ISTANBUL TECHNICAL UNIVERSITY ★ GRADUATE SCHOOL OF SCIENCE ENGINEERING AND TECHNOLOGY

A CONCEPTUAL FRAMEWORK ON AGILE TECHNOLOGY DIFFUSION IN THE TURKISH CONSTRUCTION INDUSTRY

Ph.D. THESIS

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İSTANBUL TEKNİK ÜNİVERSİTESİ ★ FEN BİLİMLERİ ENSTİTÜSÜ

TÜRK İNŞAAT SEKTÖRÜNDE TEKNOLOJİ DİFÜZYON ÇEVİKLİĞİ ÜZERİNE BİR KAVRAMSAL MODEL ÖNERİSİ

DOKTORA TEZİ

Volkan EZCAN
(501062010)

İnşaat Mühendisliği Anabilim Dalı

Yapı Mühendisliği Programı

Tez Danışmanı: Doç.Dr.Mehmet Uğur Müngen
Eş Danışman: Prof.Dr.Jack Steven Goulding

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Volkan Ezcan, a **Ph.D.** student of ITU **Graduate School of Science Engineering and Technology** student ID **501062010**, successfully defended the **thesis** entitled "**A CONCEPTUAL FRAMEWORK ON AGILE TECHNOLOGY DIFFUSION IN THE TURKISH CONSTRUCTION INDUSTRY**", which he prepared after fulfilling the requirements specified in the associated legislations, before the jury whose signatures are below.

Thesis Advisor :	**Assoc.Prof.Dr. Mehmet Uğur MÜNGEN** İstanbul Technical University	.....
Co-advisor :	**Prof.Dr. Jack Steven GOULDING** University of Central Lancashire	.....
Jury Members :	**Assoc.Prof.Dr. Murat Çıracı** İstanbul Technical University	.....
	Assoc.Prof.Dr. Ümit Dikmen Boğaziçi University	.....
	Assoc.Prof.Dr. Deniz Artan İlter İstanbul Technical University	.....
	Dr. Murat Kuruoğlu İstanbul Technical University	.....

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FOREWORD

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ABBREVIATIONS

AEC : Architecture, Engineering, and Construction
ATD : Agile Technology Diffusion
BIM : Building Information Modelling
C : Competence
CATER : Conceptual Agile Technology Engagement Framework
CC : Capability Code
CEO : Chief Executive Officer
CL : Leadership
CL1 : Empower staff to take their decisions
CL2 : Provide incentives for efficient use of new technology
CL3 : Development of an innovative culture
CL4 : Development of a collaborative culture
CL5 : Ability to develop trust to enable information sharing
CL6 : Ability to develop trust to superiors
CM : Management of Change Process
CM1 : Ability to reengineer the processes
CM2 : Ability to clarify changes in roles and responsibilities
CM3 : Ability to provide service and technical support within the company
CM4 : Ability to provide technical support from outside of the company
CM5 : Ability to develop a powerful internal communication.
CM6 : Ability to develop a powerful external communication.
COPQ : Cost of Poor Quality
CS : Development Strategy
CS1 : Ability to develop an IT strategy aligned with business strategy
CS2 : Ability to develop diffusion program for new technology
CS3 : Ability to employ IT and innovation ready staff
CS4 : Ability to develop plans to encourage staff to use new technology
CS5 : Ability to improve staffs' skill, knowledge and attitude towards new technology
CS6 : Ability to improve top management's knowledge about new technology
C-TPB-TAM : Combined Theory of Planned Behaviour/Technology Acceptance Model
DE : Domain Expert
DoI : Diffusions of Innovation
DTPB : The Decomposed Theory of Planned Behaviour
ENR : Engineering News Record
ERP : Enterprise Resource Planning
F : Flexibility
FC : First Cycle
FH : Human Resources Flexibility
FH1 : Staff's ability to work in different positions and responsibilities
FH2 : Staff's enthusiasm to develop skills and abilities

FH3 : Ability to learn new procedures quickly
FH4 : Being eager to share information to learn from other
FH5 : Ability to change work habits as a response to changes in the demands
FH6 : Ability to act efficiently even under uncertain and ambiguous conditions.
FI : IT Flexibility
FI1 : Scalability of IT infrastructure
FI2 : Modularity of IT infrastructure
FI3 : Facility of IT infrastructure
FI4 : Modernity of IT infrastructure
FI5 : Connectivity of IT infrastructure
FI6 : Compatibility of IT infrastructure
FM : First Line Management
FP : Process Flexibility
FP1 : Ability to develop a range of possible solutions in a sudden change
FP2 : Ability to develop range of possible solutions in planned change
FP3 : Ability to provide solutions within optimum time and cost difference in sudden change.
FP4 : Ability to provide solutions within optimum time and cost difference in planned change.
FP5 : Ability to provide similar results in sudden change.
FP6 : Ability to provide similar results in planned change
HR : Human Resources
HR : Human Resources
ICT : Information and Communication Technology
IDT : Innovation Diffusion Theory
IL : Importance Level
IO : Industrial Organisations
IS : Information Systems
IT : Information Technologies
MENA : Middle East and North Africa
MM : Middle Management
MPCU : Model of PC Utilization
MTM : Motivational Model
NR : Number of Respondents
OD : Organisational Dynamics
ODC : Organisational Dynamics Code
R : Responsiveness
RA : Sense, perceive and anticipate changes and risks in the environment
RA1 : Ability to be aware of emerging technologies, trends and changes in the industry
RA2 : Ability to be aware of level of organisation's resources
RA3 : Ability to be aware of organisation's external connectivity
RA4 : Ability to be aware of organisation's internal connectivity
RA5 : Ability to analyse the potential risks of change on organisational resources
RA6 : Ability to analyse the potential consequences of change on organisational resources
RBV : Resource Based View

