheses results that examine relationship among the variables as proposed in the theoretical model. The section examines the linear equations as well as the structural equations for cause and correlation, indicating the direction and strength of each such relationship.

4.19 Summary of Findings

This chapter reported the findings of this study. Initially, this study distributed the respondents according to some characteristics as exhibited in the demographic variables. The next step was to establish the construct validity of the measure through performing EFA and CFA employing SPSS and AMOS statistical packages. In addition to that, a detailed discussion on the construct validity was provided to ensure the quality of the model that was undertaken later to the hypotheses testing procedures.

Table 4.82
Summary of regression results

Regression			Estimate	S.E.	C.R.	P	Result
OH	<---	CA	0.99	0.03	27.46	***	Significant
CA	<---	TD	-0.77	0.02	-29.06	***	Significant
OH	<---	TD	-0.62	0.02	-21.91	***	Significant
OH	<---	CB	0.78	0.04	19.04	***	Significant
OH	<---	IC	0.53	0.05	10.11	***	Significant
Mediation							
CA	<---	TD	-0.97	0.01	-70.48	***	Significant
OH	<---	CA	0.84	0.02	32.03	***	Significant
OH	<---	TD	0	0.02	-0.00	0.99	Not Significant
Moderation							
CA	<---	TD	-0.57	0.03	-17.35	***	Significant
CA	<---	CB	0.14	0.03	4.42	***	Significant
CA	<---	TD_X_CB	0.18	0.02	6.82	***	Significant
Moderation							
CA	<---	TD	-0.66	0.02	-28.45	***	Significant
CA	<---	IC	0.15	0.02	6.33	***	Significant
CA	<---	TD_X_IC	0.12	0.02	5.85	***	Significant

Table Moreover, to test the hypotheses of this study, Pearson correlation and hierarchical multiple linear regression was employed. The results of the study supported all of the hypotheses. The discussion, Tables and graphs in the preceding sub-sections were devoted to examine the results of the statistical techniques outputs.

4.82 summarized the findings obtained from the models discussed in this chapter. In light of the discoveries from the Pearson correlation analysis and the regression analysis as directed in this section, Table 4.83 outlined the results identified with the hypotheses testing results at the 0.001 significance level.

Table 4.83
Summary of hypotheses testing results

Hypo. Number	Hypothesis statement	Decision
H1	There is a positive significant relationship between Competence adequacy and Organisational health.	Supported
H2	Technology disruption has a negative relationship on the Competence adequacy.	Supported
H3	Technology disruption negatively relates to Organisational health.	Supported
H4	Competence building has a positive relationship with Organisational health.	Supported
H5	Innovation capacity has a positive relationship to Organisational health.	Supported
H6	Competence adequacy positively mediates the relationship between Technology disruption and Organizational Health.	Supported
H7	Competence building positively moderates the negative relationship between Technology disruption and Competence adequacy.	Supported
H8	The negative relationship between Technology disruption and Competence adequacy is positively moderated by Innovation Capacity.	Supported

Considering everything, the results of this study from Pearson correlation and multiple regression analysis uncovered that all the hypotheses were supported by the empirical results.

4.20 Summary

First part of this chapter elaborated on the survey data editing as collected from the online survey responses and getting the data ready for SPSS analysis through alphanumeric coding. Demographic profile of the data was presented through a descriptive statistics. Further, basic assumptions of data normality were checked and confirmed. Detailed data screening for outlier detection, homoscedasticity, reliability, and validity were conducted and presented in the earlier sections.

Progressively in subsequent sections, the data analysis at the construct level was done using two-stage SEM model. First stage of the SEM model described about uni-dimensionality of the construct using a confirmatory factor analysis using a measurement model technique in AMOS. At this stage, specific examination of the construct, dimensions and items were done to check if each item in the model satisfy the minimum requirement of satndardised factor loadings (i.e., >.50) and there is no correlation of variables within the construct with no factors showing correlation coefficient of more than 0.85. Lastly, the recommended goodness of fit indices examined and adequately fit within the model. The data analysis also undertook checking residual error items for redundancy and adjusting the items as per the modification indices.

Results showed that the measurement model of this study should have been be re-determined and tried again trying to give a more parsimonious model which will be utilized as a part of the suggested steps in the structural equation model. The adjusted measurement model gave sufficient fit to the data, and all indicators were loaded sufficiently onto their predetermined variables. Every dimension in the constructs was put through the test of validity and reliability. Average variance, composite reliability values, and Cronbach alpha values were presented in appropriate tables and show satisfactory results for reliability and validity of the constructs. All the constructs in the model were presented and confirmed having achieved the required level of reliability measures. Moreover, with a specific objective to affirm the validity for every construct, measures of convergent validity, construct validity and discriminant validity were tested and confirmed. With the support of confirmation of pre requisite test results, the data was further taken up for relationship analysis through the structural equation modeling.

Further sections of this chapter presented the hypothesized model estimation using a pooled measurement model using all variables in question to be tested for relationship hypothesis. In the second stage of evaluation five such path models were tested for hypothetic relationship (H1, H2. H3, H4 & H5). The results showed that all five hypotheses were proved significant and relationships in the path model. Further, the moderation and mediation analysis results were presented to test the remaining three hypotheses (H6, H7 & H8).

The following chapter discusses results in point of interest with a specific objective to address the research questions presented in Chapter I. Further, the chapter draws suggestions for both practical and theoretical aspects; examines the restrictions of this postulation; discuss the directions for future research; and finalises the study conclusions.

CHAPTER FIVE

DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter is the summation of the thesis with a brief discussion about the findings and the significance of these findings to various parties concerned. The relationship hypothesis as supported with the empirical evidence is taken up separately to discuss the implications to telecom industry, academia and policy makers. Further, a list of potential recommendations the concerned to address the identified problem is discussed in the recommendation section. The significant contributions provided by this study to various segments are elaborated in the contributions section. This chapter discusses each component of the theoretical framework in the wake of supportive evidence and literature. It highlights the few limitations of the study and proposes future research directions in view of the learnings from the study.

5.2 Summary of The Study

To understand and empirically test the hypothesized relationship among variables, this research developed a model with Technology disruption and Organisational health through the mediated role of Competence adequacy in Indian telecommunication companies in GSM technology space. To address the questions related to this research, this model extended the relationship hypothesis to identify the effect of Technology disruption, Competence adequacy, Innovation capacity and Competence building on Organisational health. Further, it examined the interaction influence of Innovation capacity and Competence building on the relationship between Technology disruption and Competence adequacy. The research also analysed the mediation effect of Competence adequacy on the relational path between Technology disruption and Organisational health. In line with the underpinning theoretical model (Knowledge Evolution) as conceptualized by Saulais and Ermine (2012) as drawn from an objective literature review. All the variables of the study were used to develop theoretical model. Instruments customized to the context were drawn from previous studies and the same were tested for reliability and validity to suit the measurement for this study.

This study was set up with the objective of analyzing the relationship of Technology disruption, Competence adequacy, Innovation Capacity and Competence Building with Organisational health and also to evaluate the moderational effect of Innovation capacity and Competence building of the firm on the relationship between Technology disruption and Competence adequacy. Another objective of the study was also to analyse the linear relationship between Technology disruption and Competence adequacy. The study was to examine the effect of motivation given by the inconclusive findings from the past relevant literature concerning the relationship Technology Disruption (TD) and Organisational Health (OH) and its antecedents as explained by various scholars in their recent researches. The inconsistency and incompletion present in the competence studies in context of Technology organisations was identified as a potential research area with relevance and significance.

The outcomes of the study largely supported the hypotheses enumerated in the proposed model. Particularly, the results suggested that Organisational Health is negatively and significantly influenced by Technology disruption and at the same time it was also proved that, Competence adequacy significantly and positively affects Organisational health. In addition, it has been found that the constructs of Innovation capacity and Competence building are important balancing factors of

Organisational health. The evidence that Technology disruption causes imbalance in Competence Adequacy and thereby it mediates the relationship between Technology disruption and Organisational health was clear and supportive elements to the mediating hypothesis in the study. The two moderation effects of Innovation capacity and Competence building on the relationship between Technology disruption and Competence adequacy were also supportive of the hypotheses thus proposed in the research model as in Chapter III. These results demonstrate that while explaining Organisational health in Technology firms, not only competence adequacy is one of the significant contributing factors but Innovation capacity of the firm and the concentrated efforts towards Competence building also significantly influence the overall health of the organisation. These findings are elaborated more in the subsequent sections.

The study results are in supportive of the claims by Kapoor & McGrath (2014) that such rapid change in technology puts organisations on the run in hot pursuit of talent and competence. The competence adequacy required to maintain a particular technology at one point of time becomes no more relevant at a different point of time, leaving behind a profound gap in competence requirement, as a result of the Technology disruption (TD). The result empirically supported that the lowered level of competence adequacy significantly affects the Organisational health (OH). As a result of the reduction in competence adequacy, firms will no more be able to enjoy competitive advantage in the market. As Neuman and Weiss, (1995) put it that competence adequacy (CA) might influence the overall productivity of the employee group and lower the labour market participation of workers with obsolete skills (Van Loo, de Grip, & de Steur, 2001). Rathe & Witt, (1999) noticed the need of value based approach to competence building at firm level, which gives clarity in terms of adequacy with changing environmental factors. This study result is in line with this argument. The study also is an effort to fill the in around this important subject dynamic competence through the environmental uncertainties.

Based on the problem identified in Chapter I, and an extensive review of relevant literature as comprehended in Chapter II, this study aimed to achieve the following main objectives:

1. To ascertain the relationship between competence adequacy and organisational health.
2. To ascertain the relationship between technology disruption and competence adequacy.
3. To ascertain the relationship between technology disruption and organisational health.
4. To ascertain the relationship between competence building and Organisational health.
5. To ascertain the relationship between innovation capacity and organisational health.
6. To examine the mediating role of competence adequacy between technology disruption and organisational health.
7. To examine the moderating role of competence building between technology disruption and competence adequacy.
8. To examine the moderating role of innovation capacity between technology disruption and competence adequacy.

With the specific objectives identified for this study in Chapter I and the identification of potential variables in chapter II, a theoretical framework was identified encompassing all the proposed variables in Chapter III. As has been formulated in Chapter III, the theoretical framework was supported by numerous theories, for example, the Resource-Based perspective of the firm, the systems theory for organizational health, red queen evolution phenomena for changing competence landscape and lastly the knowledge evolution theory to explain the concept through an established framework. In the Indian context, the implementation of strategies around competence building and sustain of the same in telecommunication companies is considered an attempt to transform the organization through an organizational change process to achieve a better position and gain the competitiveness in the market. In this study, the researcher leverages the Systems Theory to explain Organisational health (OH) and its related constructs to fill the gaps left by the HR and organizational behavior literatures. That is, more closely considering the role of Innovation, and Competence building to balance the competence adequacy requirements for a company to maintain health in a fast changing technology space. This explains a broader conceptualization of the competence equilibrium model. This is possible because scholars of competence management have an abiding interest in what Dunlop (1958) labeled the "technological context."

A quantitative research methodology as elaborated in Chapter III was adopted in this study to empirically analyse the developed research framework. A survey questionnaire reflecting the items of measure for the constructs in the framework was utilized for data collection, which is line with the research design. The research instrument for constructs were adapted and adopted from previous similar studies and the items were customized to suit the context and subject. A standardized seven point Likert type scale was used to measure the items for all the constructs. To get the final score of each construct, the average of its items were parceled to represent the overall construct. The higher mean value of the construct represents a higher level of OH, CA, IC and CB. However, the items were designed to be easy to assimilate for the respondents. Higher mean of score in TD means higher disruption impact, which is hypothesized negatively related to OH and CA.

To ensure valid and reliable results of this study, the measures used underwent through a rigorous validation process. Prior to the real data collection stage, the measurable items for each construct were reviewed by experts and practitioners to establish the face and content validity. To ensure an initial valid and reliable measure for the study, a Pilot test was conducted involving 123 respondents. Since the results of the Pilot test were indicating satisfactory level of goodness of the measure, the questionnaire was used to collect the data for the study.

To collect data and to reach out to the maximum number of respondents from the participating telecommunication companies in India, the questionnaire was designed in a subscribed version of surveymonkey.com with the covering letter and introduction of the survey embedded in the opening page. The items were all made mandatory so that at the end the researcher need not worry about the missing values. Since the questionnaire and the administration platform were easily accessible by the respondents over the internet, there was a good response rate as expected. A total of 915 successful returns fetched a 44% response from the sample population approached. Using the real data collected, the construct validity and reliability of the measure were established. In doing that, EFA using SPSS and CFA using AMOS were performed to establish the convergent and discriminant validity. At every stage of measure development and validation, many suggested modifications were performed. This study, established the construct validity to guarantee that the obtained results are valid and reliable and efficiently explain the phenomenon understudy.

5.3 Discussion

This section discusses the specific objectives as set forth in Chapter I. Each of those objectives in the same order as in the objectives is discussed separately below in light of the findings from Chapter IV.

5.3.1 Relationship between Competence adequacy and Organizational health

Based on the literature studied in Chapter II, this study hypothesised that there is a positive significant relationship between Competence adequacy and Organisational health. This hypothesis was empirically supported from the analysis showing proof that change in Competence adequacy resulting in significant change in organisational health with high predictive power. As the technology disruption is an on-going phenomena in telecommunications sector, the result showed that most of the managers felt the competence adequacy of their respective firms are not at the required level to maintain organisational health. The results evidenced that the managers of the participating organisation in this study feel that competence adequacy and organisational health are just above average on a seven-point scale. These scores seemed homoscedastic to each other variable, when one changes the other also proportionately changes in the same direction, which means that every single point increase of competence adequacy will result in a 0.99 increase of Organisational health.

Competence adequacy, as per Cooper (1980) is an organisation's collective skills and knowledge to sustain business successfully today and in future. Companies, which are subject to constant changes, are susceptible to rapid erosion of competence. It is more so in technology-based sectors. As such, in telecommunication firms as well, the competence of people is the most valuable assets. This research results confirm the findings of Hislop, (2003) and Oltra, (2005), that deficiency in competence will negatively affect the Organisation's health. One of the Competence of the organisation is the aggregated knowledge that is significantly related to each individual's specific roles, skills and cognitive abilities which eventually contributing to organisational performance (Grant, 1996; Hislop, 2002). Consequently, it is critical for telecommunications organisations to set up efficient competence management system to equip employees with newer competence to deliver products and service in time with required quality.

Even though this study did not analyse the correlation of components at the dimension and item level of variables, it can be safely assumed that the dimensions of competence adequacy like marketing competence, technological competence and integrative competence contribute collectively and individually to organizational health. This proposition is supported by earlier seminal and fundamental competence put forward by McClelland (1973). To understand competence requirements, the best way is to observe what high performers actually do and allow people to perform key aspects of the competence to measure performance. Predictive power of the organization and technology innovation can improve the competence adequacy in telecommunication firms. Staying closer to the market and customers is another leading indicator to enhancing competence. Through the three dimensions of competence adequacy, this study analysed and provide evidence, that research and development efforts are significant contributing factors to competence adequacy. When organizational competence becomes main driver of business in technology organisations like telecom, it is essential to build learning organisations to let employees constantly expand their competence. To build up such competence base, the firm's competence management process needs to be tuned to examine present situation in terms of technology and business, future requirement for emerging competence and gap analysis of overall competence to design relevant competence interventions. Core competencies as suggested by Kaplan and Norton, (1996) are key determinants of organizational health as their direct contribution to the business areas is much wider than other competencies. There could be various methods telecommunication organizations can adopt to build up core competence by enabling knowledge networks within, managing the explicit competence by bringing them out to accessible repositories and by customizing courses and materials tailored for different roles and positions. Thus, the total competence of the organization becomes the aggregated competence of employees and the organizational competence stored in the repositories. As this study revealed, the adequacy of competence in telecommunication organisations needs regular alignment and re alignment to suit the newer requirements, which is in line with a study conducted by Cabrera et al. (2006). As elaborated earlier, this study was specifically addressing the competence and health issues of telecommunication companies in India and the results thus arrived at is in supportive of the argument put forward by Andrawina. et. al. (2008), that organisations with structured competence renewal process are better positioned in responding to the changing technological environment and delivering relatively better results than the competition.

Additionally, the findings of this study were also in line with the premises of the resource-based view (RBV) by (Penrose, 1959) who gives theoretical support to the hypothetical evidence in this study. Additionally, this study also is aligned in terms of findings with the case study conducted by Massa and Testa (2009) on Italian food producers where they found that the competitive advantage of the food producers is directly linked to the competence adequacy of the respective firm. Empirical studies undertaken by Kearns and Lederer (2003) also strengthen the argument that RBV based competence adequacy has direct alignment with organizational health.

As explained in Chapter II, collective competence of the firms forms the aggregation of individual knowledge, skills, and abilities and other attributes (KSAO) at organizational level. One of the early proponents of competence theory, McClelland (1973), argued that competence can be enhanced with learning and observation and measurement qualities which should be visible and accessible to people for replicating the same at work. Competence should result into real time outcomes at work as such telecommunication companies in India, should be able to stay relevant in the market with balanced approach on competence development. If this approach is further extended to the RBV, firms exist for profits and increasing it over the period. Core competence (Prahalad & Hamel, 1990) and sustainable competitive advantage go hand in hand in defining a firm’s health. A healthy firm will have sustainable Competitive Advantage over others. Resource based theory (Barney, 1986) suggests that a firm with competitive advantage would have employees whose competence is Valuable, Rare, In-imitable and Non-substitutable (VRIN). Technology specific and product specific core competencies are the differentiating factors in creating VRIN in India's telecommunication space. From the descriptive analysis, it was evident that telecommunication companies participated in the survey did not have sufficient arrangements to measure the competence levels at regular intervals to ensure adequacy is achieved and maintained by the firm through proactive development process.