RC	**:** Show immediate reaction to change and its demands
RC1	**:** Ability to define a clear strategic vision for organisation
RC2	**:** Ability to direct the organisation in sudden change and crisis
RC3	**:** Ability to manage knowledge efficiently
RC4	**:** Ability to ensure successful decisions by sharing knowledge efficiently
RC5	**:** Ability to make tough decisions quickly
RC6	**:** Authorise staff to make decisions in case of sudden changes
REI	**:** Relative Existence Index
RI	**:** Relative Importance
RR	**:** Recovery from change
RR1	**:** Ability to assess recovery needs in sudden/unpredicted change
RR2	**:** Ability to assess recovery needs in planned change
RR3	**:** Ability to develop a recovery plan in sudden change.
RR4	**:** Ability to develop a recovery plan for planned change
RR5	**:** Ability to quickly reorganise the resources in sudden change
RR6	**:** Ability to implement the recovery plan
SCA	**:** Sustained Competitive Advantage
SCP	**:** Structure-Conduct-Performance
SCT	**:** Social Cognitive Theory
SD	**:** Standard Deviation
SDT	**:** Self Determination Theory
TAM	**:** Technology Acceptance Model
TAM2	**:** Extension of the Technology Acceptance Model
TAM3	: Extension of the Technology Acceptance Model
TM	**:** Top Management
TPB	**:** Theory of Planned Behaviour
TRA	**:** Theory of Reasoned Action
UTAUT	**:** The Unified Theory of Acceptance and Use of Technology
UTAUT2	: Extension of the Unified Theory of Acceptance and Use of Technology
VRIN	**:** Valuable, Rare, Inimitable, Non-substitutable

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A CONCEPTUAL FRAMEWORK ON AGILE TECHNOLOGY DIFFUSION IN THE TURKISH CONSTRUCTION INDUSTRY

SUMMARY

The complex nature of the construction process needs intensive control and management mechanisms in order to effectively manage information flow. Current deficiencies in managing construction-related information have been highlighted by a range of industry reports and seminal papers, the consensus of which has reiterated these issues. Recent research on the role of Information Technologies (IT) has been proffered as a potential solution for addressing these deficiencies, along with improving competitive advantage.

Despite the rapid developments in technology field, the inefficient and slow progress of diffusion has been highlighted and examined by various studies. Whilst a number of studies have focused on nature of IT diffusion and adoption issues, limited research has concentrated on the "efficiency" of the IT diffusion process. This research addresses this gap by introducing a novel approach of "agility" in IT diffusion process within the bounded context of the Turkish Construction Industry.

This thesis developed a conceptual framework for agile technology diffusion, which applies an agility lens to technology diffusion and acceptance theories. It adopted an interpretivist approach with an explicit constrained research lens which embraces the Turkish Construction Industry as the context delimiter.

The research adopted a multiple case study approach in which qualitative and quantitative data were collected simultaneously from an identical sample, with the aim of complementing two types of data with each other. While the analysis of the quantitative data identified thepriorities in the development of agile technology capabilities, the qualitative data analysis results presented a number of dynamics which were sequentially "mapped" into a conceptual framework for critique. The conceptual framework was then tested and validated with domain experts to confirm construct validity and reinforces data veracity. This framework enables construction organisations to actively manage the technology diffusion through an agility perspective, helping them to develop their capabilities of: (1) responsiveness, (2) flexibility and (3) competence in regard of diffusion and adoption of emerging technologies.

TÜRK İNŞAAT SEKTÖRÜNDE TEKNOLOJİ DİFÜZYON ÇEVİKLİĞİ ÜZERİNE BİR KAVRAMSAL MODEL ÖNERİSİ

ÖZET

İnşaat süreçlerinin karmaşık yapısı; yönetim ve kontrol mekanizmalarının yoğun bir şekilde kullanımı ile birlikte yoğun bilgi akışını etkin bir şekilde yönetebilme becerisini gerekli kılmaktadır. İnşaat sektöründeki bilgi yönetiminin etkinliği ile ilgili eksiklikler, sektörde yaşanan sıkıntıların ele alındığı analiz raporları ve bilimsel çalışmalarda, sıklıkla vurgulanmıştır. Bilgi Teknolojilerinin inşaat sektörü üzerindeki rolünü ele alan son araştırmalar, bu teknolojilerin sektörde yaşanan pek çok problemin çözümünde etkin rol oynayacağını ve inşaat üretiminin performansının arttırılması yönünde olumlu faydalar sağlayacağını vurgulamaktadır. Bu bağlamda, geliştirilen yeni teknolojilerin inşaat üretim ve yönetim süreçleri ile bütünleşmesi neticesinde elde edilecek faydalar, inşaat firmalarının özellikle uluslararası inşaat pazarındaki rekabet güçlerini de arttıracaktır.

Ancak, teknoloji alanında süratle gelişmeler ve yenilikler yaşanırken, geliştirilen bu yeni çözümlerin firmalar tarafından kullanımı ve özümsenmesi aynı süratle ve verim ile olmamaktadır. Bu durum teknoloji difüzyonu ve adaptasyonu konusunda pek çok araştırma yapılmasına sebep olmuşken, bilgi teknolojilerinin difüzyon sürecinin "etkinliğine" yönelik çok az sayıda çalışma mevcuttur. Bu araştırma bu boşluğun kapatılması amacıyla, yeni bir yaklaşım olarak bilgi teknolojilerinin difüzyon sürecine "çeviklik" kavramının kazandırmasını hedeflemiş ve Türk İnşaat Sektörüne özel bir çözüm geliştirmesi amaçlanmıştır.

Bu doğrultuda ilk olarak işletmelerin pazarda rekabet avantajını elde edebilmeleri ve bu avantajın sürdürülebilir kılınabilmesi amacıyla takip etmeleri gereken yaklaşımlar araştırılmıştır. Strateji ve stratejik yönetim kavramları incelenmiş, rekabet kavramı ile ilişkileri ortaya koyulmuş, arkasından rekabet avantajının elde edilmesine yönelik olarak geliştirilen temel teoriler ele alınmıştır. Yapılan inceleme neticesinde; işletmelerin gerek ulusal gerekse uluslararası pazarda rekabet avantajı kazanabilmeleri ve bu avantajı sürdürülebilir kılabilmeleri amacıyla, örgütsel becerilerini geliştirilmeleri gerektiği sonucuna varılmıştır.

İkinci adım olarak teknoloji difüzyonu ve adaptasyonu kavramları üzerine odaklanılmış ve bu bağlamda geliştirilen temel teoriler ele alınmıştır. İncelenen teoriler üzerinden, teknoloji difüzyon sürecinde etkili olan faktörler belirlenmiştir. Yapılan incelemede de görüldüğü üzere, teknoloji difüzyonu ve adaptasyonuna yönelik geliştirilen teoriler, belirli bir kesit üzerinden sürece etki eden etkenleri tanımlamaktadırlar. Ancak işletmelerin sürekli yeni teknolojiler ile karşılaştığı, bunların bazılarını göz ardı edip bazılarını kullandığı düşünüldüğünde, teknoloji difüzyon ve adaptasyonunun işletme ömrü boyunca devam eden bir süreç olduğu anlaşılmaktadır. Teknolojinin, işletme performansına olumlu katkıları da göz önüne

alınarak, bu sürecin daha etkin bir şekilde yönetilmesinin de, işletmelerin elde ettiği olumlu katkıların arttırılması anlamına geleceği sonucuna varılmıştır.

Üçüncü adım olarak, üretim sektöründe süreçlerin etkinleştirilmesine yönelik katkıları sebebiyle, çeviklik kavramı ele alınmış ve özellikle üretim sektöründe çeviklik konusunda geliştirilen temel teoriler incelenmiştir. Bu bağlamda "çevik" olabilmenin temel gerekleri ortaya koyulmuş, teknoloji difüzyon sürecine, çeviklik perspektifinden bir bakış sağlanmış ve bu doğrultuda, teknoloji difüzyon çevikliği becerilerinin tanımlanmasına yönelik teorik bir çerçeve sunulmuştur.

Bu araştırmanın amacı, Türk inşaat sektöründe yer alan firmalara, yeni teknolojilerin difüzyonu ve kullanımı konusunda çeviklik kazandırabilmek için kavramsal bir çerçeve sunmaktır. Araştırmanın dördüncü adımında, bu amaca ulaşmak için benimsenen ve uygulanan araştırma yöntemi anlatılmıştır. Öncelikle, araştırmanın felsefi temelleri ortaya koyulmuş ve bu temeller doğrultusunda oluşturulan bakış açısı ile araştırma stratejisi ve metodu detaylı olarak tartışılmıştır.

Gerçekleştirilen araştırmada; gerçeklerin insanların birbirleri ve yaşadıkları çevreyle etkileşimleri ile anlam bulduğu ve bu anlamın da göreceli olduğunu kabul eden, yorumlayıcı bir yaklaşım benimsemiştir. Bu noktada, araştırma sorularının cevaplanabilmesi, gerçek yaşamın güncel bağlam ya da ortamı içindeki durumunun araştırılmasını gerektirdiğinden, araştırma stratejisi olarak durum (vaka) çalışması benimsenmiştir. Araştırmada kullanılan analiz birimi (vaka) inşaat organizasyonları, veri toplama kaynağı ise bu organizasyonlardan çalışanlar olarak belirlenmiştir.

Analiz birimlerinin, belirlenmesi sonrasında, bu birimleri diğerlerinden ayıracak olan sınırlar belirlenmiştir. Araştırmada; uluslararası pazarda rekabetçi; farklı inşaat tiplerinde müteahhitlik hizmeti verebilen (bu tecrübeye sahip); organizasyonel boyutta bir teknoloji difüzyon tecrübesine sahip; üst yönetiminde çekirdekten yetişme kadrolar yer alan; Türk İnşaat firmaları ele alınmıştır.

Amaçlı örneklem yaklaşımın benimsendiği araştırmada, belirlenen ölçütlere uyan 3 inşaat firması incelenmiştir. Firmaların teknoloji difüzyon sürecinin işleyişine dair bilgi sahibi olabilmek için farklı yönetim seviyelerinden görüşlerin toplanması hedeflenmiş ve bu doğrultuda, her firmada; üst yönetim, orta seviye yönetim ve ilk kademe yönetim olmak üzere üç farklı kademeden katılımcılardan veri toplanılmıştır. Her firmada 10'ar kişi olmak üzere üç firmadan toplamda 30 kişi araştırmaya katılmıştır. Her ne kadar araştırma temel olarak nitel bir temele sahip olsa da, veri zenginliğini arttırmak ve birbirlerini tamamlamak amacıyla hem nitel hem de nicel veri toplanmıştır. Nicel verilerin toplanmasında, teorik çerçeve temel alınarak geliştirilen anket kullanılmış; nitel veri ise, aynı katılımcılar ile gerçekleştirilen yarı-yapılandırılmış görüşmeler ile elde edilmiştir.

Araştırmanın sonraki aşamasında, her bir firmadan elde edilen nitel ve nicel veriler analiz edilmiştir. Nicel verilerin analizinde, göreceli önem indeksi yaklaşımı kullanılırken, nitel verilerin analizi için, içerik analizi yöntemi kullanılmıştır. Veri analizinin ilk aşaması olan firma içi analizlerde, her bir firmanın teknoloji difüzyon çevikliği becerilerine sahiplik durumu, bu becerilerin geliştirilmesine yönelik öncelikler ve bu becerilerin gelişimine mani olan sebepler ortaya koyulmuştur. Veri analizinin ikinci aşaması olan karşılaştırmalı sentezde ise; odaklanılması gereken önceliklere yönelik, incelenen üç firma için ortak bir sıralama belirlenmiş ve teknoloji difüzyon çevikliği becerilerinin gelişmesine etki eden organizasyonel dinamikler tanımlanmıştır.

Elde edilen verilerin iki aşamada analizi neticesinde, firmalarda;

1) teknoloji difüzyon çevikliğine yönelik becerilerin geliştirilmesinde öncelikli odaklanılması gereken noktalar,
2) teknoloji difüzyon çevikliği becerilerinin geliştirilmesine engel olan unsurlar,
3) teknoloji difüzyon çevikliği becerilerinin geliştirilmesine etki eden organizasyonel dinamikler tanımlanmıştır.