Although most of the past research lean towards the positive correlation of intellectual wealth and firm's health, McHugh and Brotherton (2000), through an empirical study argued that health and competence are not interdependent entities and the improvement of one does not necessarily improve the status of the other. However, their arguments further support the study hypothesis that an organization may appear to be healthy in terms of financial outputs, revenue, and sales numbers. But could carry symptoms of ill-health due to other environmental influences such as technology changes. Such ill health, according to them would become known in the event of intense competition. Applying the resource-based theory by Barney (1995), the major issues faced by the telecommunication companies in India is the shortage of the firm specific competence. According to Scarborough, (1998), the essence of competence is that it fairly acknowledges the interaction of technology with people and their skills, which fundamentally addresses the firm performance. The lower mean values of the survey result for competitive advantage dimension of Organisational health is the indication that the managers of these companies feel that the competence of the staff is not valuable, rare, inimitable and non-substitutable. Lucia and Lepsinger (1999), elaborated competence as required knowledge, skills, and characteristics of individual employees, which are necessary for effectively performing a role as well as meeting the performance goals of an organization. From the extensive empirical study conducted by Crook et al. (2011) on the human capital performance, they put forward that the understanding start point and environmental conditions under which human capital starts losing its value is a critical focal point to begin strategic resource based research. Addressing such imbalance in competence is essential because unlike other organizational resources, employees can choose to exit the firm (Coff, 1997).

These findings above that competence adequacy is positively and significantly related to organisational health is once again attributable to the declined competence levels of the company due to varying technology environment as evidence from the results of this study. With such fierce and fast changes in competence landscape, Indian telecommunication organisations will have challenges unless they find alternative ways to build competence and embed innovation capacity as one of the organisational priorities. Further in the next section, the antecedents of competence adequacy will be discussed in detail.

5.3.2 Relationship between Technology Disruption and Competence adequacy

The results of this study revealed technology disruption (TD) significantly and negatively related with competence adequacy (CA). These results reinforced the crucial role of competence adequacy (CA) in making an organisation's health, while it passes through a phase of technology changes. This result is very specific and relevant to the telecommunications companies in India as it witnessed in the past many communication technology changes such as 2G, 3G, and 4G etc. From the descriptive statistics, it is evident that technological capability as one of the dimensions of technology disruption (TD) scored one of the highest means values. This high score indicates that managers of these participating companies in India feel that as a common phenomenon, the telecommunication industry as a whole is facing great turbulence in technology. Most of the items under the TD variable were related to the communication industry in total. Hence, the answers to these items are specific to the industry and not specific to the companies. A high score in this area means a high impact of turbulence due to technology disruption.

As the study result indicated that the change in core technology can cause negative variation in the competence pool, the scenario in telecommunication companies in India will be declining human competence which could eventually lead to decline of productivity at the firm level. Allen and De Grip (2004), supported this argument stating technological and competence changes will require realignment and increased investment of time and effort towards re-skilling of human resources. Bartel and Sicherman (1993) supported this argument that sudden and radical changes of external environment will affect the value of human capital in terms of the competence advantage. In cases of technology disruption occurring in the telecommunication industry all over the world and specifically in India. Wright et. al. (2011) stated that organisations do not have a menu of technologies to choose so as to lessen the effort of readjusting to the new environment, which intensifies the pressure on the organization in terms of declining competence value. One of the negative components of competence deficiency in Indian telecommunication companies is based on their technological dependence, as most of these companies are heavily dependent on the universal mobile telecommunication standards (UMTS). Such changes are anticipated, it is difficult to be prepared as the equipment, software, consumer applications, and the frequency spectrum are made available to the companies only after the technology is released to the countries in the west. This makes the job of competence building even tougher for the companies.

There is a stronghold of potential relationship out there in the form of customers, suppliers, partners, regulators, and even related institutions. It is essential to keep these relationships fluid enough to allow flexibility and strong enough to ensure longevity and sustenance. The accessibility of essential talent directly affects key strategies, for example, product development, creativity and innovation, market capabilities, and revenue. Yet the scores in the study recommend that these organizations have yet to characterize the criticality of talent expected to bolster the organizations' future development. The responsibility of competence building to embrace future telecom technologies does not reside with companies only. Indeed, institutional establishments have a crucial part to play in setting the models for preparing and training youngsters so that they can grow their competence. Significant abilities will empower them to make a positive commitment to the achievement of organisations. Especially in institutions where telecommunication engineering is taught, the academia feels the need for support to cope up with the curriculum. Employers adopt new technology seeking the commercial benefit and are expected to contribute to the technology transfer to the students from the institutes. This time lapse monopolizes the technology and pose challenge to the younger generation for their competence building. An essential ingredient for any enduring partnership is equal commitment and participation from both academia and industry as well. While the academia seems up and ready to bring in changes to meet the market needs, the employers too need to contribute by maintaining institutional partnership. While in many sectors this is a common occurrence, it is important that this practice is accepted throughout the sectors and is not restricted to few colleges and geographic areas.

Even though a precise anticipation of change in technology is impossible for Indian telecom companies, they should be wary of the fact that changes can happen in break neck speed and source of such changes may arise from expected or unexpected areas including globalization, standardization, new definitions of competition based on price, personalization, speed and, the demands of stakeholders. Macky, and Boxall, (2007) noted that among all these sources of change, technology disruption perhaps is the most important one which organisations currently experience with unprecedented speed. As a measure of precaution, Indian telecom companies can keep the internal and external boundaries of the organization permeable to such changes to allow the changes to be adapted faster than the competitors can. It is also important for these organisations to develop a healthy network of relationship with external parties to ensure seamless exchange of information, resources, and services.

With the above discussions and the findings from the hypothesis, it is concluded that Technology disruption (TD) significantly and negatively moderate competence adequacy (CA). In the next section, the relationship between technology disruption and organizational health is discussed in detail

5.3.3 Relationship between Technology disruption and Organisational health

The results of this study revealed that, technology disruption (TD) significantly and negatively related with organisational health (OH). As it was discussed earlier, competence adequacy is positively related to organisational health and further technology disruption is negatively related to competence adequacy, as such there is a negative relationship between technology disruption and organisational health. The results of this hypothesis testing reinforces that technology changes can significantly affect the organisational health. The high score of the components of TD as indicated earlier points that managers of these participating companies in India feel that as a common phenomenon, the telecommunication industry as a whole is facing great turbulence in technology. While majority of the items under the TD were related to the communication industry in total the items under OH mostly related to the organisation. Through the answers to the questionnaire managers expressed that there is a growing concern of the organisational health in their respective companies.

In the telecom sector of India, technological obsolescence is not recent common phenomenon where companies are pushed into newer technological possibilities. The advance technologies available in the west are easily permeable as customers move around the world and experience the power of mobile applications in enhanced and advance network. This makes customers more demanding more than what they have been experiencing until present. Fitzpatrick, (2011) opined that companies while choosing a specific technology, and analyzing the characteristics of such technologies, it is necessary to analyze the extent of disruption it can cause to the business.

Competition pressures and globalization are constantly changing the business environment in India especially in telecommunication sector. The war of talent has certainly intensified over the past few years due the number of opportunities that have cropped up, given the improving health of the economy. The talent war exists for all organisations especially in Indian telecommunications sector compared to other sectors. In an increasingly competitive world, how companies fight this battle has become a critical differentiator. There are various elements behind this pattern, and companies need to comprehend these components and detail a plan to keep on drawing in and hold the top pick of telecommunication related talent. While economic sentiment is buoyant, availability and access to quality talent continues to be a serious impediment for organisations. As per a report published by Deloitte in 2015, paucity of talent is likely to continue to pose a problem over the next five years. Organisations have now started to acknowledge talent as one of the key factors in order to steer the next wave of growth.

Clavareau and Labeau (2009), while analyzing the impact of technology obsolescence on organisations identified that the obsolescence caused by the emergence of disruptive technology can make the products unprofitable; for the development of knowledge that enables innovations in production processes; for changes in the economic structure associated with the scale of production; the availability of resources, or a combination of these factors which can cause decline of firm health. According to Tidd and Bessant, (2011), disruption sometimes is associated with the age of technology. This concept is more related to the efficiency of a technology and its incompatibility with the social and environmental context. For example, diaspora of disruptive communication technology (2G, 3G, LTE etc.) has made the related technologies obsolete abruptly. To stay compatible with consequent changes, sporadic innovations around the family of technologies need to be undertaken by the telecom organisations.

The Technology Life-cycle model suggested by Ansoff (1984), explains that when dynamic technological development occurs, firms operating in such markets come under constant pressure to introduce new state-of-the-art products. In such condition, innovation becomes a critical success factor; even though life cycles are short, maintaining competitiveness demands an adequate return on investment. In markets with turbulent technological development, discontinuities occur frequently and old technologies are constantly replaced by new ones (Benkenstein & Bloch, 1993). This causes great impact on the sustaining power of the organisation. Both empirical and theoretical studies proved that technology not only brings new waves of innovation in products and process, but it radically changes the rules of the game in business. Such tectonic shift in the way business is done due technological changes can destroy established markets and create fresh markets in unexpected geographic regions leading to emergence of newer players in the market (Tushman & Anderson, 1986). In India, the competition among telecommunication companies is very intense that many of the companies abandoned the operations in the midst due to lack of appropriate skills and competence to run the business. Business sensible and remarkable innovations can clearly push firms to higher levels of competitive advantage. Thereby, pushing the threshold of organizational health (Gobeli & Brown, 1994). Technology disruption is an inimitable component in telecommunication sector. Most of the respondents in this study expressed that the while the company's technological capability is low, the market turbulence created by the new technologies is very high. Similarly, managers also felt that the technological turbulence through the speed, unpredictability, and impact created by the change is also significantly high. Combining all these factors, all of the participating companies faired high on the technology disruption. As suggested in Chapter I, there were many telecommunication firms in India, which consistently showed declining trend, where technology changes were more frequent than the previous years.

5.3.4 Relationship between Innovation capacity and Organizational health

Suggestions from previous literature and, also referring the research hypothesis, the assumption was that there exists a positive siginificant relationship between innovation capacity (IC) and organizational health (OH). The relationship between innovation capacity and organizational health, Subramaniam and Youndt (2005); and Menor, Kristal, and Rosenzweig (2007) concluded that innovation capacity has a positive significant relationship with organisation health. It is in line with the findings of the study where there is evidence to support the hypothesis of positive significant effect of Innovation capacity on Organisational health. This is true because the combination of organizational support, collective behavior, task, and integration coupled with information and communication towards innovation will create a healthy organization with competitive advantage. These efforts and innovation capacity have very high potential to raise firm's unique capability and competence, which consequently will improve performance.

In the past several studies conducted on innovation and firm performance indicated relationship between both (Chaveerug & Ussahawanitchakit, 2008; Fruhling & Siau, 2007; Rujirawanich, Addison, & Smallman, 2011; Phusavat, Comepa, Sitko-Lutek, & Ooi, 2011). As firm performance is the consequence of organizational health this study findings support the previous research on the subject that innovation capacity has positive influence on firm performance. As mentioned before, innovation capacity refers to collective ability of the firm to generate and implement new ideas with business value, which consequently will improve firm performance.

A case study conducted by Nair et. al. (2015) on the much accomplished telecommunication firms Nokia, Motorola and Blackberry, it is evident that innovation capacity is a critical factor for telecommunication companies. Disruptive innovation is a term coined by Christensen (1997) to explain the defense mechanism developed by technology companies to withstand the technology disruption. Christensen's theory of disruptive innovation can be applied to the Indian telecommunication firms when many of them fail to innovate faster and fall prey to the technology disruption as in the case of Nokia in the recent past. In the descriptive analysis, innovation capacity scored the lowest overall mean score (2.993) compared to other variables. The dimensions of IC, innovation task, innovation behavior, innovation support, innovation integration and information & communication all fared lower score on a general comparison with other variable dimensions. It is evident from these scores that Indian telecommunication companies lack adequate innovation capacity. The items under each dimension of the innovation capacity were related to individual level, team level and organizational level. The responses to these items can be deemed as the direct experience of the participating managers.

The real-time demands of the telecommunication industry on technology can be met by the companies only if there is a serious effort towards innovation capacity building. Most of these companies have their idea generation process; innovation week etc as routine initiatives to collect ideas from employees. These ideas and thoughts are however not taken up seriously to the next level for evaluation and practical applications. Such callous approach towards innovation will reduce participation from employees on such initiatives as they do not find value in giving ideas. Technology intensive companies like Google and Apple deal with innovation very seriously and they do not lose any opportunity to tap ideas from employees. Such ideas generated are taken up for further evaluations and many such ideas were put in practice to market as products and services. Such serious efforts will encourage employees to participate and they will be proud to be associated with products and service, which carry the label of their ideas. Empirical evidence of the correlation between innovation capacity and organizational performance in terms of market share and profitability have been confirmed by the researchers in the past (Calantone et. al., 1995; Han et. al., 1998). The question whether innovation capacity remains as a personal attribute with employees or can it be extended to the organization as an emergent property has been discussed in brief by few researchers in the past (Leavy, 1997).

Roberts (2003) explained the need to improve organization's Innovation capacity in order to adapt to the advanced technological systems to move faster than the competitors. Such competitive pressure among the firms are increasing globally, resulting reduced life cycle of technologies and products, and pushing companies into proposition of innovation (Griffin, 1997). Telecommunication companies in India have younger generation as sizeable workforce and their relevance and presence are increasing, as they are able to be associated with innovation more closely than the previous generations. Keeping a youthful workforce requires the formation of a hierarchical society that encourages a less formal climate, a flexible environment open to change, and focused on sharing and innovation through dialogue. To build a culture of this nature, organisations must adopt creative approaches that provide the employees with balance, autonomy and control over both their professional and personal lives. Some of the telecommunication companies in India have started initiatives such as flexible work arrangements, connected workplace, incentives for ideas etc. to promote innovation.

5.3.5 Relationship between Competence building and Organizational health

As illustrated, the relationship between competence building as a composite variable, and the organizational health was found to be significant, supporting the hypothesis. This finding is consistent with the finding of the previous studies (such as Dubois & Rothwell, 2004; Vakola, Soderquist, & Prastacos, 2007). This finding in turn supported effect of CB on organizational health (OH) as widely reported in the competence literature.

In the view of the knowledge evolution theory and competence equilibrium model, it can be argued that competence building acts as a controlled iteration process when there is lessening of competence in an organization. To make such iteration of competence in telecommunication companies in India, it is essential to have the professional knowledge, skills, abilities and other attributes of individuals are assessed at appropriate intervals and developed in relation to the technology changes in the industry. With regard to this most of the managers responded that their current professional knowledge is not relevant to the context of the technology which organization is indulged in. Similarly, if employees are not involved in decision-making processes and not sufficiently empowered, they may drive the organization away from the right direction. Once again, it is to what extent the level of capabilities and qualification of both managers and employees fits the intended human resource practices. Therefore, prior to plan any change or improvement, there should be a proper studies to identify the determinants of a good fit and how these factors to be enhanced to reach a successful level. The question regarding the individual competence being used optimally in the current job was responded low by the managers. It is evidence from this response that telecommunication companies in India need to give attention to the key skills of employees and ensure utilizing the skills on the job.

As it has been widely discussed in the literature, the requirement of developing newer and futuristic competencies as the need of the hour to maintain the OH in technology companies (Suutari, 2002; March, 1991), has been further elaborated on firms, which seek and explore new opportunities by upgrading their competence in order to sustain in the market and improve performance. Competence related to technology has been deemed the most relevant one to achieve sustainable competitive advantage specifically in the high technology sector and there is a positive relationship between technological competences adequacy and firm performance as put forth by Malerba and Marengo, (1995). With the idea of Core Competencies, Hamel and Prahalad (1994) introduced a newer approach to the organizational health. They argued that the Core Competencies if identified and nurtured within the organization would fetch clear and sustainable competitive advantage for the firm. With sustainable competitive advantage, a firm can attain progressive performance over a long period in comparison to the competitors.

The cases of Nokia, Motorola and Blackberry confirm the way that company's status and ability to precisely appraise its future fitness necessities will have genuine ramifications on its health, and even on its long haul survival. This needs to be seriously taken note by the telecommunication companies in India. To be able to implement the business strategy successfully, telecom companies need to address the most important question of its workforce competence needs for the future (Huselid, Becker, & Beatty 2005). This question can be answered through multiple resource building approaches by building competence in anticipation of creating, propelling, and holding the number and right mix of workers that will be required at every point in time later on (Sharp, 2006). Building competence, concentrating on the core business, and ensuring constant anticipatory talent pipeline in the changing technological scenario are important survival techniques for telecom companies.

Many researchers have acknowledged the importance of aligning collective competence of the firm with health and performance so that an organisation accomplishes its basic objectives and long haul future achievement. Furthermore, core competence comprised of aggregate skills that can profoundly affect numerous items and administrations and along these lines give intensity in the market place (Green, 1999; King, Fowler, & Zeithaml, 2001; Henderson, 2007). Therefore, it is essential to ensure competence anticipation and efforts to build up such important future resources.

Resource-based arguments can be cited to describe the use of competence building in increasing the value and rarity of the collective competence and, making competence deficiency more damaging to organizational health (Arthur, 1994; Guthrie, 2001). The RBV theory proposes that employees become more valuable when their competence is aligned and tuned with changing business environments (Coff, 1997). Competence readiness can make the intrinsic resource valuable, rare & inimitable (Ployhart et al., 2009). Supporting the RBV arguments, Arthur (1994) stated that substantial investment in competence building will result into valuable talent pool and inimitable core competence. Their expanded quality implies that they are relied upon to contribute more and regularly have occupations that request more experience and more residencies. Companies that put in little efforts towards competence renewal will have issues to promote innovation improvements and creativity (Osterman, 1987). Efforts towards competence renewal bring equilibrium to the level of competence and organizational performance.

Employees should be able to enjoy the work related learning as they improve and increase the competence. It is important to emphasize the competence traits such as risk taking, seamless internal communication efforts, and flexibility around the business process as key drivers to Organisational Health. Healthy organisations can recover faster from adversities, as they are immune to internal politics, functional disorders and procedural confusion. Such organisations continuously flush out incompetence to create exciting opportunities for the worthy and inculcate superlative performance. Such organisations seldom fail as they set individuals free to design products of the future, deliver compelling customer experience and solve problems together. Cohesive leadership, simple systems, clarity in organizational targets and multi-channel communication are the pre requisites of OH (Lencioni, 2012). Such unprecedented changes in technological space will make skills obsolete in three to five years (Noceraz, 1996). He adds that this frequent but impending obsolescence demands un-learning of older skills and relearning of newer techniques to sustain. Cotton and Hart (2003) enumerate that competence building positively affects performance. They further argue that competence building moderates between organisational health and competence adequacy of the firm.

The findings of this study, also were in line with the premises of the Knowledge Evolution theory (KET) and resource based theory as modeled in the competence equilibrium model that insists on the concept of fit. Unless there is a good fit between the employee's knowledge, skills, abilities and other attributes in relation to the core technology the firm is depending on, the organisational health will be in danger. As such, this study revealed that there is significant positive effect of competence building on organisation health, which supported the hypothesis H5 as per the fifth objective of this study.

5.3.6 Moderating effect of Competence building

This result of this study reinforces the importance of competence building in telecommunication companies to retain the competence adequacy at the time when rapid changing technology displaces the existing level of competence in the organization. The challenges posed by the new technologies on telecom companies tend to further reinforce the importance of maintaining the optimum level of competence within the firm. Globalization of communication technologies in telecommunication sector has led to reduced life cycle of mobile application products in India, which exposed the telecom companies in India to ever-changing competition. The current competitive landscape in India makes telecom companies coexist with increasingly complex organizational environments. This puts pressure on companies to develop a set of anticipatory skills to deal with the multiple variables that affect the strategic choices of firms (Ashington & Hardy, 2009). The rapid obsolescence of technology is high, especially in the telecommunication sector in India. As Flood and Olian, (1995) highlighted, human resources are capable of renewing the competence when it is depleted by external environmental factors.

Scarce resources and the cumulative nature of technological know-how of the company emphasize the need to define a strategy to expand the content of existing technologies and to access and absorb emerging technologies at minimal cost (Pawar, Menon, & Reidel, 1994). The innovative procedure has turned into a focal idea of the organization, and the innovation now constitutes one of the establishments of strategy, controlling the crucial questions of how to set up sustainable competitive advantage. With this, business strategies and technology become increasingly interdependent, while the formulation of technology strategy shall have to consider internal and external aspects of the firm. This means that companies are not entirely free to define their technology strategies without considering the competence requirements for future (Fitzpatrick, 2011).

One often mentioned factor for telecommunication industry is the rapid competence creation and its short shelf life. Such imminent competence turbulence is expected in technology sector, especially in fast moving sector like telecommunication. To dilute the impact of such turbulence, firms need to anticipate changes and build the future ready competence well in advance (Chakravarthy, 1997). By adopting disruptive innovation strategies, firms can distinguish themselves from the competition and strengthen their competence base to face such imminent challenges of rapid changes in technology standards. Technical professionals from the telecommunication organizations are the driving force behind the discovery of newer technologies and channelizing the effort towards building anticipatory competence to create and sustain competitive advantage (Von Glinow, 1988). He further opines that the rapidity of technological changes makes consequent obsolescence of their knowledge and skills, affecting the technical professional's ability to contribute to the organizational effectiveness.

Competence level of individual may vary with respect to the service with the firm, complexity of the role and seniority of the position in terms of accountability & expertise. If competence at individual level can be measured, competence erosion due to technology disruption and other environmental changes can also be measured. According to Hansson (2001), by taking into account an individual's perception of the importance of a specific functional competence for performing a particular job, one can avoid focusing on less important competencies. Competence related to specific business function is perceived as a source of competitive advantage for the firm (Li, 2000; Droge, Vickery, & Markland, 1994; Hoffman, 2000). There have been tremendous changes in the job market in Indian telecommunication sector with respect to technology, modes of hiring, competition in the market etc.

With the above discussed findings and the results of moderation analysis among the variables in the model, this study concluded that there is significant moderation effect of competence building (CB) in the relationship between technology disruption (TD) and competence adequacy (CA). The next section will discuss in detail the moderating effect of innovation capacity on technology disruption and competence adequacy.

5.3.7 Moderating effect of Innovation capacity

This findings of the study reiterate the importance of innovation capacity in telecommunication companies to retain the competence adequacy at the time when rapid changing technology displaces the existing level of competence in the organization.

From the results of this moderation effect, the components of innovation capacity have moderation effect on the impact of competence caused by technology disruption. It is important to note that Indian telecom companies to implement active innovation programs to cushion the competence problems. According to Frohman (1985), technological innovation can make or break profitability, while Maidique and Patch (1982) stated that ‘capacity to innovate’ is a vital force in the competitive environment of the modern firm. The current competitive landscape makes companies coexist with increasingly complex organizational environments. This puts pressure on companies to develop a set of anticipatory skills to deal with the multiple variables that affect the strategic choices of firms (Ashington & Hardy, 2009). The ultimate answer lies in how much and how fast the organization can go to the market with innovative products and services. Creating opportunities to generate and exchange ideas within the company is an essential requirement for telecom companies. Wu, Wang, Tseng, and Wu (2008) explained the need of improving organization’s Innovation capacity in order to adapt to the advanced technological systems to move faster than the competition. Such competitive pressure among the firms are increasing globally, resulting into reduced life cycle of technologies and products, and putting companies to compelling proposition of innovation.

The results support the proposition that Indian telecom companies should take necessary steps to develop adequate resources to explore and implementing innovative ideas within the company. One of the two major streams of innovation studies focuses on the technological aspects of innovation as antecedent the other stream looks at the competence aspect. Napolitano (1991) extended the fields around a technological view of innovation and LeBlanc, Gaston, and Nguyen (1997) emphasized the dichotomy of research and development and technology in innovation. At this point, it is worth to note that Indian telecom companies should concentrate on hiring and retaining employees with innovative and enterprise skills. The other stream of study strongly views human capital as the center stage to launch innovation. Needless to mention that a vast majority of previous studies are in line with this study results, as human competence is the essential causal factor in determining the level of innovation and capacity of a firm (Cooper & Kleinschmidt, 1995; Zien & Buckler, 1997).

This result also supports previously conceived model of innovation as developed by Vrakking (1990) which integrates various organizational fields within the spectrum of competence such as technical resources that are impacted by the aggregation of firm specific knowledge and skills in relation to the existing and emerging technologies, management of overall human resources, team-competence, career management and a flexible culture. There are several approaches suggested to determine the competence management with technology disruption. In the competence management context, it is important to systematically monitor changes required to the existing technologies and identifying emerging technologies. Competitors' technological capabilities play an important role in the firm's competitive advantage. Hence, it is essential to assess the same to re-establish firm specific core competence based on desired capabilities (Burgelman, Christensen, & Wheelwright, 2004).

Top management's focus and strategy towards innovation will be a key successfactor of telecom companies in India. It is also important to note that employee's work schedules should allow time to think of creative solutions to organizational problems. The employees make substantial difference to innovation as opposed to technology. Hence, it is imperative that competence management constitute one of the basic factors in organizational success. Contextual imbalances created by the technology disruption can be neutralized to a great extent through competence intervention and effort should be directed towards creating and sustaining perfect levels of (Kanter, 1983; Woodman, Sawyer, & Griffin, 1993; Claver et al., 1998). Indeed, in managing innovation, the major role of management is to create an environment to innovate (Hauser, 1998).

5.3.8 Mediating effect of Competence adequacy

Prior to archival evidence, inconsistencies existed in the effect of technology disruption on organizational health, indicating a gap between the relationship of technology disruption and organizational health. The study assumed that competence adequacy is the invisible bridge that existed between technology disruption and organizational health. It means that competence adequacy has the ability to significantly change the impact created by technology disruption on organizational health. The better a firm is prepared with the competence adequacy, the greater the chance for the firm to survive the difficult times of technology changes which gives differentiated potential to the firm to sustain value and position itself ahead of its competitors. Those firms facing rapid technology changes but with the same quality resources find the organizational health declining, due to a differentiated competence requirement. That is why several previous researches showed conflicting results.

The competence adequacy of Indian telecommunication companies are shaped by the continuing evolution of technology, the disruption of digital transformation and the market demands for more mobility that directly affects the industry. Each of these business challenges present leaders with an evolving and shifting talent and human resources agenda. Telecom organizations rated organizational acceleration, the new way of managing change, as the most relevant trend. This is not surprising, as telecom has been characterized by rapidly changing technology, innovative start-ups, regulation and a long history of mergers and acquisitions. This continuous cycle of change and industry evolution has put a great deal of organizational strain on achieving future business benefits. In addition, the need to integrate company cultures and operational processes has made managing change effectively and efficiently very important. That said, the relevance of this trend varies across geographies as global regions are at different stages of the cycle of change.

In high technology organisations, technical professionals are the driving force behind the discovery of newer technologies and channelizing the effort towards building anticipatory competence to create and sustain competitive advantage (Von Glinow, 1988). He further opines that the rapidity of technology changes make consequent obsolescence of their knowledge and skills impacting the technical professional's ability to contribute to the organizational effectiveness. In addition to this, according to Form et. al. (1988) competence obsolescence leads to low employee morale, restricted career opportunities and limited success possibilities among technical professionals.

Organizational health indicators can be categorised into three broad areas based on the proximity towards the contribution to perform. It is expected that the attrition (competence depletion) turns out to be the strongest and most proximal (e.g., customer fulfillment, worker work states of mind, non-attendance), humble for reasonably proximal measures (e.g., quality, wellbeing, workforce profitability), and feeble for distal ones (e.g., financial performance) (Park & Shaw, 2012). Warmington (1974) states that any form of obsolescence in an organisation in terms of equipment or production process can often be attributed to a reduction in efficiency which is caused by a deficiency in competence. According to Goggin (2008), the rate at which the firm adjusts the competence deficiency to the changing technology environment defines the direction and strength of the company's health.

This study conforms to the resource based theory suggested by Barney (1995), that firm specific resources directly measurable (e.g., access to inputs) or immeasurable (e.g., skills managerial or technical) based on tangibility. To sustain competitive advantage in the market, firms must not only review their current pool of talent but also anticipate resource requirements to succeed (Ketchen, Ireland, & Snow, 2007). Firms that evaluate newer pastures and seek opportunities to acquire competitive knowledge will be most adaptive and improve performance (March, 1991). According to Leonard-Barton (1992), any continuous competence building activities in related technology areas lead to strengthening of the firm's knowledge base, however over time, this may create competence deficiencies. Hence, in the short run, competence leveraging tends to look at the survival of the core competence, but over time, the continued concentration of present competence base may affect detrimentally on the anticipatory competence. To leverage competence, the firm needs to recycle competence at regular intervals of time. Leveraging firm specific competence may not always be feasible especially in the fast moving technology environment.

Bandura (1997) defined competence adequacy as a team's shared perception on its aggregate competencies. Depending on the operating context and available resources, this perception can vary and remains negotiable (Yu, & Hang, 2009). According to the social constructionism theorists, when members of a group interact with one another through a social system, the aggregate knowledge is generated and stored through the interactions (Berger & Luckmann 1966).

This difference between the competent and in competent talent pool is a common problem in telecommunication sector in India. While every year millions of qualified candidates are added to the talent pool, the one's with required skills is very low. While the growth opportunities in telecom sector are very lucrative, the inability to meet the talent needs is a major hurdle. With the decreasing skill levels in engineers, telecommunication, and even technology companies in general are finding it difficult to meet their demand. This situation calls for rapid actions from Academia as well as the Government to impart the desired skills to Talent pool so that they are fit to get employment in Industry.

Reading these sentiments might create a picture of Indian telecom companies whining for shortage of skills and doing nothing about it. However, reality is a bit different. Corporate efforts are being made, but they do not suffice considering the beneficiaries they are supposed to cater to. One merely has to look around and see what these companies are doing to solve this problem of skill scarcity. Be it internships, projects, or various other activities, Corporates are trying to interact with the skill pool as much as the skill pool is trying to interact with them. Major Companies in the telecom sector now have a campus relationship team to maintain a direct connect with the source pool. This however is not enough to solve the skill issues. Employers know and believe that only through combined efforts would this problem be solved. A great deal of time and speculation are done to persuade the students to be prepared to join the workforce. There is a lot more can be done from both supply and demand sides for rendering better results.

At any given point of time, there could be an issue around competence adequacy existing in the firm, which can dampen the Organisational Health. For a firm to sustain competitive advantage from the resource based view, it is imperative that the firm maintains lowest rate of depletion and obsolescence always so as to maintain the competence adequacy at the desired level.

The descriptive analysis of the response data for genders and experience levels revealed that male respondents were more assertive when responding about the organizational health. Female respondents mean score on organizational health showed that they are generally in agreement that their respective organisations are sufficiently healthy. However, the response on technology disruption, both male and female respondents equally agreed on the high levels of technology disruption in their companies. While competence adequacy and innovation capacity were scored more for males compared to females, competence adequacy mean score was slightly higher (0.7) in case of females. The lower mean score for females could be attributed to the suppressive nature of female opinions in India. Socially, males dominate over females in India when an opinion about a specific concept is to be formed.

The responses of the service category 12-15 years was found more assertive (higher mean score for all constructs) than any other category. This could be due to their closer proximity to company's strategic information and interaction with operations on ground as well. At the designation level, manager category fared higher scores than others. They were also relatively in larger number (273) among the respondents. The scores of technology disruption were the largest mean score among all the other variables for manager category. Those at the designation of manager felt that technology strongly disrupts the smooth functioning of the business. This finding was in line with response from managers during the initial interviews with them to ratify the problem statement.

This study attempted to examine the above-mentioned scenario in the context of Indian telecommunication sector. As the telecommunication companies stand gullible to the rapidity of technology changes, this study confirms the mediating effect of competence adequacy (CA) on the negative significant relationship between technology disruption (TD) and organizational health (OH). As this section concludes the discussion on the objectives of the study and findings of hypothesis, next section will open up for specific recommendations arising out from the findings of the study.

5.4 Recommendations

Based on the results and detailed discussions over each hypothesis, the researcher puts forward the following recommendations to address the identified issues and problems faced by Indian telecommunication companies.

5.4.1 Be smart to anticipate Competence changes

Based on the literature and from the findings of the study, it is imperative that managing competence is associated with managing employees. It is the employees that contribute to the sustainable competence adequacy and thereby place organizations in a healthy platform. According to Way (2002) there is a general consensus on the positive impact of firm's collective competence adequacy with health of the organisation. It is through the application of competence that the other organizational components are able to function well and contribute positively to the health. Therefore, finding the right employees with the right competence for the right job is essential, not only to improve the competence adequacy but also to create potential value beneficial to organizational health. Selecting the best competence starts with hiring process where firms should carefully select candidates based on the knowledge, skills, abilities, and other attributes. In addition, it is important to measure the overall competence gap on a regular basis to intervene with appropriate competence building process.

The competence is context and firm specific and that is the reason why new joinees take longer time to be productive than their counterparts within the organization with similar education background and experience. Competence comes through skill building, knowledge sharing, developing abilities and imparting attributes and virtues (Alsaaty, 2011). Firms should constantly anticipate future competencies emerging and be prepared to renew existing competence. In order to do so, firms need to develop appropriate training curriculum (Joshi, Cahill, & Sidhu, 2011; Chang & Lee, 2007). Learning and training are essential pre requisites to renew, upgrade and enhance competence where each individual in the firm has different and varied competence requirement based on the role he or she is playing. Only certain people are assumed to have relevant and adequate knowledge, skill, abilities, and other attributes. Higher the level of competence in the firm, greater is the capacity to innovate and improve opportunities to add value and sustain organizational health. Thang and Buyens (2009) shared the same view when they found evidence in their study that collective competence has an effect on financial performance of the firm. Proceeding forward, science, technology and telecommunication companies should identify the business critical competence in context of the emerging technologies and design programs to aggregate and develop such future talent within the firm.

5.4.2 Stay ahead of technology

It is important for telecommunications companies to be at the forefront of research in domestic and global telecommunications technology. India has shown its potency as a provider of technology solutions to the world. Communication technology based research is also to be promoted by the government to identify next generation technologies and interoperability to further optimize the available infrastructure. Emerging telecommunication technologies like WIMAX, LTE etc should be subjected to research and development with the intervention of telecommunication ministry. The emphasis should be given to affordable technologies that can improve quality of life in rural areas. It is very important that government, telecommunication operators and academia come together on a single platform to address the digital divide and also to strengthen the research and development infrastructure in the technology and telecommunication field. For such objective in mind, Government of India set up the Telecommunication Centers of Excellence (TCoE) to promote entrepreneurship and encourage technology research in India. However, a more focused and integrated approach is required to attract enormous technical competence available in India into a serious research landscape. Besides funding telecom technology projects across institutions, government also introduced the program like Support International Patent Protection in Electronics & IT (SIP-EIT) to increase the penetration of technology in the telecommunications sector. Unfortunately, despite having such conducive environment for technology, majority of the technology companies in India are yet to embark of serious in-house research in the technology sector.

The study results showed that majority of the respondent managers believe their companies do not have excellent human resources and talent programs. Head of HRs for these companies must begin another discussion, concentrated on business needs, for example, changing HR to complete recruitment in a shorter time-frame, build adaptable HR capacity as the organization propels into new markets. In putting forth the defense for change, HR division must concentrate on key results, innovations, and strategies.

5.4.3 Continuously build competence

Competence development is particularly relevant in telecommunication sector, given the speed at which the telecom industry evolves in India and thus innovation is the key driver of many workforce challenges and trends.

Large investments in telecommunication infrastructure technology, products, and applications make the difference between achieving innovative margins or huge loses. This innovation imperative creates enormous pressure to have right competence at the right time and right place on workforce recruiting and competence development. Current technology trends in telecommunication (i.e. cloud computing, digitalization, social media, mobility and data analytics) have telecommunication employees and companies scrambling to change technology platforms, generating huge investments while they look to find promising margin-generating business models that leverage hard-to-find skills. Another relevant trend for telecommunication companies in India is technology leadership. However, telecom organizations today face an unprecedented variety of challenges; globalization, unpredictable business environments, and disruptive technology. Each unique challenge requires a unique kind of leader. Telecommunication organizations today require a reserve of competence with technical, market, and integrative skills, which complement the technological changes in the market.

Business leadership from the telecommunication companies hand in hand with the human resources department should come up with sustainable partnership to develop and implement value adding business strategies, to ensure competence requirements are aligned with the upcoming technology and product design space. With such rapid growth in many organizations, talent acquisition and development is a primary concern, and the fight for key talent often sets the stage for the success of the company.

Lastly, these organisations need to transform HR to meet new business needs. While in the past, HR trasnformation concentrated fundamentally on making existing HR works more productive and viable, today HR capacities bolster the business, as well as empower business systems. To quicken business development, telecom companies must utilize HR transformation to plan HR and ability frameworks that can work crosswise over geographic limits and can bolster diverse plans of action. Keeping pace with growth, expanding into emerging markets, and supporting mergers & acquisitions are key telecom industry trends that encourage organizations to invest in a scalable and flexible platform. .