Ancak, inşaat firmalarında, bahsi geçen becerilerin geliştirilmesine yönelik benimsenecek bir stratejik yaklaşım için izlenecek adımların öncelik sırası, diğer bir deyişle becerilerin gelişimine engel olan faktörlerin önem sırasının belirlenmesi gereklidir.

Araştırmanın bir sonraki aşamasında, teknoloji difüzyon çevikliği becerilerine engel olan faktörlerin etki derecelerine yönelik sıralamaların oluşturulması hedeflenmiş, bu doğrultuda, alandaki uzmanların görüş birliğinin oluşturulması için Delphi tekniği kullanılmıştır. Bu aşamaya katılan uzmanlar, araştırma hakkında bilgi sahibi olmaları sebebiyle, önceki aşamalarda yer alan katılımcılar arasından seçilmiştir. Farklı yönetim kademelerinden görüş alınabilmesi için her bir kademeden ikişer kişi bu aşamaya katılmış, her firmadan 6, toplamda ise 18 katılımcı ile çalışma gerçekleştirilmiştir.

Delphi tekniği kullanılmak suretiyle uzmanlara yönelik görüş birliğinin elde edilmesi, dört aşamada sağlanmıştır. İlk olarak, birinci firmaya gidilerek, araştırmanın önceki aşamalarında elde edilen, teknoloji difüzyon çevikliği becerilerine engel olan faktörleri her bir beceri için önem sırasına koymaları istenilmiştir. Firmadaki katılımcıların görüş birliği oluşturularak elde edilen sıralama, bir sonraki firmaya götürülmüş ve bir önceki firmada yapılan sıralamaya yönelik gerekçeler de sunularak, sıralamaya dair değerlendirmeleri talep edilmiştir. İkinci firmaya ait sıralama, sonraki firmaya götürülerek aynı işlem tekrar edilmiştir. Üçüncü adım sonrasında elde edilen sıralama, üç firmanın temsilcilerinden oluşan son bir görüşmede tekrar tartışılmış ve faktörlerin nihai sıralaması oluşturulmuştur.

Sonraki adımda, araştırmanın farklı aşamalarında yapılan analizlerden elde edilen sonuçlar birleştirilmek suretiyle; teknoloji difüzyon çevikliği becerileri, birbirleriyle ilişkileri, etki eden organizasyonel dinamikler ve odaklanılması gereken öncelikli noktaların görselleştirildiği bir kavramsal çerçeve sunulmuş ve beraberinde, her bir becerinin geliştirilmesine yönelik dikkat edilmesi gereken unsurlar açıklanmıştır.

Geliştirilen kavramsal çerçevenin geçerliliğinin onaylanması için, iç ve dış geçerliliğin test edilmesine yönelik önemli bir yöntem olan, alan uzmanlarının görüşlerinden faydalanılmıştır. Bu doğrultuda, akademi ve sektörden, araştırmaya katılmamış uzmanlar ile görüşülmüş, geliştirilen kavramsal çerçeveye yönelik görüşleri alınmış ve bu görüşler kavramsal çerçevenin geliştirilmesi amacıyla değerlendirilmiştir.

Araştırmanın sonraki aşamasında elde edilen bulgular, literatürde yer alan çalışmaların ışığında tartışılmıştır. Teknoloji difüzyon çevikliğinin üç temel becerisi olan; 1) karşılık verebilme, 2) esneklik ve 3) süreci yönetebilme becerileri üzerinden gerçekleştirilen tartışmanın neticesinde, yapılan araştırmanın hedeflerine nasıl ve ne ölçüde ulaşıldığı ele alınmıştır.

Tezin son aşamasında; araştırma süreci hakkında genel bir bilgi verilmiş, araştırmanın genel bulguları sunulmuş, araştırmanın mevcut bilgi tabanına olan

katkısı teorik ve pratik açıdan ayrı ayrı tartışılmış, araştırmanın kısıtları belirtilmiş, bulgular doğrultusunda inşaat işletmelerine tavsiyelerde bulunulmuş ve yapılan araştırmaya ait bulgulardan yola çıkarak gelecek araştırmalara yönelik öneriler sunulmuştur.

1. INTRODUCTION

1.1 Introduction

This chapter introduces the rationale for the research with respect to the primary aim of developing a conceptual framework for agile diffusion of new technologies in the Turkish construction industry. In this regard, the chapter outlines the background of the research, then presents the research problem, aim and objectives followed by a brief overview of the thesis structure.

1.2 Research Background

Construction is a major industry all over the Globe, not only with its impact on economic growth and employment, but also with its linkages with other industries, both in construction (process) and post construction (product) phases (Bon *et al.*, 1999; Giang & Pheng, 2011). This positive impact on the environment, serves as the origin of the approach to industrialise construction production (Turin, 2003). However, due to its unique characteristics or "peculiarities", the solutions developed for manufacturing industry do not always provide similar results for construction (Fernández-Solís, 2008; Vrijhoef & Koskela, 2005). This brings the need of tailored fit solutions for the industry, as the development of different patterns to describe the nature of innovation in construction (Aouad *et al.*, 2010).

Innovation in construction can be defined as "the successful development and/or implementation of new ideas, products, processes or practices in order to increase organisational efficiency and performance" (Akintoye *et al.*, 2012). In the course of achieving this efficiency and performance, information and communication technologies (ICT), which have been presented as a solution by several influential reports on the construction industry (e.g., Egan, 1998; Latham, 1994), can either be one this "products" or act as an enabler in all domains of innovation (Aouad *et al.*, 2010; Peansupap, 2005). Importance of ICT as a strategic tool to gain and maintain competitiveness, highlights the need for efficient implementation and use of new

technology. Realising this need, national strategies to establish industry-wide adoption have been developed by government clients across the globe, based on the fact that these strategies need the internalisation of unique characteristics of the countries that the organisations belong to (Bew & Underwood, 2010; Ezcan *et al.*, 2013).