5.4.4 Constantly promote innovation

Coombs and Bierly, (2006) noticed that, studies related to innovation capacity gained attention among researchers for the reason that it positively contributes to the sustainable competitive advantage of the organization. They opined that innovation capacity gives firms the ability to be relevant in the changing market and be advantageous among the competition. Keeping this as a central organizational theme, firms should know how to promote innovation among the employees. The capacity of a firm to innovate depends on the quality of competence it possesses. Laforet (2011) shared the same view and mentioned that innovation prevails only when there is a capacity of a firm to innovate. The ways of managing competence and innovation which were mentioned in the previous section are also the ways of managing innovation capacity. Amongst them are learning and development, open work procedures to encourage innovative behavior, reduced bureaucracy and establishment of norms that facilitate interaction, relationship and collaboration with all external parties in the eco system. Managers need to manage their team's innovation support in order to enhance overall innovation capacity of their firms.

As competition became increasingly intense, firms need to create an environment that allows innovation to flourish. In other words, firms need to establish innovation culture, support, and behaviour. Alsaaty (2011) suggested that organizations need to have relevant knowledge and rewards mechanisms so that employees are motivated to participate in the innovation activity. Teamwork, collaboration and information sharing are important components to promote innovation behavior in an organization. Hence, telecom organizations should ensure steps towards building an open culture is taken by the HR and management.

Employees need to be rewarded for contributing to organisational innovation activities. If the ideas generated by the employees are seriously evaluated and taken forward for meaningful implementation, the contributors of the idea will feel part of the team and be proud to be associated with such idea generation process. In a study conducted on the relationship between job satisfaction and innovation capacity, Mohamed (2002) also shared the same viewpoint. In addition, firms should avoid a work culture that consists of formalized rules and procedures, which may hinder the performance of innovation. It is because innovation tends to flourish if employees are given free communication to ask questions, seek feedbacks, or propose new ideas. Innovation also will occur when the employees have the freedom to communicate with each other at any time where the tendency to obtain and integrate ideas amongst them is high. Penalties for rule violations or being judged negatively for proposing an opinion will make employees become more averse to risk, thereby giving up searching for new ideas, being creative or trying new approaches. In this case, research evidence by Mosey, Clare and Woodcock (2002) proved that an employee suggestion scheme and a new product development team facilitate new product development project, which consequently determine the innovativeness of a firm.

Telecommunication companies must build a work culture that promotes sharing of ideas not only with employees in the firm but also with the outsiders. This is because any effort that enhances connectedness in the work culture is perceived to have impacts on innovation. Connectedness implies strong ties, where high level of connectedness promotes openness (Jansen, Den Bosch, & Volberda, 2006) and results in better ideas and feedbacks. In order to increase the level of connectedness, Indian telecom firms must organize idea generation workshops as they allow individuals and teams to experience new ways for innovative team works promoting new collaborations in cross-functional areas. It is also an effective way to identify areas of innovation opportunities, facilitate the sharing of knowledge, and turn it into visible outcomes. Moreover, establishing good networking with external sources such as telecom industry forums, research and development organisations and competitor companies is paramount. The rationale is that networking provides sharing of useful information concerning existing and potential opportunities that push firms to innovate (Alsaaty, 201 1). Companies, which are part of a social network, are likely to have access to resources than firms operating outside the network. Wincent, Anohkin and Biter (2009); and Subramaniam and Youndt (2005) shared the same view when they reported that networking with outsiders such as customers and suppliers is found to have a positive impact on firm's innovation activities through the exchanging resources and ideas. Intel Corporation in the past was able to re-design many of the product lines based on the ideas and suggestions received from the customers (Brooking, 1996).

Knowing and interacting with customers facilitate firms in getting feedbacks and information that are useful and beneficial. Proceeding further, R&D facilitates innovation activities in a firm because it is difficult for a firm to innovate without an R&D facility or laboratory. Firms will spend more on R&D when they expect it will result high earnings (Osma & Young, 2009). It is important for Indian telecommunication firms to assess their in-house R&D capability to optimize the technology available to them through enormous ideas generated from both employees and customers.

Finally, the findings show that telecom companies do not possess adequate competence or appropriate resources to seriously take up innovation efforts. The researcher agrees with Oke, Burke and Myers (2007) that the local government initiatives are important to encourage telecom sector to innovate which consequently improve growth.

5.4.5 Technical competence in institutions

While the industry is thriving ahead with latest technological know-how, institutions in India are still grappling with vintage curriculum. For example in the computer science field, while the world has gone far ahead of analog devices, the major portion of the computer course curriculum today still talks about the systems used in mainframes. New advances in automotive engines are made quite often, but a mechanical engineer is still taught about archaic systems. Similar is the case of other engineering branches like telecommunications as the radio communication and equipment of decades ago are the syllabus followed in many of the telecommunication courses. While an understanding of these systems might be useful to form a strong base; complete focus on old systems is definitely not desirable. How can a student, who is being trained on age-old systems, be prepared to work on the most modern systems and application in telecommunication sector.

Academia, industry and government should come together to address the issue of competence to ensure the supply of quality skill is available for the technology sector as in the current era of knowledge economy, the quality of the force work is more important than quantity. In fact it has a low number of skilled labor is much better than a workforce whose largest portion is incompetent. Given the current situation, this is the future of telecommunications in India should strive for. Stringent measures to deal with this challenge, then, are the need of the hour. This requires combined efforts of various stakeholders. Therefore, sincere efforts to ensure collaboration between the source of skills (schools, students, etc.) and destination (the industry) are necessary. It is imperative to educate students about the expectations of each so that informed plans for the future can be made. One important thing to note is that this phase of growth would not stay for long. Research has shown that it is the success or failure of a nation in the realization of the economic potential of young people during this period of "low dependency ratio" that can make the difference between sustainable development and long-term faltering. (Dhillon & Yousef, 2007).

As the gap between available and required competence is widening in technology based industrial sectors, and more particularly in telecom sector, it is very important to come up with plausible solutions to fill this gap. Technology organisations are finding it difficult to hire and retain right talent with appropriate business related competence. While the hiring managers have access to pool of manpower, they do not find the talent that can bring in products and solutions in emerging technology platforms. The availability of right talent, which drives on technology innovation, operating efficiency and sustainable competitive advantage, is a challenging task for recruiters. Agreeing to a survey led by HCI and Kelly OCG, only twenty percent of companies have access to the right talent pool, which brings in great talent frustration to large number of companies. This is indeed a paradoxical situation with great pool of manpower available in India. To be successful and fully leverage the talent pool available, telecom companies in India should implement sound adaptation strategies is the smart way forward.

5.5 Contributions

This thesis focused on competence adequacy in telecommunication sector, specifically on organizational health, and in a technology disruption scenario. In a nutshell, the study findings signify the essentials of competence in a firm thereby managing the effectiveness of organisational health in technological context. The contributions in this study are discussed as theoretical, practical and policy level contributions:

5.5.1 Theoretical contributions

Firstly, with the explanatory power of the competence model, this study contributes theoretically to the area of competence and organizational health. This study provides a model framework to examine an Organisation's health in relation to the competence adequacy. The research contributes to the competence theory by integrating the moderating factors of innovation capacity and competence building to balance the level of competence required for maintaining organisational health in a changing Technological environment, thus putting forward a competence equilibrium model.

Secondly, this research helps address the gap identified in the literature that there is inconsistency within organisations to generate innovation behavior and manage the overall innovation capacity. This include what types of capacities and incentives required to improve organisation's health (Hjalager 2010), and that technology organisations often lack sufficient competence adequacy to take on sudden and unexpected changes (Vermeulen 2004).

Thirdly, this research complements the thinking underlying Bowman and Collier's (2006) contingency framework for the competence anticipation process. By providing insights into the particular capabilities needed to support organisational health, this research helps to understand how assets and capabilities in the business can be developed in order to sustain adequate level of health. In particular, this research supports the proposition that measures of competence are mainly industry specific (Lawson & Samson 2001), and that of firm capabilities are often context-specific (Ethiraj et al. 2000).

5.5.2 *Practical contributions*

The results of this research provide important contributions and implications to both policy makers and practitioners as well. This research, moreover, provided advantageous insights on how CA, CB, and IC can enhance the overall organizational health. Some of these contributions and findings are in the following. Firstly, the findings of this study can enhance the awareness among managers in Indian telecommunication firms on the importance of institutionalizing competence building in their establishments. Moreover, the results also highlight that anticipating environmental changes like technology disruption, which is imminent for such companies, as leading indicator for organisations to be ready for future and achieve a sustainable edge over competitors and survive at the marketplace.

Secondly, as innovation and competence building are two distinct and separate streams of organizational development, relatively equally, and positively influence the organizational health. Hence, it is imperative that extensive efforts should be put forth to establish supportive environment for promoting innovation within the firm. In line with the Knowledge Evolution Theory, this study revealed that when changes in environment affects the competence equilibrium, controlled iteration in terms of competence building efforts and cognitive stimulus as collective innovation capacity could significantly moderate the impact. It is important for managers from the technology firms to give equal importance to both these initiatives. Innovation in most companies is practiced just as an idea collecting initiative.

Serious efforts to be put towards building concerted innovation capacity as an innovative company can survive the threats of technology disruption and remain competitive in the market.

Thirdly, the research provide a list of suggested activities that could be developed as “competence preparedness for technology changes” in telecommunication sector. These specific actions required to be taken by the telecommunication firm managers are discussed in this chapter. In addition, this measurement models suggested here can be used by managers themselves or by consultants as a diagnostic tool to identify the specific components of business operations that can be developed and improved to provide the greatest impact to improve competitiveness, and business performance.

Lastly, this research re-constructs an existing instrument to measure Organisational Health (OH) with an extension to performance and competitive advantage through a grounded theory approach, which is the approach most frequently used for scale development (De Vellis 2003). The current available instrument does not include the important dimensions of Competitive advantage and Performance as constructs of OH. This instrument, the researcher believes, will be of significant importance to technology companies looking for a timely measure of the readiness for future business. Organisational health analysis in this research focuses on these three important components and the interplay amongst them to make an operational model of OH. The instrument worked out under each component also provides guidance for practicing managers who seek to understand organizational health under changing business situations.

5.5.3 Policy level contributions

The risks of competence deficiency in telecommunication sector belong to the heart of the economic challenge for thriving economies like India. The country, though a young nation, still face this impending challenge of quality technical education which may indicate severe risks of technical competence deficiency. India's universities, firms and policy makers need to come together to address this skill demand issue in telecommunication sector by bridging the gap between academia and telecommunication sector. Collaboration among the institutions, government and industry is essential to bring about significant progress in building fundamental aspect of telecommunication competence in the country.

This research highlights the fundamental human capital issue prevailing in the country to ensure necessary precautionary measures are taken by the respective governing agencies. The research throws light to the grave situation of technology disruption and the resultant Organisational health problems among the telecommunication companies in India. Appropriate policy changes need to be introduced at the government level to acknowledge the competence demand supply issue to ensure robust development telecommunication ready graduates from the technical institutions catering to the domestic talent requirements. This will facilitate improvement of opportunities for the domestic labour market and desired growth of the economy.

Secondly, the higher educational institutions in India should equip the graduates with the abilities to use the available information to predict the impending disruptions by emerging technologies and take note of the changing competence requirements. Faster adoption of new competencies is important for students to get working in technology firms. Hence the curriculum in universities should be reviewed to accommodate such progressive approach to competence building in students to be ready for the fast-paced technology field and acquire the abilities not only to respond well to any new technological competence, but also to use them to get better outcomes.

Finally, this study is also of a great value for the consulting companies offering consultation related to organisational health and competence. The consultant companies, conducting culture-based survey to measure the organisational health, can advise companies to look at appropriate goal alignment in the company and, competence building to ensure value, rarity, inimitability and non-substitutability of their human resources.

As it is the case in any research work, the following sub-section discussed the limitations identified in this study.

5.6 Limitations of The Research

Realizing the limitations of the field is an innate force of any research study (Dolen & Lemmink, 2004). Even though there is reasonable and significant contribution from this study to the literature of organizational health, the researcher acknowledges some imminent limitations encountered during the study, which need to be clarified.

Even though this research provides good understanding and contributions, the contributions of this study, interpretation of the results obtained and the conclusions drawn accordingly ought to be considered in the light of such limitations identified. As it is always the case in doing research work, this study had few limitations that were recognized and reported in this section. The main limitations of this study can be addressed through three categorizations namely, causality, generalizability and methodology. These three categories are further discussed as in the following.

5.6.1 Causality

A survey questionnaire research design was employed for this study with stratified cross sectional data collected during a specified time period to examine the theories. As it is perpetually the case in the survey research design, the information obtained only show the level of connection between variables. Thus, whilst the causal relationships can be derived based on the answers obtained, they cannot be strictly determined.

Additionally, a comprehensive critique of the Competence Adequacy and Organisational Health revealed that they are long-term strategies in nature. Passed on this fact, examining the association among TD, CA, CB, IC and OH at one point of time will lack the accuracy since the outcomes will be dependent on the time of their execution. This means that in order to be able to analyze the essence of these schemes on the organizational health, it is strongly advised that longitudinal studies should be guided to test this issue.

The study attempted to explore the extent to which Technology disruption causes imbalance in competence levels of firms and thereby affecting the overall Organisational health. The study was an endeavor to also analyse if

Innovation and focused Competence building efforts within the firm can alter the strength and direction of the impact on OH created by TD. Although other factors may contribute to organizational health such as firm culture, market situations, competition etc, this study focused purely on the competence landscape and the effect of rapidly changing technology (termed as Technology disruption) on such competence status.

5.6.2 *Generalizability*

This study was conducted using a sample of Telecommunication companies operating with GSM (Global standards for mobile) technology in India. Hence, the result should not be extrapolated to generalize other types of companies using different communication technologies like CDMA (Code division multiple access). Furthermore, the study took place in India, which is classified as a developing country with relatively higher technology adoption in telecommunication sector. This study may not give similar results in countries with different technology adoption standards.

Even though utmost care was taken while selecting the sampling frame, there were 10% of the GSM companies left out from the sampling frame as the researcher assumed that the four largest telecommunication companies in India in GSM space is a fairly reasonable representation of the population. Responses gathered from these active firms were used to generate the findings, which are assumed meaningful and reliable.

5.6.3 *Methodology*

Using stratified sampling technique, the researcher reached out to the managers of the selected firms to evaluate the effect of technology disruption on organizational health. The instruments and items were adapted from previous studies and with minor customizations to the industry sector, were found reliable from the source. The questionnaire set in English language was meant for the managers who are supposedly English educated. Hence, it is assumed that all respondents understood, comprehended, and answered the questionnaires freely without undue influence from any parties.

One of the major limitations of this study was that this study used seven-point Likert scale in which the respondents measure their degree of agreement towards statements related to OH, CA, TD, IC, and CB. Using such measure may cause a patterned response which is the fact that respondent s tend to answer the items automatically without paying careful attention to the statements. This happened since different individuals have different interpretation to the numbers used to measure their perceptions. However, it is difficult to assume that the respondents in its complete essence have understood all the items completely and the data collected is completely reliable.

Additionally, the conclusion of this thesis is from the empirical data gathered from the managers of the participating organisations. These respondents were deemed to be the best representatives who can describe the OH, CA, TD, IC and CB with a reasonable understanding of technology and context the business is operating in. Other stakeholders such as employees and customers could also evaluate constructs in some future studies.

From another methodological perspective, this study employed perceptual measures to measure the dimensions of the variables employed in the study. Although this measures were put through rigorous validity and reliability examination, the results of such measures are still questionable compared to the outcomes of objective measures. Therefore, future research work could benefit from using both perceptual and objective measures to draw objective conclusions about the organizational performance construct.

With the elaboration of limitations as above, the next section will discuss directions for future research for those students of organizational health and competence in technology companies.

5.7 Directions for Fture Study

Based on the findings and limitations, this study directs to a number of research opportunities in various aspects. Future researches are advised to look into the relationships and examine other factors that may have existed among the five variables in this study.

Firstly, as it has been discussed in the limitations section, this study employed the survey questionnaire research design to gather appropriate data for this thesis. However, the nature of stratified data sample collected at any given point of time limited the researcher to observe and subsequently examine the dynamic nature of the effect of TD on CA and further effect of it on OH as hypothesized in this study. This study could not compare organisations with potentially high levels of IC and CB with those of lower levels of IC & CB. However, to be able to investigate the natural and dynamic relationships operating in changing context as stipulated by the Knowledge Evolution Theory, potentially a case study approach may be better. Case study approach will enable the researcher to carry out a deeper investigation on the complex relation between TD, CA and OH and the interaction effects of IC and CB on them. The results could be different and provide insights into other potential factors.

Secondly, to further examine the complex joint effect of strategies such as TD and CA on the organizational health, a longitudinal research could be applied. It is proposed that longitudinal approach could explain this complex relationship over long period of time. This approach may reveal the development of the variables over time and detect the changes in their relationships through the process. For this, the researcher needs to assess the technology disruption at different stages of technological evolution such as different generations of telecommunication technologies and their relative disruption on competence. Even though such research demands panel data collection, it will be an important contribution to examine competence in technology organisations.

Thirdly, future study may be undertaken to analyse how each of the dimensions of CA affecting the dimensions of OH. Each variable in this study may be correlated and causally related to the dimensions of other variables. For example, how each dimension of Competence building is influencing the Competence adequacy? Such deeper research will throw light on focused approach to competence development.

Finally, to draw conclusions that are generalizable to the Indian context as well as other countries with similar technological background, examining the effect of TD on CA and OH should be conducted. Meaning that, other studies in India examining the same model in other technological sectors like, Information Technology, Electronic manufacturing sector etc. are highly recommended. In addition to that, for further investigations, this relationship can be examined using data collected from other countries that have unique and strong technology adoption background.

5.8 Conclusion

The study has provided answers to eight objectives and the result findings validated the importance of competence building and innovation capacity on organisational health. Managing competence is as important as managing innovation. Competence and innovation are tied up in the firm's process built over a period of time and strong management skills are required to reveal the gap in competence adequacy and to take necessary steps to fill the gap. Nevertheless, the most crucial part is creating strong human resources practices to anticipate competence requirements for future and be prepared for future technology changes thereby, keeping sustainable competitive advantage in telecommunication organisations in India.

In conclusion, the organizational health of telecommunication companies in India will remain as one of the major issues related to the overall contribution to the economy and growth of the nation. The enhancement of the overall organizational health of telecommunication organizations has evolved recently as a great concern of all stakeholders involved in the business. It has been widely recognized that CA and OH have been growing in popularity to be among the most effective strategies that can help organizations to seek better performance and produce innovative products and services. In India, the importance of CA and OH has been widely acknowledged in context of the advent of emerging and global technologies adapted fast to India.

Competence building is based on the real work practices that both employees and companies reap benefit out of it. The aim is to build and maintain competence adequacy to face environmental changes like technology disruption on competence. In this setting, this dissertation contributes a substantial input into the literature by providing an empirical model that attempts to explain the relationship between competence adequacy and organizational health in dynamic technological change perspective. This example gives a better understanding of the relationship among Technology disruption, Competence adequacy, Organisational health, Innovation capacity, and Competence building in a single relationship model. Even though there are various possibilities to have constructs which are not included here, this study incorporated the most relevant constructs, which are balancing part of successful competence equilibrium. Specifically this thesis complimented the research on competence equilibrium by analyzing the effect of them on organizational health with dimensions of goal alignment, competitive advantage, and change capacity of the firm) and Technology disruption (technology and market turbulence). Results have revealed that Technology disruption negatively impacts the level of Competence Adequacy and at varying levels of competence adequacy and mediating effect in the relationship between TD and OH. The results also threw light on the important initiatives namely; Innovation capacity and a serious look at the Competence building as important balancing factors of building Competence adequacy in organisations.

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Appendix A: **Survey request to participants**

Universiti Utara Malaysia - Ph.D Research Survey

1. THE EFFECT OF TECHNOLOGY DISRUPTION ON ORGANISATIONAL HEALTH

Dear Friend,

Greetings! Congratulations for being chosen as one of the respondents for this study.

I am Hari AP Nair, a doctoral research student in the area of Human Resource Management at the Universiti Utara Malaysia. With this note, I am seeking your kind attention to spare 20-30 minutes of your valuable time in order to fill out this questionnaire which is related to the Organisational health aspects of Indian telecommunication companies. This questionnaire is the research instrument I am using in order to fulfill the requirement of my dissertation.

I am very appreciative of your time and support in answering this questionnaire. Please understand that I require this questionnaire to be answered completely (all questions) because the reliability of the results will not be accepted if not complete.

Your responses are very important and I assure you that your personal details will be kept confidential and your response to this questionnaire will be analysed only for the academic purpose. Should you have questions, please contact me at: E-mail: hariapnair@gmail.com ;Tel: +6012 200043.

Regards
Hari AP Nair

1

Appendix B: **Survey introduction to participants**

Universiti Utara Malaysia - Ph.D Research Survey

2. An introduction

World is going through a period of technology revolution with unprecedented speed. Telecommunication sector is highly impacted with these changes which demand differentiated approach to the product development, marketing, sales and customer services. Are we really prepared to face this? With this study, my endeavor is to understand the special preparations required by the telecommunication companies to keep the Organisational health intact through the changing climatic conditions brought in by emerging technologies.

Please put on your supervisory hat and give your personal views and perceptions on the situations in the subsequent pages.

2

Appendix C: **Survey main questionnaire**

Universiti Utara Malaysia - Ph.D Research Survey

3. Section 1 - My perceptions about Organisational Heath

This section has 29 questions which refer to the health of your organisation. Please try to answer from your perspective as to what you think about various statements given in the questionnaire.

*** 1. In my organisation, the management demonstrates by action, a balance between short and long term objectives**

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	◯	◯	◯	◯	◯	◯	◯

*** 2. In my company, the management backs up words with action**

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	◯	◯	◯	◯	◯	◯	◯

*** 3. I feel comfortable voicing my opinion even if it is different from that of my supervisor**

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	◯	◯	◯	◯	◯	◯	◯

*** 4. My supervisor responds to ideas and suggestions on how to improve the way work is done**

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	◯	◯	◯	◯	◯	◯	◯

*** 5. I am encouraged to take reasonable risk to solve quality problems in our work**

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	◯	◯	◯	◯	◯	◯	◯

3

* 6. In my department, all levels of employees work well together

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

* 7. InManagement encourages team work among departments to solve common problems

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

* 8. In my organisation, there is a strong agreement and a belief in our corporate strategies

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

* 9. I have authority to solve work related problems in timely manner

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

* 10. In my company, views of employees from different cultures and backgrounds are valued

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

* 11. Our competences are not easily imitable by our competition

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

* 12. The measures used in my organisation support and enable the accomplishment of our business strategies

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

4

* 13. In my organisation, I have right skills to achieve business strategies

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

* 14. In my organisation, I have right resources and tools to achieve business strategies

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

* 15. I understand my work group's objectives and how they contribute to achieving the goals and vision of our company

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

* 16. My company ensures to develop unique telecom competencies

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

* 17. I have received sufficient training to do my job well.

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

* 18. Our customers would say that overall quality of work done by our team is very good

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

* 19. I have opportunity to take decision required to exceed customer expectation

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

*** 20. My organisation structure facilitates accomplishment of our business strategies**

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree							

*** 21. My company is well equipped to meet the challenges of competition in next few years**

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree							

*** 22. I believe that our company is delivering the promises to the shareholders**

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree							

*** 23. My company's business targets are deeply meaningful**

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree							

*** 24. I have clear understanding of my company's business strategies**

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree							

*** 25. I am very clear on my goals and their linkage to the work group strategies**

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree							

*** 26. My roles and responsibilities are every clear**

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree							

*** 27. I am very clear on my workgroup's business strategies**

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

*** 28. Communication from the management is open and honest**

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

*** 29. My company has adequate communication meetings**

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

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4. Section 2 - My perceptions about technology disruption

This section has 15 questions which touch upon the disruptive effects caused by changing technologies to the telecommunication industry as a whole and specifically to your organisation. You are required to answer all the questions.

1. Value added services and digital contents are released to market with great speed

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

2. During the last three years I have seen several changes to our business plans due to a variety of new technologies

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

3. Any change in communication technology will impact our company's skill requirements

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

4. There is an unprecedented technology revolution happening in telecommunication sector

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

5. We have the ability to accurately predict future technological trends

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

6. Due to the change in technology, there is a decrease in demand for our older products

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

7. We are one of the leaders in telecom industry to establish and upgrade technology standards

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

8. We always lead technology innovation of the principal industry in which we operate

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

9. We have strong capability to integrate external technological resources with in-house resources of our firm

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

10. The level of market turbulence caused by technology is extremely high

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

11. It is impossible to predict accurately the rapidly changing demands and tastes of consumers

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

12. Activities of major competitors are unpredictable and competition is very intense

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

13. The speed of technological changes in telecom industry in which our firm operate is fast

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

14. The technological changes in telecom industry in which we operate is unpredictable

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

15. The impact of new technology on business operations and competition is rather high

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

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5. Section 3 - My perceptions about competence adequacy

With 25 questions, this section deals with the competence adequacy of your organisation in light of the technology disruption you have been witnessing in the telecommunication domain. As a supervisor, please answer the your perception about current competence situation and how do you manage such situation in your respective team.

1. Our capability in obtaining real time information about changes of customer needs is very strong

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

2. Our capability in communicating with customers about their potential and current demands is very strong

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

3. We have strong capability of involving customers in the process of product testing and assessment

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

4. Our capability enables us to respond quickly to customers' requirements and deliver offerings in time

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

11

5. We have strong capability to acquire real time information of competitors' evolution of strength and weakness

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

6. Our capability in benchmarking the product and service practices of major competitors is very strong

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

7. We have strong capability of building and enhancing large-scale marketing channels

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

8. We have strong capability of managing close customer relationship effectively for long-term

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

9. We always make relatively heavy investment in R&D activities

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

10. We have accumulated stronger and various technological skills

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

11. On-job training is provided frequently in our firm to improve the technical skills of employees

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

12. We are qualified to attract and motivate talented experts

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

13. We have the ability to accurately predict future technological trends

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

14. We are skilful in apply new technology to problem-solving

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

15. We are one of the leaders in our primary industry to establish and upgrade technology standards

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

16. We always lead technology innovation of the principal industry in which we operate

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

17. Our capability in communication among functions in the process of product and service design is very strong

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

18. We have strong capability to share and leverage marketing and technology knowledge among functions/business units

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

13

19. We have strong capability to integrate external resources with the in-house resources of our firm

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

20. We have strong capability to share and leverage information about competing strategies of major competitors

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

21. We have strong capability to coordinate and integrate activities of functions/business units in our corporate strategy

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

22. We are good at embedding of the newly achieved technological findings in new products and services

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

23. We have strong skills in integrating customers' innovative ideas into final products and services

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

24. We have strong capability to deliver superior value to customers by integrating different processes

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

14

25. We have strong capability to coordinate effectively in the implementation process of corporate strategy

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

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6. Section 4 - My perceptions about Innovation Capacity

Your organisation's innovation efforts and collective ability to improve and customise products are touched upon in this section with 23 questions.

1. My organization has active programs to upgrade employees' knowledge and skills

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

2. There are many opportunities to exchange and generate ideas in my organization

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

3. Innovation behaviour is timely rewarded in our company

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

4. My organization gives adequate resources to exploring and implementing innovative ideas

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

5. In my organization innovative and enterprising employees are well paid

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

6. My work schedule allows me time to think of creative solutions to problems

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

7. Innovation is clearly a part of my organization's mission or basic beliefs

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

8. There are many opportunities and freedom in my work to explore and try out new ideas

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

9. I frequently encounter non-routine and challenging work in my organization

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

10. The type of work we do requires large amount of imagination and creativity

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

11. There is much knowledge to gain from the work I do for my organization

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

12. I found my colleagues very helpful when I encounter difficulties with my work

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

13. In my organization people show interest in each other's work

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

14. I find my colleagues very helpful in sharing knowledge and information

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

15. In my organization lots of people take the initiatives to raise new projects

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

16. Teamwork is great in my organization

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

17. In my organization different departments work together harmoniously

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

18. In my organization there is a strong sense of mutual trust

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

19. My organization is able to accumulate knowledge or learn and benefit from experience

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

20. In my organization the dissemination of information relevant to work is excellent

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

21. Documentation, information and databases are well managed in my organization

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

22. My organization's information system is a great aid to finding ideas and opportunities

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

23. My organization captures information diligently from external sources, e.g. customers

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

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7. Section 5 - My perceptions about Competence Building

With 15 questions this section deals with your organisation's competence preparedness to deal with the gap in competence created by the technology disruption.

1. How relevant do you consider your present professional knowledge for your current job?

	1	2	3	4	5	6	7
1 = Not relevant 7 = Very relevant	◯	◯	◯	◯	◯	◯	◯

2. How relevant do you consider your present skills for your current job?

	1	2	3	4	5	6	7
1 = Not relevant 7 = Very relevant	◯	◯	◯	◯	◯	◯	◯

3. How would you rate these skills in relation to the demands of your current job?

	1	2	3	4	5	6	7
1 = Not relevant 7 = Very relevant	◯	◯	◯	◯	◯	◯	◯

4. To what extent does your present job utilise your competence?

	1	2	3	4	5	6	7
1 = Very low 7 = Very high	◯	◯	◯	◯	◯	◯	◯

5. How would you rate your present level of motivation to keep up-to-date?

	1	2	3	4	5	6	7
1 = Very low 7 = Very high	◯	◯	◯	◯	◯	◯	◯

20

6. How has the competence requirement for the job changed over the past two years?

	1	2	3	4	5	6	7
1 = Not changed 7 = Much changed	○	○	○	○	○	○	○

7. How challenging generally do you find your job assignments?

	1	2	3	4	5	6	7
1 = Not challenging 7 = Very challenging	○	○	○	○	○	○	○

8. How employable do you think your skills are in other organisations?

	1	2	3	4	5	6	7
1 = Not Employable 7 = Very much employable	○	○	○	○	○	○	○

9. In general, how would you rate your present ability to learn work-related knowledge/skill?

	1	2	3	4	5	6	7
1 = No Learning 7 = High Learning	○	○	○	○	○	○	○

10. To what extent has your ability to learn changed in the past two years?

	1	2	3	4	5	6	7
1 = Not changed 7 = Changed very much	○	○	○	○	○	○	○

11. How much do you enjoy new work-related learning?

	1	2	3	4	5	6	7
1 = Do not enjoy 7 = Enjoy very much	○	○	○	○	○	○	○

12. According to you how difficult it is to find telecom skills in the job market?

	1	2	3	4	5	6	7
1 = Very Difficult 7 = Very Easy	○	○	○	○	○	○	○

13. My professional expertise is essential for the achievement of good results

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

14. My company is one of the leaders in the primary industry to establish and upgrade technology standards

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

15. My company has a great level of technological experts or specialists

	1	2	3	4	5	6	7
1 = Strongly Disagree 7 = Strongly Agree	○	○	○	○	○	○	○

Appendix D: Survey questionnaire - Demographic profile

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8. Profile of the respondent

Please answer about some of your profile data for me to analyse the answers appropriately

1. State your total experience here

- ○ Less than 8 years
- ○ 8 - 10 years
- ○ 10 - 12 years
- ○ 12 - 15 years
- ○ More than 15 years

2. What is your gender?

- ○ Female
- ○ Male

3. Are you currently holding a supervisory role?

- ○ Yes
- ○ No

4. Total service with the current organisation

- ○ Less than one (1) year
- ○ More than one (1) year

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Appendix E: Descriptive statistics of survey data

			Statistic	Std. Error
TDTC	Mean		2.3123	.04276
	95% Confidence Interval for Mean	Lower Bound	2.2284	
		Upper Bound	2.3962	
	5% Trimmed Mean		2.1882	
	Median		2.0000	
	Variance		1.673	
	Std. Deviation		1.29348	
	Minimum		1.00	
	Maximum		7.00	
	Range		6.00	
	Interquartile Range		1.11	
	Skewness		1.617	.081
	Kurtosis		2.018	.162
TDMT	Mean		4.9166	.05715
	95% Confidence Interval for Mean	Lower Bound	4.8044	
		Upper Bound	5.0287	
	5% Trimmed Mean		5.0041	
	Median		5.6667	
	Variance		2.988	
	Std. Deviation		1.72860	
	Minimum		1.00	
	Maximum		7.00	
	Range		6.00	
	Interquartile Range		2.67	
	Skewness		-.822	.081
	Kurtosis		-.648	.162
TDTT	Mean		4.3133	.06876
	95% Confidence Interval for Mean	Lower Bound	4.1784	
		Upper Bound	4.4482	
	5% Trimmed Mean		4.3409	
	Median		4.3333	
	Variance		4.326	
	Std. Deviation		2.07985	
	Minimum		1.00	
	Maximum		7.00	
	Range		6.00	
	Interquartile Range		4.00	
	Skewness		-.046	.081

	Kurtosis		-1.593	.162
CAMC	Mean		4.0411	.03969
	95% Confidence Interval for Mean	Lower Bound	3.9632	
		Upper Bound	4.1189	
	5% Trimmed Mean		4.0479	
	Median		4.0000	
	Variance		1.441	
	Std. Deviation		1.20048	
	Minimum		1.00	
	Maximum		7.00	
	Range		6.00	
	Interquartile Range		1.71	
	Skewness		-.031	.081
	Kurtosis		-.841	.162
CATC	Mean		4.7168	.05091
	95% Confidence Interval for Mean	Lower Bound	4.6169	
		Upper Bound	4.8167	
	5% Trimmed Mean		4.7684	
	Median		5.1250	
	Variance		2.372	
	Std. Deviation		1.54010	
	Minimum		1.00	
	Maximum		7.00	
	Range		6.00	
	Interquartile Range		2.50	
	Skewness		-.623	.081
	Kurtosis		-.822	.162
CAIC	Mean		4.3106	.03964
	95% Confidence Interval for Mean	Lower Bound	4.2328	
		Upper Bound	4.3884	
	5% Trimmed Mean		4.3428	
	Median		4.4444	
	Variance		1.438	
	Std. Deviation		1.19913	
	Minimum		1.11	
	Maximum		6.78	
	Range		5.67	
	Interquartile Range		1.89	
	Skewness		-.302	.081
	Kurtosis		-.802	.162
OHCC	Mean		4.1627	.04762
	95% Confidence Interval for Mean	Lower Bound	4.0693	
		Upper Bound	4.2562	

			4.2108	
	5% Trimmed Mean		4.3000	.081
	Median		2.075	.162
	Variance		1.44038	.03910
	Std. Deviation		1.00	
	Minimum		7.00	
	Maximum		6.00	
	Range		2.10	
	Interquartile Range		-.375	
	Skewness		-.507	
	Kurtosis		3.9633	
	Mean			
OHCA	95% Confidence Interval for Mean	Lower Bound	3.8866	
		Upper Bound	4.0400	
	5% Trimmed Mean		3.9867	
	Median		4.1429	
	Variance		1.399	
	Std. Deviation		1.18261	
	Minimum		1.00	
	Maximum		6.71	
	Range		5.71	
	Interquartile Range		1.57	
	Skewness		-.357	.081
	Kurtosis		-.285	.162
OHGA	Mean		3.8895	.04693
	95% Confidence Interval for Mean	Lower Bound	3.7974	
		Upper Bound	3.9816	
	5% Trimmed Mean		3.8879	
	Median		3.7500	
	Variance		2.015	
	Std. Deviation		1.41952	
	Minimum		1.00	
	Maximum		7.00	
	Range		6.00	
	Interquartile Range		2.17	
	Skewness		.098	.081
	Kurtosis		-.786	.162
ICIS	Mean		3.0337	.03968
	95% Confidence Interval for Mean	Lower Bound	2.9558	
		Upper Bound	3.1116	
	5% Trimmed Mean		2.9789	

	Median		2.8571	
	Variance		1.441	
	Std. Deviation		1.20031	
	Minimum		1.00	
	Maximum		6.71	
	Range		5.71	
	Interquartile Range		2.00	
	Skewness		.616	.081
	Kurtosis		-.310	.162
ICIT	Mean		2.8904	.03935
	95% Confidence Interval for Mean	Lower Bound	2.8132	
		Upper Bound	2.9677	
	5% Trimmed Mean		2.8340	
	Median		2.5000	
	Variance		1.417	
	Std. Deviation		1.19035	
	Minimum		1.00	
	Maximum		7.00	
	Range		6.00	
	Interquartile Range		1.75	
	Skewness		.744	.081
	Kurtosis		-.045	.162
ICIB	Mean		3.0238	.04221
	95% Confidence Interval for Mean	Lower Bound	2.9409	
		Upper Bound	3.1066	
	5% Trimmed Mean		2.9832	
	Median		2.7500	
	Variance		1.630	
	Std. Deviation		1.27681	
	Minimum		1.00	
	Maximum		6.25	
	Range		5.25	
	Interquartile Range		2.00	
	Skewness		.460	.081
	Kurtosis		-.686	.162
ICII	Mean		2.8959	.03381
	95% Confidence Interval for Mean	Lower Bound	2.8296	
		Upper Bound	2.9622	
	5% Trimmed Mean		2.8679	
	Median		2.7500	
	Variance		1.046	
	Std. Deviation		1.02260	
	Minimum		1.00	