During their life cycle, organisations face innovations in various numbers depending on their attitude and openness to modernisation. The diffusion process in an innovative organisation has a continuous nature which comprises repetitive sub process, instead of discrete attempts. In this regard, the organisation should overcome its stiffness and possess the ability to facilitate the efficiency and success of the diffusion process of novel technologies, in order to provide continuity and sustainability (Yang Chen *et al.*, 2014; Overby *et al.*, 2006).

1.3 Research Problem

The increasing and pervasive use of new technologies offers the construction industry several solutions to improve organisational performance. However, while these new technologies develop quickly, construction organisations are not currently that fast in diffusing and using them in the right way and/or level. In order to solve this problem, various studies have been conducted to describe the nature of technology diffusion and adoption processes, especially in the information management, ICT and construction domains. However, this problem still continues. One possible reason for this permanency might be that the way that these solutions have been presented. Given this, there is a lack of research that approaches technology diffusion as a repetitive process. Moreover, there is a need to develop solutions that have long term focus, such as developing organisations' capabilities to provide them success in diffusion in the long term. Within the Turkish Construction Industry, there is a real need to capture, harness and diffuse ICT innovation to deliver real agility (in line with market drivers). The research gap therefore is the need to provide these organisations with a dynamic model that can successfully manage this diffusion process.

Hereafter within this thesis, ICT will be referred to as "technology".

1.4 Research Aim and Objectives

The aim of this study is, to; develop a conceptual framework which will lead the organisations to be agile in diffusing and using emerging technologies in the market by capturing the perceptions and understandings of the professionals working in the Turkish Construction Industry.

In order to fulfil the aim of the research, the following objectives are presented;

O1: To understand the ways of achieving competitiveness

O2: To investigate the critical factors that affect technology diffusion

O3: To investigate the casual factors that affect organisational agility

O4: To establish and define the capabilities needed for agile technology diffusion

O5: To identify the priority areas and needs to be focussed in order to improve the agility of technology diffusion in Turkish construction organisations.

O6: To develop a conceptual framework that codifies the key elements of Agile Technology Diffusion

O7: To test and validate the developed conceptual framework with domain experts; and draw comments for future research

1.5 Structure of Thesis

This section presents the structure of thesis developed to fulfil the aim and objectives of the research. After the presentation of the chapters that address the research aim and objectives (Table 1.1), a general outline of the ten chapters that contained within this thesis is provided (Figure 1.1).

Chapter 1: Introduction, introduces the background and context of this research. The research gap, research problem and aim and objectives are identified. A brief review of the research is presented.

Chapter2: The chapter starts with giving information about strategy and strategic management concepts as the background of competitiveness. Subsequently, defines the competitiveness concept and argues the importance of competitiveness for construction industry. After a brief presentation of the theories of competitiveness,

chapter concludes pointing out the importance of organisational capabilities for competitive advantage.

Table 1.1 : Thesis chapters addressing the research questions and objectives.

Research Questions / Objectives	Main Steps			
	Literature review	Within case analysis	Cross case synthesis	Conceptual Framework
O1: To understand the ways of achieving competitiveness	Ch2			
O2: To investigate the critical factors that affect technology diffusion	Ch3			
O3: To investigate the casual factors that affect organisational agility	Ch4			
O4: To establish and define the capabilities needed for agile technology diffusion	Ch4			
O5: To identify the priority areas and needs to be focussed in order to improve the agility of technology diffusion in Turkish construction organisations.		Ch6	Ch7	
O6: To develop a conceptual framework that codifies the key elements of Agile Technology Diffusion				Ch8
O7: To test and validate the developed conceptual framework with domain experts; and draw comments for future research				Ch8

Chapter3: The chapter starts with defining innovation concept and argues the importance and benefits of technology for the construction industry, as an innovation. Afterwards, the chapter emphasises the importance of diffusion process for the companies that are aiming to benefit from the technology and discusses the drivers of technology diffusion process with a review of the main theories that describes technology diffusion and adoption behaviour.

Chapter 4: Initially, the chapter describes the Agility concept and outlines its use in manufacturing industry. Then, based on the innovation drivers the chapter proposes a new glance for technology diffusion capabilities through an agility lens.

Chapter 5: Presents and justifies the research methodology that is adopted for this research. The chapter starts with the philosophical foundations of the research and continues with explaining the method to be used, sampling strategy, data collection and analysis techniques that are adopted for this research.

Chapter 6: Demonstrates the within case analysis which embraces the analysis of quantitative and qualitative data analysis that were collected from three cases. Based on the results of the analysis; chapter presents the priority areas that are needed to be focussed (quantitative analysis) and the factors that barrier the capabilities of agile technology diffusion (qualitative analysis).

Chapter 7: Presents the cross case synthesis of the findings from the three cases. Results of this analysis, provides the organisational dynamics that prevent organisations from being more agile in technology diffusion process.

Chapter 8: This chapter demonstrates an overview of Delphi method and describes the modified Delphi process used in the development phase of the framework. It synthesises the findings from the quantitative and qualitative analysis, and explains the developed framework, reporting the findings from the validation process with domain experts.

Chapter 9: Discusses the findings of this research. This chapter also demonstrates how these findings met the research aim and objectives.

Chapter 10: Outlines the conclusions derived from the research, highlights the contributions to theory and practice, discusses inference (i.e. generalisability and repeatability) and presents limitations and recommendations for future research.