	Maximum		6.25	
	Range		5.25	
	Interquartile Range		1.25	
	Skewness		.342	.081
	Kurtosis		-.178	.162
ICIC	Mean		3.1232	.03852
	95% Confidence Interval for Mean	Lower Bound	3.0476	
		Upper Bound	3.1988	
	5% Trimmed Mean		3.0828	
	Median		2.7500	
	Variance		1.358	
	Std. Deviation		1.16514	
	Minimum		1.00	
	Maximum		6.75	
	Range		5.75	
	Interquartile Range		1.75	
	Skewness		.521	.081
	Kurtosis		-.658	.162
CBPK	Mean		3.1971	.04813
	95% Confidence Interval for Mean	Lower Bound	3.1026	
		Upper Bound	3.2916	
	5% Trimmed Mean		3.1799	
	Median		3.0000	
	Variance		2.120	
	Std. Deviation		1.45602	
	Minimum		1.00	
	Maximum		6.33	
	Range		5.33	
	Interquartile Range		2.33	
	Skewness		.148	.081
	Kurtosis		-1.187	.162
CBUM	Mean		3.4247	.04059
	95% Confidence Interval for Mean	Lower Bound	3.3450	
		Upper Bound	3.5044	
	5% Trimmed Mean		3.4156	
	Median		3.2000	
	Variance		1.507	
	Std. Deviation		1.22774	
	Minimum		1.00	
	Maximum		6.60	
	Range		5.60	
	Interquartile Range		1.60	
	Skewness		.212	.081

	Kurtosis		-.680	.162
	Mean		3.1202	.04292
	95% Confidence Interval for Mean	Lower Bound	3.0360	
		Upper Bound	3.2045	
	5% Trimmed Mean		3.0821	
	Median		3.0000	
	Variance		1.686	
CBUA	Std. Deviation		1.29842	
	Minimum		1.00	
	Maximum		6.75	
	Range		5.75	
	Interquartile Range		2.25	
	Skewness		.333	.081
	Kurtosis		-.970	.162
	Mean		3.1825	.04396
	95% Confidence Interval for Mean	Lower Bound	3.0962	
		Upper Bound	3.2688	
	5% Trimmed Mean		3.1573	
	Median		3.0000	
	Variance		1.768	
CBIE	Std. Deviation		1.32980	
	Minimum		1.00	
	Maximum		6.67	
	Range		5.67	
	Interquartile Range		2.33	
	Skewness		.231	.081
	Kurtosis		-.954	.162

Appendix F: Inter-Item correlation of the Pilot Study

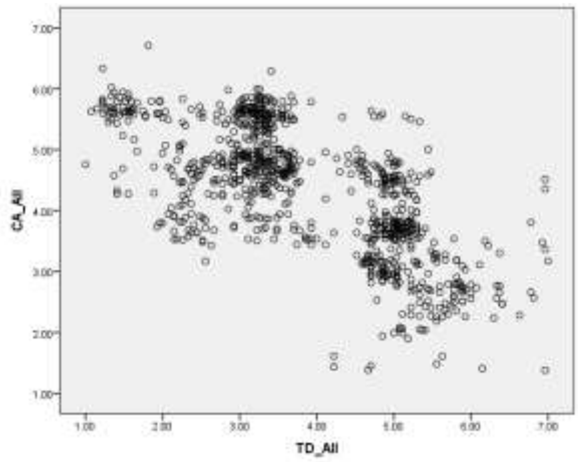
	TDTC	TDMT	TDTT	CAMC	CATC	CAIC	OHCC	OHCA	OHGA	ICIS	ICIT	ICIB	ICII	ICIC	CBPK	CBUM	CBUA	CBIE
TDTC1	**0.95**	0.61	0.64	-0.10	-0.11	-0.08	-0.54	-0.49	-0.62	-0.14	-0.10	-0.11	-0.16	-0.14	-0.21	-0.19	-0.14	-0.24
TDTC2	**0.90**	0.57	0.62	-0.12	-0.14	-0.07	-0.49	-0.47	-0.58	-0.12	-0.10	-0.10	-0.15	-0.12	-0.19	-0.18	-0.13	-0.22
TDTC3	**0.90**	0.59	0.62	-0.15	-0.12	-0.11	-0.51	-0.48	-0.61	-0.15	-0.13	-0.14	-0.19	-0.15	-0.25	-0.22	-0.15	-0.28
TDTC4	**0.90**	0.61	0.64	-0.08	-0.06	-0.02	-0.54	-0.50	-0.63	-0.14	-0.12	-0.10	-0.13	-0.11	-0.19	-0.17	-0.14	-0.21
TDTC5	**0.92**	0.60	0.67	-0.13	-0.13	-0.09	-0.58	-0.53	-0.66	-0.09	-0.08	-0.08	-0.15	-0.12	-0.16	-0.16	-0.12	-0.17
TDTC6	**0.90**	0.57	0.64	-0.10	-0.10	-0.07	-0.54	-0.49	-0.62	-0.11	-0.08	-0.11	-0.16	-0.13	-0.17	-0.17	-0.12	-0.19
TDTC7	**0.85**	0.58	0.62	-0.10	-0.10	-0.07	-0.59	-0.52	-0.64	-0.18	-0.11	-0.13	-0.21	-0.16	-0.25	-0.22	-0.16	-0.28
TDTC8	**0.91**	0.59	0.66	-0.09	-0.10	-0.04	-0.57	-0.50	-0.65	-0.14	-0.11	-0.08	-0.18	-0.16	-0.22	-0.19	-0.13	-0.24
TDTC9	**0.91**	0.58	0.64	-0.13	-0.14	-0.09	-0.57	-0.52	-0.63	-0.09	-0.09	-0.08	-0.14	-0.11	-0.16	-0.15	-0.11	-0.17
TDMT1	0.61	**0.96**	0.71	-0.08	-0.07	-0.06	-0.58	-0.51	-0.63	-0.16	-0.14	-0.16	-0.23	-0.21	-0.21	-0.26	-0.19	-0.25
TDMT2	0.63	**0.95**	0.71	-0.06	-0.06	-0.03	-0.62	-0.54	-0.66	-0.11	-0.09	-0.13	-0.25	-0.21	-0.19	-0.22	-0.14	-0.21
TDMT3	0.63	**0.96**	0.71	-0.08	-0.04	-0.04	-0.60	-0.55	-0.64	-0.14	-0.12	-0.15	-0.21	-0.17	-0.19	-0.23	-0.16	-0.21
TDTT1	0.65	0.70	**0.94**	-0.17	-0.15	-0.15	-0.60	-0.53	-0.70	-0.20	-0.14	-0.17	-0.31	-0.27	-0.26	-0.32	-0.26	-0.30
TDTT2	0.64	0.66	**0.91**	-0.13	-0.10	-0.08	-0.58	-0.53	-0.71	-0.14	-0.14	-0.14	-0.27	-0.24	-0.24	-0.26	-0.19	-0.26
TDTT3	0.68	0.70	**0.93**	-0.11	-0.06	-0.09	-0.63	-0.55	-0.72	-0.11	-0.11	-0.14	-0.23	-0.20	-0.20	-0.22	-0.18	-0.24
CAMC1	-0.11	-0.03	-0.12	**0.71**	0.43	0.32	0.04	0.06	0.08	0.23	0.11	0.18	0.23	0.24	0.23	0.27	0.17	0.23
CAMC2	-0.08	-0.05	-0.08	**0.79**	0.42	0.33	0.01	0.02	0.03	0.19	0.11	0.17	0.21	0.20	0.20	0.25	0.16	0.19
CAMC3	-0.08	-0.06	-0.11	**0.80**	0.30	0.35	0.03	0.04	0.09	0.13	0.03	0.11	0.16	0.14	0.15	0.20	0.12	0.14
CAMC4	-0.12	-0.07	-0.13	**0.77**	0.28	0.16	0.05	0.06	0.08	0.14	0.06	0.10	0.19	0.13	0.15	0.17	0.08	0.18
CAMC5	-0.10	-0.09	-0.13	**0.79**	0.20	0.24	0.06	0.05	0.11	0.16	0.05	0.13	0.18	0.15	0.18	0.23	0.11	0.19
CAMC6	-0.11	-0.10	-0.11	**0.77**	0.25	0.25	0.06	0.02	0.09	0.10	0.06	0.08	0.12	0.11	0.13	0.15	0.08	0.12
CAMC7	-0.08	-0.05	-0.12	**0.81**	0.25	0.21	0.04	0.04	0.11	0.15	0.03	0.12	0.19	0.12	0.17	0.15	0.07	0.16
CAMC8	-0.07	-0.03	-0.11	**0.79**	0.21	0.26	0.00	0.00	0.10	0.11	0.06	0.09	0.15	0.14	0.15	0.16	0.13	0.15
CATC1	-0.11	-0.04	-0.08	0.29	**0.92**	0.41	-0.01	0.00	0.02	0.11	0.08	0.18	0.14	0.16	0.21	0.18	0.17	0.20
CATC2	-0.10	-0.05	-0.08	0.29	**0.89**	0.37	-0.01	0.02	0.01	0.10	0.08	0.17	0.19	0.19	0.23	0.20	0.16	0.21
CATC3	-0.11	-0.05	-0.10	0.37	**0.92**	0.38	0.01	0.02	0.02	0.14	0.06	0.18	0.17	0.18	0.23	0.21	0.17	0.22

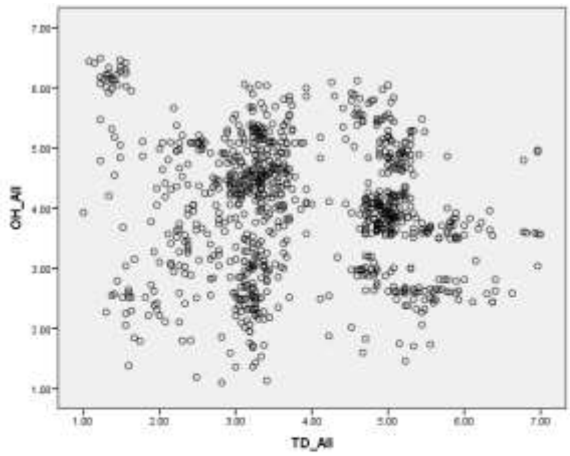
CATC4	-0.10	-0.06	-0.10	0.35	**0.92**	0.43	-0.01	-0.01	0.03	0.12	0.08	0.19	0.17	0.20	0.23	0.22	0.19	0.22
CATC5	-0.13	-0.08	-0.12	0.32	**0.93**	0.44	0.02	0.04	0.04	0.14	0.07	0.22	0.18	0.21	0.24	0.25	0.19	0.23
CATC6	-0.12	-0.07	-0.13	0.36	**0.93**	0.42	0.02	0.03	0.05	0.15	0.09	0.21	0.18	0.19	0.24	0.24	0.21	0.23
CATC7	-0.12	-0.06	-0.11	0.37	**0.92**	0.48	0.02	0.03	0.04	0.15	0.07	0.23	0.19	0.18	0.23	0.25	0.18	0.21
CATC8	-0.10	-0.03	-0.09	0.39	**0.92**	0.45	-0.01	0.01	0.03	0.18	0.06	0.20	0.14	0.18	0.23	0.23	0.19	0.22
CAIC1	-0.07	-0.04	-0.11	0.37	0.45	**0.87**	0.06	0.01	0.05	0.16	0.09	0.18	0.17	0.16	0.20	0.25	0.16	0.18
CAIC2	-0.07	-0.04	-0.10	0.21	0.38	**0.86**	0.06	0.05	0.04	0.12	0.07	0.14	0.13	0.14	0.21	0.20	0.17	0.19
CAIC3	-0.07	-0.05	-0.11	0.31	0.40	**0.87**	0.07	0.01	0.05	0.15	0.05	0.16	0.12	0.13	0.17	0.21	0.13	0.15
CAIC4	-0.04	-0.03	-0.07	0.31	0.39	**0.87**	0.05	0.03	0.04	0.14	0.07	0.17	0.16	0.19	0.22	0.22	0.17	0.19
CAIC5	-0.07	-0.02	-0.08	0.33	0.43	**0.85**	0.03	-0.01	0.07	0.11	0.10	0.14	0.15	0.15	0.18	0.23	0.17	0.17
CAIC6	-0.03	-0.01	-0.10	0.31	0.36	**0.88**	0.05	0.03	0.07	0.14	0.06	0.18	0.19	0.21	0.22	0.23	0.18	0.20
CAIC7	-0.05	-0.02	-0.08	0.20	0.37	**0.87**	0.03	0.03	0.06	0.14	0.04	0.14	0.12	0.16	0.16	0.21	0.16	0.13
CAIC8	-0.11	-0.04	-0.10	0.26	0.38	**0.82**	0.05	0.01	0.08	0.17	0.08	0.17	0.14	0.13	0.18	0.22	0.15	0.16
CAIC9	-0.08	-0.07	-0.12	0.30	0.36	**0.78**	0.05	0.05	0.07	0.21	0.11	0.21	0.21	0.24	0.27	0.29	0.21	0.23
OHCC1	-0.51	-0.55	-0.53	0.04	-0.02	0.02	**0.93**	0.65	0.64	0.09	0.06	0.08	0.19	0.14	0.16	0.16	0.08	0.15
OHCC2	-0.55	-0.57	-0.57	0.02	-0.03	0.02	**0.93**	0.67	0.66	0.10	0.08	0.11	0.18	0.12	0.16	0.16	0.09	0.17
OHCC3	-0.56	-0.57	-0.60	0.06	0.00	0.03	**0.90**	0.65	0.65	0.08	0.07	0.08	0.18	0.15	0.16	0.17	0.11	0.15
OHCC4	-0.54	-0.55	-0.59	0.03	0.01	0.07	**0.89**	0.62	0.63	0.13	0.12	0.11	0.23	0.20	0.21	0.22	0.13	0.21
OHCC5	-0.51	-0.53	-0.57	0.04	0.03	0.07	**0.89**	0.63	0.63	0.08	0.07	0.07	0.19	0.14	0.18	0.18	0.09	0.15
OHCC6	-0.55	-0.57	-0.59	0.05	0.00	0.05	**0.91**	0.64	0.63	0.11	0.09	0.11	0.22	0.17	0.19	0.20	0.09	0.18
OHCC7	-0.58	-0.58	-0.63	0.03	0.01	0.07	**0.90**	0.64	0.69	0.06	0.09	0.08	0.19	0.14	0.15	0.17	0.09	0.16
OHCC8	-0.56	-0.57	-0.59	0.04	0.03	0.07	**0.91**	0.65	0.64	0.11	0.14	0.12	0.25	0.20	0.21	0.23	0.13	0.23
OHCC9	-0.56	-0.56	-0.60	0.05	0.01	0.09	**0.91**	0.63	0.65	0.08	0.10	0.12	0.19	0.15	0.19	0.19	0.09	0.19
OHCC10	-0.58	-0.61	-0.63	0.04	0.00	0.04	**0.88**	0.61	0.64	0.10	0.11	0.13	0.20	0.15	0.20	0.19	0.13	0.21
OHCA1	-0.51	-0.53	-0.55	0.04	0.03	0.05	0.66	**0.91**	0.59	0.10	0.06	0.09	0.20	0.14	0.14	0.19	0.13	0.14
OHCA2	-0.49	-0.48	-0.50	0.02	0.04	0.03	0.65	**0.85**	0.59	0.11	0.08	0.08	0.19	0.15	0.14	0.20	0.13	0.14
OHCA3	-0.50	-0.48	-0.50	0.00	0.02	0.03	0.61	**0.85**	0.60	0.10	0.06	0.05	0.13	0.08	0.09	0.17	0.09	0.10
OHCA4	-0.47	-0.50	-0.51	0.06	0.03	0.05	0.63	**0.90**	0.61	0.12	0.09	0.13	0.22	0.17	0.20	0.22	0.15	0.22
OHCA5	-0.51	-0.51	-0.54	0.05	0.03	0.00	0.64	**0.88**	0.60	0.07	0.05	0.05	0.17	0.12	0.11	0.15	0.08	0.13

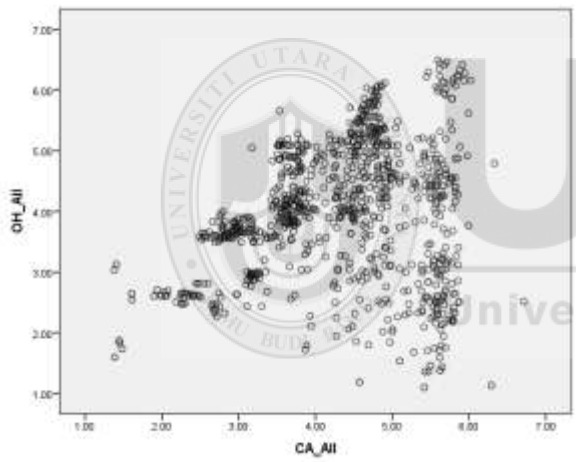
OHCA6	-0.39	-0.40	-0.42	0.02	-0.01	-0.02	0.50	**0.79**	0.49	0.08	0.01	0.04	0.12	0.05	0.08	0.12	0.05	0.08
OHCA7	-0.44	-0.42	-0.44	0.06	-0.02	0.03	0.54	**0.79**	0.54	0.12	0.01	0.03	0.09	0.04	0.12	0.13	0.06	0.13
OHGA1	-0.65	-0.61	-0.67	0.08	0.00	0.05	0.62	0.60	**0.88**	0.11	0.09	0.10	0.19	0.15	0.18	0.20	0.13	0.18
OHGA2	-0.58	-0.56	-0.60	0.11	0.04	0.10	0.60	0.56	**0.84**	0.11	0.06	0.12	0.24	0.20	0.18	0.20	0.11	0.19
OHGA3	-0.57	-0.58	-0.64	0.09	0.01	0.06	0.59	0.58	**0.88**	0.13	0.08	0.12	0.22	0.17	0.18	0.20	0.14	0.18
OHGA4	-0.59	-0.57	-0.66	0.10	0.03	0.10	0.63	0.53	**0.87**	0.13	0.11	0.11	0.24	0.19	0.18	0.24	0.14	0.20
OHGA5	-0.62	-0.57	-0.66	0.11	0.05	0.05	0.59	0.54	**0.84**	0.16	0.10	0.08	0.18	0.15	0.18	0.21	0.14	0.18
OHGA6	-0.60	-0.62	-0.65	0.03	0.05	0.05	0.61	0.56	**0.83**	0.11	0.08	0.09	0.16	0.15	0.14	0.20	0.15	0.14
OHGA7	-0.59	-0.59	-0.69	0.09	-0.02	-0.01	0.60	0.57	**0.84**	0.14	0.11	0.10	0.23	0.17	0.16	0.21	0.14	0.15
OHGA8	-0.57	-0.54	-0.63	0.07	-0.01	0.07	0.59	0.56	**0.88**	0.12	0.11	0.09	0.17	0.14	0.16	0.19	0.13	0.17
OHGA9	-0.61	-0.59	-0.69	0.11	0.05	0.04	0.61	0.60	**0.88**	0.16	0.15	0.16	0.24	0.22	0.24	0.27	0.19	0.23
OHGA10	-0.62	-0.60	-0.71	0.12	0.01	0.07	0.64	0.62	**0.90**	0.13	0.15	0.12	0.24	0.20	0.19	0.26	0.16	0.20
OHGA11	-0.57	-0.56	-0.65	0.13	0.04	0.03	0.64	0.59	**0.86**	0.09	0.14	0.15	0.28	0.23	0.22	0.28	0.18	0.20
OHGA12	-0.60	-0.59	-0.68	0.12	0.07	0.11	0.69	0.63	**0.86**	0.17	0.17	0.23	0.27	0.23	0.28	0.31	0.23	0.30
ICIS1	-0.10	-0.09	-0.08	0.16	0.13	0.18	0.04	0.04	0.08	**0.83**	0.23	0.33	0.16	0.21	0.41	0.38	0.39	0.45
ICIS2	-0.07	-0.09	-0.11	0.14	0.17	0.19	0.11	0.03	0.09	**0.74**	0.12	0.35	0.21	0.27	0.38	0.36	0.35	0.34
ICIS3	-0.12	-0.10	-0.14	0.15	0.11	0.16	0.08	0.08	0.11	**0.82**	0.10	0.31	0.13	0.13	0.40	0.34	0.38	0.39
ICIS4	-0.13	-0.15	-0.19	0.17	0.12	0.14	0.12	0.14	0.17	**0.78**	0.28	0.30	0.25	0.28	0.39	0.50	0.42	0.40
ICIS5	-0.11	-0.10	-0.11	0.14	0.11	0.14	0.07	0.09	0.11	**0.85**	0.08	0.31	0.11	0.13	0.36	0.39	0.39	0.39
ICIS6	-0.11	-0.08	-0.12	0.18	0.15	0.17	0.08	0.06	0.10	**0.85**	0.12	0.36	0.19	0.19	0.44	0.42	0.42	0.41
ICIS7	-0.10	-0.11	-0.13	0.17	0.14	0.14	0.07	0.10	0.13	**0.86**	0.14	0.29	0.10	0.17	0.37	0.40	0.42	0.37
ICIT1	-0.12	-0.16	-0.15	0.07	0.09	0.12	0.13	0.12	0.16	0.12	**0.86**	0.35	0.34	0.36	0.39	0.45	0.35	0.41
ICIT2	-0.09	-0.06	-0.10	0.09	0.11	0.10	0.04	0.03	0.10	0.08	**0.70**	0.25	0.16	0.20	0.28	0.29	0.24	0.28
ICIT3	-0.06	-0.04	-0.07	-0.03	-0.04	-0.01	0.05	0.00	0.03	0.08	**0.81**	0.29	0.23	0.30	0.32	0.34	0.30	0.34
ICIT4	-0.10	-0.13	-0.12	0.13	0.10	0.07	0.10	0.05	0.13	0.15	**0.85**	0.45	0.45	0.47	0.50	0.53	0.42	0.49
ICIB1	-0.06	-0.10	-0.10	0.10	0.15	0.12	0.06	0.05	0.08	0.32	0.30	**0.86**	0.45	0.41	0.47	0.52	0.55	0.45
ICIB2	-0.09	-0.13	-0.13	0.15	0.25	0.18	0.10	0.06	0.13	0.21	0.44	**0.82**	0.49	0.53	0.57	0.57	0.57	0.54
ICIB3	-0.12	-0.13	-0.15	0.14	0.21	0.18	0.09	0.07	0.11	0.28	0.32	**0.88**	0.41	0.40	0.51	0.52	0.54	0.52
ICIB4	-0.11	-0.16	-0.17	0.13	0.13	0.16	0.12	0.09	0.16	0.34	0.35	**0.84**	0.43	0.42	0.54	0.55	0.54	0.55

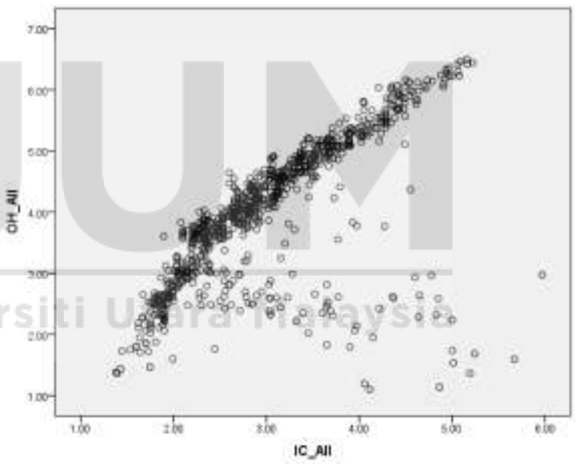
ICII1	-0.09	-0.13	-0.16	0.16	0.13	0.14	0.12	0.11	0.14	0.08	0.31	0.40	**0.75**	0.57	0.45	0.48	0.37	0.47
ICII2	-0.14	-0.20	-0.24	0.17	0.15	0.12	0.18	0.13	0.20	0.12	0.27	0.40	**0.84**	0.66	0.55	0.42	0.36	0.56
ICII3	-0.18	-0.22	-0.28	0.19	0.15	0.16	0.22	0.18	0.24	0.14	0.33	0.47	**0.83**	0.78	0.61	0.57	0.51	0.59
ICII4	-0.18	-0.22	-0.27	0.22	0.18	0.18	0.20	0.20	0.26	0.24	0.31	0.45	**0.87**	0.67	0.61	0.61	0.51	0.62
ICIC1	-0.14	-0.18	-0.24	0.17	0.17	0.16	0.16	0.13	0.21	0.12	0.37	0.40	0.75	**0.92**	0.54	0.55	0.50	0.60
ICIC2	-0.07	-0.11	-0.15	0.13	0.19	0.13	0.08	0.06	0.13	0.17	0.30	0.39	0.59	**0.80**	0.52	0.44	0.46	0.55
ICIC3	-0.13	-0.20	-0.23	0.21	0.21	0.23	0.17	0.11	0.19	0.23	0.40	0.48	0.72	**0.89**	0.62	0.60	0.52	0.60
ICIC4	-0.16	-0.23	-0.26	0.18	0.14	0.18	0.19	0.13	0.22	0.18	0.37	0.55	0.81	**0.91**	0.66	0.60	0.54	0.68
CBPK1	-0.21	-0.20	-0.24	0.20	0.21	0.22	0.19	0.15	0.21	0.36	0.48	0.57	0.66	0.63	**0.93**	0.60	0.56	0.84
CBPK2	-0.19	-0.17	-0.23	0.20	0.22	0.20	0.19	0.16	0.21	0.40	0.37	0.54	0.58	0.59	**0.92**	0.57	0.54	0.83
CBPK3	-0.21	-0.19	-0.22	0.19	0.26	0.23	0.16	0.10	0.18	0.40	0.43	0.59	0.63	0.61	**0.91**	0.60	0.54	0.85
CBUM1	-0.12	-0.18	-0.22	0.14	0.23	0.20	0.10	0.12	0.16	0.33	0.36	0.61	0.52	0.56	0.57	**0.80**	0.79	0.56
CBUM2	-0.16	-0.17	-0.21	0.23	0.20	0.26	0.18	0.13	0.19	0.46	0.39	0.51	0.49	0.46	0.53	**0.81**	0.71	0.50
CBUM3	-0.21	-0.21	-0.24	0.19	0.20	0.16	0.17	0.20	0.23	0.20	0.42	0.45	0.44	0.46	0.44	**0.79**	0.55	0.47
CBUM4	-0.20	-0.26	-0.28	0.22	0.17	0.22	0.24	0.23	0.28	0.35	0.43	0.54	0.57	0.53	0.54	**0.89**	0.67	0.54
CBUM5	-0.15	-0.18	-0.22	0.25	0.19	0.26	0.16	0.14	0.23	0.39	0.45	0.48	0.57	0.54	0.53	**0.80**	0.51	0.53
CBUA1	-0.08	-0.10	-0.12	0.06	0.16	0.11	0.01	0.03	0.08	0.32	0.31	0.54	0.38	0.44	0.41	0.60	**0.87**	0.41
CBUA2	-0.12	-0.16	-0.19	0.14	0.23	0.22	0.11	0.09	0.14	0.39	0.34	0.62	0.49	0.52	0.57	0.72	**0.87**	0.55
CBUA3	-0.13	-0.14	-0.19	0.13	0.14	0.17	0.11	0.12	0.17	0.34	0.40	0.55	0.48	0.51	0.53	0.71	**0.88**	0.54
CBUA4	-0.18	-0.20	-0.27	0.17	0.17	0.19	0.16	0.15	0.21	0.40	0.36	0.55	0.51	0.52	0.57	0.74	**0.86**	0.56
CBIE1	-0.26	-0.24	-0.30	0.21	0.20	0.15	0.20	0.18	0.21	0.40	0.35	0.49	0.57	0.56	0.80	0.52	0.49	**0.89**
CBIE2	-0.22	-0.20	-0.26	0.18	0.20	0.19	0.19	0.14	0.22	0.32	0.48	0.58	0.68	0.68	0.87	0.61	0.58	**0.89**
CBIE3	-0.17	-0.18	-0.20	0.19	0.23	0.22	0.14	0.10	0.17	0.38	0.43	0.55	0.57	0.60	0.76	0.56	0.51	**0.87**

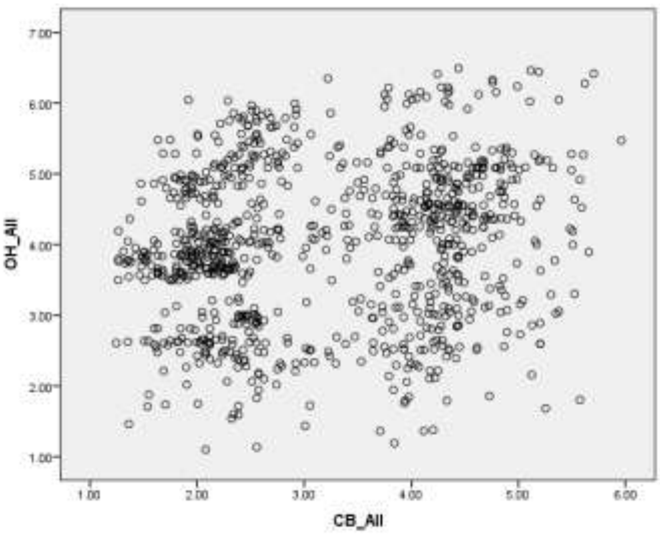
Appendix G: Partial correlation plots for normality test











Appendix H: Specimen data from the main survey

Sl	TDTC1	TDTC2	TDTC3	TDTC4	TDTC5	TDTC6	TDTC7	TDTC8	TDTC9	TDMT1	TDMT2	TDMT3	TDTT1	TDTT2	TDTT3	CAMC1	CAMC2	CAMC3
1	2	2	2	2	2	2	1	2	2	7	6	7	6	6	7	1	1	1
2	5	5	5	5	1	5	2	5	5	7	7	7	3	7	4	1	1	1
3	5	5	5	3	5	2	5	5	6	7	7	7	7	4	2	2	1	1
4	5	5	5	5	5	5	5	5	5	7	7	3	3	6	6	3	1	4
5	5	5	5	5	5	5	5	5	5	7	7	2	5	7	5	3	4	4
6	5	5	5	5	5	5	5	5	5	3	7	7	4	7	5	3	2	2
7	5	5	5	5	5	5	5	5	5	7	7	2	7	4	7	2	2	2
8	5	5	6	6	5	5	5	5	5	3	7	7	7	7	4	3	4	1
9	2	2	2	2	1	2	2	2	1	6	7	6	6	5	7	6	4	2
10	2	2	2	2	1	1	1	2	1	7	6	6	7	7	6	4	3	2
11	1	1	2	2	2	2	1	5	2	7	6	7	7	5	4	1	3	3
12	1	1	2	1	2	5	2	2	2	6	6	6	6	5	7	3	2	2
13	2	2	1	2	1	2	2	2	2	7	6	7	7	7	4	3	2	4
14	2	2	2	1	5	1	1	2	2	6	6	7	7	7	3	2	4	2
15	2	2	2	2	2	2	1	1	2	6	7	6	7	6	6	3	4	4
16	2	2	2	2	2	1	5	2	2	6	7	6	6	7	2	2	1	2
17	2	2	2	2	2	1	1	2	2	6	7	7	5	6	7	3	3	3
18	3	2	5	2	2	2	5	2	4	4	6	6	5	3	3	1	2	1
19	1	1	5	1	2	2	1	5	2	6	6	7	7	7	3	4	3	2
20	2	2	1	2	2	2	2	2	2	7	6	7	6	6	7	2	2	4
21	2	3	2	2	3	2	2	2	3	5	2	3	1	2	2	6	6	6
22	2	2	2	2	2	2	2	2	2	2	2	2	5	3	4	7	5	6
23	2	3	3	2	4	1	2	3	4	3	1	2	1	2	3	6	4	7
24	1	2	5	1	2	1	2	3	2	2	2	2	5	4	2	6	6	6
25	2	1	3	1	2	2	2	3	2	1	5	6	2	2	2	7	4	7
26	1	2	5	1	2	2	5	2	2	2	2	2	2	2	4	5	7	7
27	2	2	3	2	4	1	4	1	3	2	5	2	1	2	2	6	6	6
28	2	2	2	2	2	2	2	2	2	2	2	2	5	3	4	5	5	5
29	2	2	2	2	2	4	3	2	3	3	2	1	2	4	2	2	5	6
30	2	2	1	2	1	1	3	1	4	2	6	6	2	2	1	6	4	6
31	2	2	2	4	2	2	2	1	2	3	7	2	2	2	1	7	4	6
32	1	2	1	1	4	2	2	1	4	6	6	2	1	1	2	7	7	3
33	1	1	1	2	2	2	2	2	2	6	5	2	1	3	4	5	5	6
34	1	2	3	1	1	4	1	1	1	6	6	6	2	1	1	3	3	3
35	2	2	2	3	3	3	2	2	3	3	2	5	2	1	1	4	6	6

Sl	CAMC4	CAMC5	CAMC6	CAMC7	CAMC8	CATC1	CATC2	CATC3	CATC4	CATC5	CATC6	CATC7	CATC8	CAIC1	CAIC2	CAIC3	CAIC4	CAIC5
1	2	1	2	1	2	1	2	3	2	1	2	2	1	1	1	1	1	1
2	1	3	1	4	3	1	1	1	1	1	1	1	1	2	2	1	1	2
3	2	3	2	3	2	2	1	1	2	2	2	1	1	1	1	2	3	2
4	2	3	2	3	2	2	1	1	2	2	2	1	1	1	1	2	3	2
5	4	4	4	3	3	2	2	1	2	1	2	2	3	1	2	3	2	1
6	3	2	2	2	2	3	3	2	1	2	4	2	1	1	2	4	2	1
7	2	2	2	2	2	3	3	2	4	2	1	2	4	1	2	4	2	1
8	1	1	2	4	1	2	1	1	1	2	1	1	2	5	2	3	3	2
9	4	4	3	3	7	3	4	3	3	4	4	4	4	2	3	1	4	1
10	3	5	3	4	3	2	3	7	3	3	3	3	2	3	3	2	1	3
11	1	3	3	1	2	3	2	3	3	3	2	3	3	3	3	4	3	1
12	3	2	2	2	2	3	3	2	3	2	3	2	4	3	2	4	2	4
13	2	3	4	1	4	1	2	3	2	3	2	1	2	2	4	2	3	4
14	2	4	4	3	2	3	2	3	2	3	2	4	2	3	2	2	1	1
15	2	3	2	3	2	2	1	4	2	2	2	1	5	4	4	2	3	2
16	2	1	2	2	2	3	3	2	4	3	2	3	3	4	2	2	6	2
17	2	3	3	1	2	3	2	2	3	4	2	3	4	3	3	4	3	1
18	2	2	1	1	2	3	3	3	4	2	2	2	4	4	3	5	3	3
19	3	5	3	4	3	2	2	1	1	3	3	3	2	2	2	2	5	3
20	2	3	4	1	4	2	4	3	1	1	1	1	2	2	4	2	3	4
21	6	5	5	6	5	5	5	6	6	6	6	5	6	6	6	6	5	5
22	6	7	4	4	4	4	4	6	7	7	7	7	7	6	6	6	7	4
23	4	4	6	6	6	6	7	6	6	6	7	4	7	6	4	4	4	6
24	6	5	6	5	1	7	7	6	6	7	7	6	7	6	6	6	5	6
25	5	7	5	5	5	5	5	7	7	6	7	7	7	6	4	4	4	5
26	7	7	7	7	5	7	7	7	7	7	7	7	7	4	5	5	6	7
27	6	7	4	6	6	6	6	4	4	4	4	6	6	6	4	6	7	4
28	3	3	3	3	7	7	7	5	7	5	5	5	5	5	7	7	7	5
29	7	7	7	8	5	6	5	5	6	5	6	6	5	6	6	6	6	6
30	6	5	5	6	7	5	5	7	6	7	6	6	6	7	4	3	5	5
31	6	5	5	6	7	5	5	7	6	7	6	6	6	5	4	6	5	5
32	4	3	3	7	3	7	7	7	7	6	7	7	7	6	6	6	6	6
33	6	6	6	6	5	5	5	5	5	5	5	6	5	5	6	6	6	6
34	3	3	3	3	3	6	5	6	6	5	6	6	6	6	6	6	7	6
35	5	6	6	5	7	6	6	6	6	5	6	7	7	5	6	5	6	6