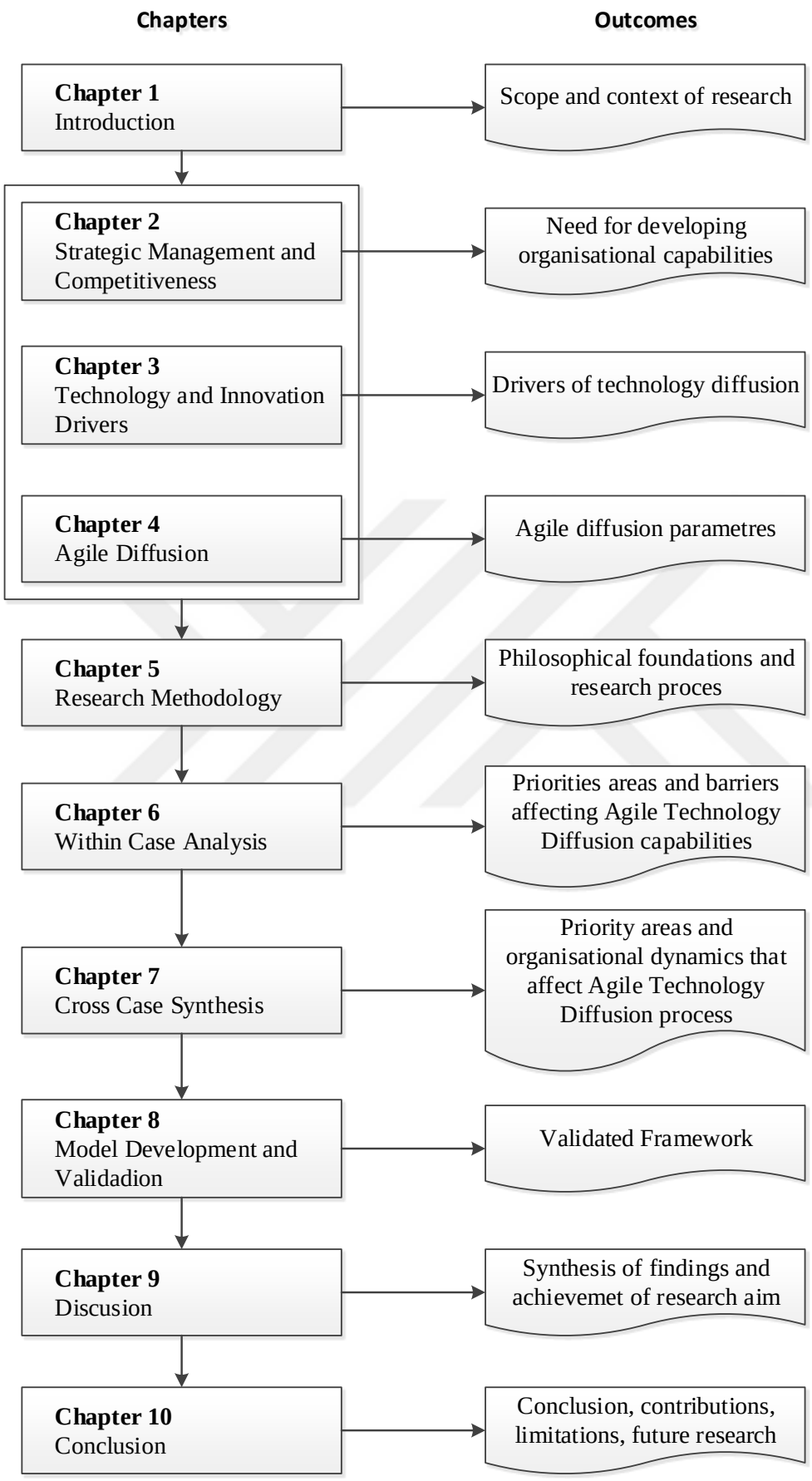


Figure 1.1 : Outline of the thesis chapters and outcomes.

1.6 Summary of the Chapter

This chapter provides and introduction to the research. The main argument of the research is that current literature about construction management does not adequately provide a solution that focusses on the elements that will provide construction organisations a sustainable efficiency and success in technology diffusion. The chapter beings with the argument which points out, sequentially, the importance of construction industry for the country, technology for the construction industry and successful diffusion for benefitting the emerging technologies. Subsequently, the chapter identifies the research aim and objectives and presents an outline of the thesis that is structured to fill the research gap by providing the answers of research questions, meeting the research objectives and fulfilling the research aim.

2. STRATEGIC MANAGEMENT AND COMPETITIVENESS

2.1 Introduction

This chapter explores the fundamentals of competitiveness and the approaches from different researchers about the ways of achieving it. It starts with introducing the strategy concept, starting from its origins, then presents the approaches for providing competitiveness, including the main theories of competitive advantage.

2.2 Strategy

The origins of the term "strategy" go back to ancient Greek words; stratēgia – generalship or *stratēgos*. *Stratēgos* was the name of a famous general in ancient Greek and the word was used to refer to the art of achieving military objectives. From the military point of view, the term strategy embraces the capabilities of formulating overall aim as specific military objectives and marshalling the resources and their deployment in a way which maximises their effect, to ensure the success of implementation. Using these military origins as the basis, Niccolo Machiavelli added a political dimension to the study of strategy with his book "The Prince", which was published in the early sixteenth century. Today, the art of military strategies are accepted as a powerful guide for business strategists (Machiavelli, 1994; Macmillan & Tampoe, 2000; White, 2004).

Strategy, encompasses the actions or activities that are designed and carried out to accomplish specified objectives, which are clearly defined, articulated and serve as the basis steps that lead the organisation towards its aims (Thompson & Martin, 2005). Macmillan and Tampoe (2000) define strategy as "ideas and actions to conceive and secure the future" and emphasise the importance of "future" for the concept of strategy. Dobson *et al.* (2004) assert that a well-defined strategy "integrates an organization's major plans, objectives, policies and programmes and commitments into a cohesive whole" that aims to manage and exploit the limited resources in the best way. White (2004) identifies strategy as a "process of

translating perceived opportunity into successful outcomes, by means of purposive action sustained over a significant period of time" and points out the importance and difficulty in ensuring effectiveness in design and pursuing.

Given these definitions and approaches that are aiming to enlighten the concept of strategy, the characteristics of a successful strategy can be identified as; looking to the future instead of dealing with past or present; aiming for a balance between stability and flexibility; asking new questions rather than dealing with the answers of old ones; recognising the interconnections between the different aspects of business activity (holistic) and integrating all the functional business activities (integrative); being complex; reflecting the experience through which an organisation has reached (path dependent); and being interactively structured by taking other players' strategies into account (White, 2004).