Sl	CAIC6	CAIC7	CAIC8	CAIC9	OHCC1	OHCC2	OHCC3	OHCC4	OHCC5	OHCC6	OHCC7	OHCC8	OHCC9	OHCC10	OHCA1	OHCA2	OHCA3	OHCA4
1	1	2	1	1	6	6	6	6	6	5	1	6	6	6	5	1	1	1
2	2	1	1	3	4	5	5	5	6	6	4	5	6	4	1	1	1	1
3	3	2	2	1	5	4	3	4	3	4	2	5	4	3	1	1	5	1
4	3	2	2	1	1	1	1	1	2	1	1	1	1	1	1	1	2	2
5	2	1	2	4	3	2	2	3	3	4	2	2	2	3	3	3	3	2
6	2	2	3	3	3	3	4	2	2	3	2	2	3	2	2	2	3	1
7	2	2	3	3	5	1	1	5	5	1	1	1	1	1	1	1	1	1
8	3	2	3	5	5	5	1	1	1	5	1	1	4	4	4	4	1	1
9	3	3	3	3	5	5	5	5	5	5	5	5	5	5	1	4	4	1
10	6	6	5	4	1	1	1	1	1	1	1	1	1	1	4	5	5	4
11	1	4	3	2	1	1	1	6	5	5	5	6	5	1	1	1	1	1
12	2	2	3	3	4	4	1	1	1	5	1	1	4	1	4	1	1	3
13	5	4	2	4	6	1	4	5	4	6	5	5	6	4	1	1	1	1
14	5	2	3	2	5	6	7	5	6	5	4	3	5	4	1	4	4	1
15	3	2	2	1	5	1	1	5	1	1	5	1	1	5	1	1	5	1
16	4	2	3	4	5	5	1	5	5	4	4	4	4	4	1	1	1	5
17	1	4	3	2	2	2	2	2	2	2	2	2	2	2	2	2	3	2
18	3	5	5	3	1	1	1	1	1	5	5	5	5	5	5	1	1	1
19	4	2	4	2	1	1	1	1	1	1	1	1	1	1	6	1	5	6
20	5	4	5	4	3	3	3	3	2	2	2	3	2	3	3	3	4	3
21	6	5	5	5	7	7	7	6	6	7	7	7	6	6	6	7	7	6
22	5	4	5	5	6	6	7	7	7	7	5	7	6	5	6	7	7	6
23	6	6	6	6	6	6	5	4	3	5	5	3	6	5	6	6	6	6
24	5	1	6	5	5	4	4	5	6	5	4	5	6	5	6	6	6	6
25	5	5	5	4	6	6	6	6	6	5	6	5	6	6	4	5	5	4
26	7	5	6	5	7	7	6	7	7	7	6	6	5	7	4	3	7	7
27	6	6	5	6	7	7	7	6	7	7	5	6	7	7	7	6	7	7
28	5	7	7	7	6	6	1	1	6	6	1	6	6	6	6	6	6	6
29	1	5	6	5	5	5	5	6	5	5	5	6	6	6	6	1	5	6
30	4	3	7	7	6	6	6	6	5	6	6	4	5	6	5	5	5	5
31	4	7	5	4	6	6	6	6	5	6	6	4	5	6	5	5	5	5
32	6	6	6	6	5	5	5	5	5	4	4	5	4	4	4	5	6	6
33	6	5	5	5	6	6	6	6	6	5	6	5	6	6	4	5	5	4
34	6	7	6	5	5	7	7	5	7	5	7	5	7	5	7	7	7	5
35	5	5	6	5	5	5	5	4	5	4	4	5	4	3	4	5	6	5

Sl	OHCA5	OHCA6	OHCA7	OHGA1	OHGA2	OHGA3	OHGA4	OHGA5	OHGA6	OHGA7	OHGA8	OHGA9	OHGA10	OHGA11	OHGA12	ICIS1	ICIS2	ICIS3
1	5	1	5	1	1	1	1	5	1	5	1	1	1	1	1	3	2	3
2	1	1	1	1	1	1	1	1	1	5	5	1	1	6	1	1	1	2
3	1	1	3	4	3	2	3	2	1	3	5	3	2	2	1	1	2	2
4	1	1	1	3	4	3	2	2	2	2	2	1	1	1	1	1	1	1
5	2	3	3	3	2	3	3	2	2	2	3	2	3	2	3	1	2	1
6	1	2	2	1	2	1	1	1	1	2	1	1	1	1	1	2	2	1
7	1	1	1	5	1	1	1	5	1	1	1	5	1	1	5	1	4	4
8	1	5	1	1	1	4	1	1	1	1	4	1	4	1	5	2	7	2
9	4	4	4	1	1	1	1	1	1	1	1	1	1	1	1	1	3	1
10	5	4	5	6	1	6	6	1	6	1	1	6	6	1	1	1	2	1
11	5	1	2	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2
12	4	2	1	1	1	1	1	1	1	4	1	5	1	5	1	3	3	2
13	1	2	1	5	6	4	4	2	3	4	6	4	4	4	3	2	2	2
14	1	4	4	4	1	4	1	1	1	5	5	4	4	6	1	1	2	1
15	6	6	1	1	6	1	1	5	1	6	1	1	1	1	1	1	5	6
16	1	1	1	1	1	1	1	1	4	1	1	4	1	1	4	2	3	6
17	3	3	2	2	2	2	4	4	3	3	3	3	4	3	3	2	2	2
18	5	6	1	1	1	1	1	5	5	1	1	1	1	5	1	1	2	2
19	5	6	6	5	1	1	1	5	1	1	1	1	1	1	1	5	5	4
20	3	4	3	2	2	1	2	2	3	3	3	3	2	1	1	2	2	2
21	6	6	7	7	7	7	7	5	7	7	7	6	4	7	7	6	3	6
22	7	6	7	5	6	7	7	7	7	7	7	7	7	7	7	6	3	6
23	7	7	6	5	6	5	3	2	5	2	5	2	3	2	2	3	3	3
24	5	4	2	5	6	1	6	1	4	4	4	6	4	5	5	3	3	3
25	4	4	4	6	5	5	5	5	5	5	5	6	5	5	5	4	5	5
26	7	7	7	7	7	7	7	5	7	7	7	7	7	7	7	5	5	6
27	6	7	7	7	6	7	7	7	7	5	7	6	7	6	7	3	2	3
28	6	4	1	6	4	6	6	4	4	6	6	1	6	1	1	2	2	5
29	5	6	4	1	4	4	5	5	1	4	1	6	4	4	5	3	3	3
30	5	4	3	6	5	5	5	5	5	5	5	5	5	5	5	2	2	2
31	5	4	3	6	5	5	5	5	5	5	5	5	5	5	5	4	5	5
32	5	6	6	6	5	6	6	6	5	5	6	5	5	5	6	1	6	1
33	4	4	4	6	5	5	5	5	5	5	5	6	5	5	5	2	2	2
34	7	7	7	7	5	7	7	7	7	7	5	7	5	5	7	5	5	5
35	5	3	4	6	5	5	5	5	5	5	5	5	5	5	5	7	7	7

Sl	ICIS4	ICIS5	ICIS6	ICIS7	ICIT1	ICIT2	ICIT3	ICIT4	ICIB1	ICIB2	ICIB3	ICIB4	ICII1	ICII2	ICII3	ICII4	ICIC1	ICIC2
1	3	3	3	3	4	3	4	4	4	5	5	5	3	4	3	4	3	2
2	1	2	1	1	2	1	1	1	3	2	2	1	1	1	2	2	1	1
3	1	2	1	1	1	3	2	1	1	3	1	1	2	1	1	1	2	2
4	1	1	1	1	2	1	2	2	1	2	1	1	3	2	3	3	3	2
5	1	2	3	2	1	1	3	1	3	2	2	1	2	2	2	4	2	2
6	2	1	3	1	1	3	1	2	3	2	2	2	2	2	2	2	2	2
7	1	1	4	3	1	1	1	1	2	2	2	1	2	1	1	2	5	2
8	5	2	2	2	6	6	7	6	3	3	2	3	7	6	5	6	7	6
9	3	1	1	1	3	5	3	3	2	2	2	1	1	4	3	1	3	2
10	2	1	2	1	4	3	4	4	2	4	2	1	2	4	2	2	2	2
11	2	2	2	2	4	2	2	3	4	4	5	4	3	2	2	3	2	2
12	3	3	3	3	2	1	2	2	1	1	1	1	2	4	4	3	5	2
13	2	2	2	2	1	2	2	1	1	1	1	7	1	2	1	3	6	7
14	1	3	2	1	3	3	3	3	4	5	5	5	2	2	2	2	2	5
15	4	6	1	1	3	5	3	3	2	2	2	1	1	1	3	1	3	2
16	2	2	2	2	1	3	1	2	1	1	3	1	2	3	3	1	6	5
17	2	2	2	2	4	2	2	3	4	4	5	4	3	2	2	3	2	2
18	1	1	1	4	4	3	4	4	2	2	2	1	5	6	2	1	3	2
19	2	4	5	2	2	2	2	3	3	3	3	3	3	4	3	4	4	4
20	2	2	2	2	6	6	2	2	7	7	1	7	2	2	2	2	4	4
21	6	6	2	6	2	5	2	3	7	3	7	1	3	4	3	4	3	2
22	6	6	2	6	2	5	2	3	7	3	7	1	3	4	3	4	3	2
23	4	3	3	3	3	7	2	2	7	7	7	3	3	4	3	4	4	4
24	4	3	3	3	5	6	6	6	7	7	7	7	2	2	2	2	2	2
25	4	4	5	4	2	4	2	2	4	3	4	4	4	7	2	3	5	7
26	5	5	6	5	7	7	7	7	5	5	6	5	2	2	2	2	2	2
27	5	3	3	3	4	3	4	4	7	7	7	7	3	3	3	3	3	2
28	6	2	6	6	5	2	6	6	3	7	7	5	2	2	4	2	2	2
29	4	3	3	3	6	5	6	5	7	7	7	7	2	2	2	2	2	2
30	2	2	2	2	6	7	2	2	7	7	6	7	2	5	2	2	6	5
31	4	4	5	4	2	4	2	2	4	3	4	4	4	7	2	3	3	7
32	6	5	6	6	3	3	3	3	5	3	5	3	3	3	7	3	3	3
33	2	2	2	2	7	2	3	3	6	2	7	5	2	5	7	3	6	7
34	7	7	5	7	2	2	2	3	7	7	5	7	3	3	7	3	7	7
35	7	7	7	7	1	1	2	2	7	7	7	3	2	7	5	7	7	6

Sl	ICIC3	ICIC4	CBPK1	CBPK2	CBPK3	CBUM1	CBUM2	CBUM3	CBUM4	CBUM5	CBUA1	CBUA2	CBUA3	CBUA4	CBIE1	CBIE2	CBIE3
1	3	3	1	4	3	2	3	4	4	3	4	2	1	1	3	2	4
2	2	1	1	2	2	1	1	2	1	1	2	1	1	1	4	4	4
3	1	1	2	1	4	3	2	1	1	2	2	3	3	4	1	1	1
4	3	3	1	2	2	1	1	2	1	1	3	2	1	4	5	3	3
5	2	2	2	2	3	4	5	2	2	2	2	1	1	2	1	2	1
6	2	6	1	2	2	1	1	1	1	2	4	1	2	1	4	5	5
7	2	5	1	2	1	3	1	3	1	1	2	1	1	1	6	6	4
8	7	7	3	2	4	3	1	3	2	2	1	2	1	2	6	6	5
9	3	3	1	2	1	2	3	1	1	1	2	1	1	1	6	7	6
10	2	2	2	1	2	2	2	4	3	1	1	2	2	2	4	4	4
11	2	2	1	3	3	2	3	3	1	4	4	1	1	3	4	6	6
12	5	5	3	3	3	2	4	2	3	3	1	1	1	1	6	6	6
13	5	6	7	5	4	1	1	3	4	1	1	1	1	1	5	5	5
14	2	2	4	2	1	3	2	2	3	1	1	4	4	2	5	5	6
15	3	3	5	2	1	3	3	3	2	2	1	2	2	2	6	5	6
16	5	5	4	4	3	3	4	3	4	3	2	3	3	2	4	2	1
17	4	2	1	4	1	4	3	3	3	3	2	3	2	2	5	4	5
18	6	4	4	2	1	3	4	3	2	2	1	2	2	2	5	6	6
19	4	4	3	3	3	3	2	2	2	3	1	1	3	2	6	6	6
20	6	5	1	1	1	3	3	2	4	4	4	1	3	2	6	6	6
21	3	3	5	5	5	3	4	4	4	4	3	4	3	3	4	3	5
22	3	3	5	5	3	4	4	3	3	3	4	4	3	4	5	4	5
23	4	4	6	4	6	3	4	3	3	3	2	3	3	4	4	5	6
24	3	2	5	4	4	4	3	3	3	3	3	3	3	4	6	6	6
25	7	2	4	4	4	5	5	5	1	5	4	4	4	5	5	4	1
26	6	2	5	5	5	4	4	3	3	4	2	3	4	3	5	5	5
27	2	3	4	5	4	3	3	3	4	2	5	5	4	6	6	6	6
28	2	2	6	6	6	3	4	4	3	3	5	6	3	3	4	6	4
29	2	2	5	5	5	5	3	4	5	4	3	2	5	4	6	5	5
30	5	6	3	3	4	6	5	6	6	5	2	4	4	5	5	4	4
31	7	2	5	4	4	2	3	4	4	4	6	4	5	5	5	6	5
32	3	7	4	2	4	6	3	6	3	4	5	2	5	7	5	6	5
33	7	6	4	5	5	5	5	5	5	5	3	4	4	5	3	5	4
34	7	6	2	6	5	7	7	6	6	6	2	3	1	3	5	6	4
35	6	6	5	5	4	4	4	4	3	3	5	5	3	4	1	5	6

Appendix I: AMOS Output Tables for Path Analyses

Regression Weights: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
OH <--- CA	.997	.036	27.463	***	
OH1 <--- OH	1.000				
OH2 <--- OH	.868	.034	25.428	***	
OH3 <--- OH	1.082	.038	28.655	***	
CA3 <--- CA	1.000				
CA2 <--- CA	1.118	.039	28.794	***	
CA1 <--- CA	1.039	.036	28.636	***	

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	14	33.428	7	.000	4.775
Saturated model	21	.000	0		
Independence model	6	3559.633	15	.000	237.309

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	.036	.988	.964	.329
Saturated model	.000	1.000		
Independence model	1.349	.320	.048	.229

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.991	.980	.993	.984	.993

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

FMIN

Model	FMIN	F0	LO 90	HI 90
Default model	.037	.029	.013	.053
Saturated model	.000	.000	.000	.000
Independence model	3.895	3.878	3.668	4.097

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.064	.043	.087	.123
Independence model	.508	.494	.523	.000

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
OH	<---	IC	.532	.053	10.119	***	
OH1	<---	OH	1.000				
OH2	<---	OH	.898	.040	22.689	***	
OH3	<---	OH	1.118	.047	23.752	***	
IC2	<---	IC	.997	.064	15.459	***	
IC1	<---	IC	.877	.062	14.106	***	
IC3	<---	IC	1.000				
IC4	<---	IC	1.110	.060	18.551	***	
IC5	<---	IC	1.318	.074	17.751	***	

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	18	78.664	18	.000	4.370
Saturated model	36	.000	0		
Independence model	8	2659.635	28	.000	94.987

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	.116	.979	.957	.489
Saturated model	.000	1.000		
Independence model	.822	.488	.342	.380

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
CA	<---	TD	-.926	.044	-21.244	***	par_5
CA3	<---	CA	1.000				
CA2	<---	CA	1.041	.037	28.174	***	par_1
CA1	<---	CA	1.012	.034	29.989	***	par_2
TD3	<---	TD	1.000				
TD2	<---	TD	.951	.035	27.276	***	par_3
TD1	<---	TD	.510	.028	18.456	***	par_4

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	14	34.310	7	.000	4.901
Saturated model	21	.000	0		
Independence model	6	3196.662	15	.000	213.111

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	.049	.988	.963	.329
Saturated model	.000	1.000		
Independence model	1.462	.354	.096	.253

Regression Weights: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
OH <--- CB	.785	.041	19.046	***	
OH1 <--- OH	1.000				
OH2 <--- OH	.892	.039	23.112	***	
OH3 <--- OH	1.140	.045	25.503	***	
CB2 <--- CB	.890	.036	24.464	***	
CB1 <--- CB	.923	.044	21.217	***	
CB3 <--- CB	1.000				
CB4 <--- CB	.226	.031	7.404	***	

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	15	54.181	13	.000	4.168
Saturated model	28	.000	0		
Independence model	7	2690.942	21	.000	128.140

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	.068	.983	.963	.456
Saturated model	.000	1.000		

Model	RMR	GFI	AGFI	PGFI
Independence model	.906	.433	.244	.325

Regression Weights: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
OH <--- TD	-.623	.028	-21.908	***	
OH1 <--- OH	1.000				
OH2 <--- OH	.904	.038	23.802	***	
OH3 <--- OH	1.134	.043	26.250	***	
TD3 <--- TD	1.000				
TD2 <--- TD	.886	.037	24.187	***	
TD1 <--- TD	.421	.025	16.742	***	

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	13	38.520	8	.000	4.815
Saturated model	21	.000	0		
Independence model	6	2640.218	15	.000	176.015

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	.066	.986	.964	.376
Saturated model	.000	1.000		
Independence model	1.312	.401	.162	.287

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
ZCA_All	<---	ZTD_All	-.668	.023	-28.445	***	
ZCA_All	<---	TD_X_IC	.122	.021	5.855	***	
ZCA_All	<---	ZIC_All	.153	.024	6.336	***	

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	10	.000	0		
Saturated model	10	.000	0		
Independence model	4	727.165	6	.000	121.194

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	.000	1.000		
Saturated model	.000	1.000		
Independence model	.253	.764	.607	.458