Development of any type of strategy should be analysed in the dimensions of; process, content and context. The process dimension is about "how" the strategy is formulated, implemented and controlled. The main issues to be considered in this dimension are; the people or parties involved, the place of activities that will take place, the positioning of the company in the market and the industry. The content dimension aims to explain "what" is or will be the strategy and defines its various sections, parts and levels. The meaning of strategy changes according to these levels, depending on functionality and scope of it. However, all levels should be aligned with each other in order to accomplish the main aim and objectives (White, 2004). The conditions that process and content dimensions are determined, can be defined as the context dimension or "where" of strategy. All three dimensions are interrelated with each other and they define the characteristics of any strategy that is to be developed by answering the questions; how, what, where (Hannagan, 2002).

Along with the dimensions, strategy has different levels that are developed in a hierarchy, aiming to address different levels of objectives. Even though there are different approaches for this levelling, in their studies, Hannagan (2002), Thompson and Martin (2005) presented a three level approach which can be described as generic but a good-fit. The three main levels of strategy are accepted as; corporate, business and functional strategies. Corporate Strategy is related with the decisions that are taken at the broad general level. Andrews (1978) defined corporate strategy as "the pattern of major objectives, purposes or goals and essential policies or plans

for achieving those goals, stated in such a way as to define what business the company is in or is to be in and the kind of company it is or to be". A more simplified definition to describe corporate strategy, is; "the identification of the *purpose* of the organisation and the plans and actions to achieve that purpose" (Lynch, 2006).

Table 2.1 : Levels of strategy (Thompson & Martin, 2005).

Corporate Strategy	The strategic perspective (range, scope, diversity,) of the organisation
Competitive Strategy	The research for a distinctive competitive advantage for each business / product / service
Functional Strategies	The source of competitive advantage in the activities and functions carried out by business

Business Level strategy is more concerned with competitiveness in the market by generating value from the resources and ensuring sustainability in competitive advantage. Kay (1993) defines business strategy as "the match between its internal capabilities and its external relationships. It describes how it responds to its suppliers, customers, its competitors and the social and economic environment within which it operates". Taking these approaches into consideration some researchers named this level as the level of "Competitive Strategy" which can be defined as "creating and maintaining a competitive advantage in each and every area of business" (Porter, 1980; Thompson & Martin, 2005).

Functional strategies are the strategies that focus on the functional departments or divisions of the organisation, such as human resources strategy (Gholamzadeh & Jalali, 2013), information systems strategy (Cassidy, 2005), information technology strategy (Albeladi *et al.*, 2014) and etc. They should be designed and managed in a coordinated way that allows them to interrelate with each other, which also ensures the successful implementation of competitive strategy (Hannagan, 2002; Thompson & Martin, 2005).

2.3 Strategic Management

The strategic management field started to take shape in the 1960's with the works of Chandler and Ansoff who were key professors at Harvard Business School. In 1965, Ansoff provided a more realistic and planning oriented view of strategy than the

general management focussed business policy in his work named as "Corporate Strategy". This transition phase was followed by the study of Schendel and Hatten (1972) in which they proposed an alteration about the name of the field "business policy" to "strategic management". Their proposal was discussed and confirmed by the researchers sharing the similar point of view at a conference in Pittsburgh University in 1977 (Lyles, 1990; Pettigrew *et al.*, 2006). As a result of these discussions, they concluded on the following definition;

> "Strategic management is a process that deals with the entrepreneurial work of the organisation, with organisational renewal and growth, and more particularly, with developing and utilising strategy, which is to guide the organisation's operations."

Subsequently, strategic management has been a field of growing interest for the researchers and there have been various efforts to define the concept from different angles. Some of these, emphasised the importance of decision making and defined strategic management as *"*the art and science of taking decisions that enable organisation to achieve its objectives*"* (David, 2011; Kong, 2007).Others see strategic management as a process "by which organizations determine their purpose, objectives and desired levels of attainment; decide on actions for achieving these objectives in an appropriate timescale, and frequently in a changing environment; implement the actions; and assess progress and results*"* (Thompson & Martin, 2005). Along with these, researchers like Hannagan (2002) presented a broader perspective that embrace both views with the approach that accepts strategic management as a set of processes that embody decisions and actions that will lead the organisation to achieve its aims and objectives.

As the researchers' stance and viewpoints differ, various approaches have been derived to explain the logic behind the formulation of strategy. Mintzberg *et al.* (1998) proposed a framework in which different approaches to strategy formulation that they name as "schools", have been defined. Each school represents the views of a group from the domain of strategic management research. This framework, which is named as the Ten Schools of Thought, claims that, strategy formulation can be seen as; a conceptual process that develops a strategy based on strengths, weaknesses, opportunities and threats (Design School); a formal process that covers setting objectives, external-internal audits, strategy evaluation, operationalisation and scheduling (Planning School); an analytic processing which the strategy is seen as a

generic position in a market that is economic and competitive and strategy formulation is the selection and improvement of the generic position based on analysis (Positioning School); a visionary process in which the strategy, as a vision, is nested in the mind of the leader that promotes this vision single-mindedly and keeps close control over implementation (Entrepreneurial School); a cognitive process that takes place in the mind of the strategist as an analysis, in the form of concepts, maps, schemas and frames (Cognitive School); an emergent process in which the strategy is developed as a result of small steps that are provided by collective learning process that aims developing and exploiting core competences (Learning School); a process of negotiation between the power holders within the company and/or the external stakeholders (Power School); a collective process of social interaction that unite all departments' views and reflect the shared beliefs and values of the organisation (Cultural School); a reactive process that serves as a response to the challenges imposed by the external environment that is accepted as the "actor" rather than a "factor" and reading environment and helping the organisation to adapt is regarded as the main role of leadership (Environmental School); a process of transformation from one type of decision making structure to another (Configuration School) (Mintzberg *et al.*, 1998; Sadler, 2003).

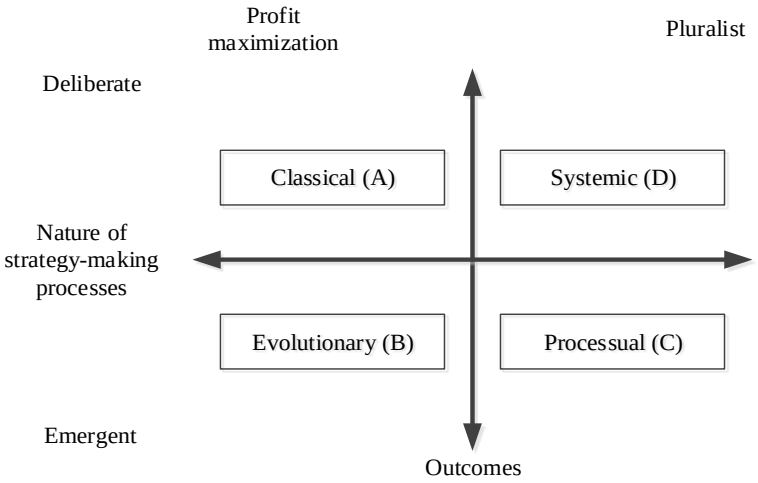


Figure 2.1 : General perspective on strategy (Whittington, 2001).

Another approach for strategy making was proposed by Whittington (2001) as a framework that encapsulates four general approaches that changes according to the dimensions of; (i) outcomes and (ii) nature of strategy-making processes (Figure 2.1).

Classical Approach represents the traditional view of strategy making, which accepts profit maximisation as the only motivation and regards strategy making as a deliberate, explicit and rational analysis. The formulation and implementation of strategy are seen as separate and sequential phases while leaders are accepted as the strategists that choose the strategy and hand it down to the managers to be implemented. It is more likely to be adopted by start-up companies or the ones that are in crises and attempting a turnaround.

Evolutionary approach adopts a fatalistic stance that is shaped by the impacts of competitive discipline of the market. The strategies that adapt the changing economic environment survive; the ones that fail to adjust successfully to the changes are eliminated as the result of "natural selection". In this environment, the profit maximisation is unavoidable because of the competitive nature. This approach can be useful in new industries or the ones that subject to rapid and dramatic change.

Processual approach adopts a stance that is away from economic rationality and profit maximisation or the views that accept the leader as infallible. It takes a pragmatic view of behaviour that stresses a number of key constraints, such as (1) knowledge and information processing capacity of individuals, (2) nature of political bargaining and negotiation and (3) the popularity of satisficing in the environments that are focused on satisfactory outcomes rather than maximums, on the process of strategy making. It is relevant to any bureaucratic systems or knowledge based enterprises.

Systemic approach reflects the attitudes, values and behavioural patterns of the social system. It asserts that the strategy must fit to its context, which determines the contents of a strategy (White, 2004; Whittington, 2001).

2.4 Competitiveness

Even though the terms competitive advantage and firm performance was used interchangeably in the earlier literature, they are different constructs. Competitive advantage is a relational and context-specific measure that is based upon the competition among different firms (Peteraf, 1993; Porter, 1980; D. Teece & Pisano, 1994) and it does not ensure absolute superior firm performance (Sanders & Premus,

2002). It reflects firm's ability to achieve and preferably sustain a performance better than the average of the industry (Barney, 1991; Porter, 1980).

The importance of competitive advantage for organisations was introduced to research domain, in 1930's by the conceptual study that was conducted by Edward Chamberlain (Roberts & Sonnenschein, 1977). As the economic and social factors started to change in the environment, the importance of competitive advantage and firm performance became clearer and this surely had an impact on the research that focussed on these issues (Thomas *et al.*, 1999).

Strategic Management domain, uses different perspectives to explain competitive advantage. These perspectives mainly focus on two concepts; the relation between environment and organisation; the locus of competitive advantage (Hrebiniak & Joyce, 1985). The relation between environment and organisation can be explained with two different theories that handle the concept from two diverse perspectives. The *environmental determinism* perspective argues that environment is the determiner of organisational behaviour and a manager's key task is to protect the organisation from environmental change (Hrebiniak & Joyce, 1985; Porter, 1981).

Table 2.2 : Theories on competitive advantage.

	Industrial Organisations	Resource Based	Dynamic Capabilities
Locus of Competitive Advantage	External	Internal	Internal / External
Sources of Competitive Advantage	Superior position in the industry	Unique resources, capabilities and competencies	Ability to adapt resources, capabilities and competences to external changes
Common Dependent Variable	Competitive Advantage	Competitive advantage/ sustained competitive advantage	Competitive advantage/ sustained competitive advantage
Seminal Reference	Porter (1981,1985)	Barney (1991), Wernerfelt (1984)	Teece (1997)

At the other hand *strategic choice* perspective, which is accepted as the basis for resource based view, claims that organisations have a degree of autonomy in their strategic choices and are not dependent to the environment (Barney, 1991). The relation between environment and organisation acts as the determiner for the locus of competitive advantage. A perspective that accepts environment as the main

determinant will surely concentrate on strategies with external locus. Identically, internal locus will be the choice of strategist that focus on the importance of organisational assets.

With the increased intense on identifying and describing the nature of competitive advantage, scholars realised that in some cases competitive advantage was hard to imitate and that was leading the firm to a long lasting and superior economic performance (Amit & Schoemaker, 1993; Barney, 1991; Black & Boal, 1994). This awareness directed the competitive advantage research towards the development of a solution that will enable firms to sustain the advantages they gained in the competitive market; the concept of sustained competitive advantage (SCA) (Barney, 1991; Black & Boal, 1994). Porter (2008a) described sustained competitive advantage as "above average performance in the long run" which points out the two components of SCA; the notion of above average performance and the notion of persistence. Wiggins and Ruefli (2005) highlighted that only a small minority of the firms in the industry exhibit superior economic performance and this performance rarely persists for long time frames, which supports the importance of "above average" notion for "sustained" competitive advantage.

2.4.1 Industrial Organisation Theory

The industrial organisations (IO) perspective is originated on micro-economics and it accepts industry structure as the main element that shapes the competition (Rumelt, 1991). This perspective of competitiveness, dominated the strategic management domain between late 1960s and 1980s (Porter, 1991; D. J. Teece *et al.*, 1997).

The roots of IO model go back to the structure-conduct-performance paradigm (SCP). SCP assumes that the market environment's impact on market structure has a direct influence on firms' economic conduct and so its market performance. In this regard, the main determinant of profitability and performance is the market environment and so the market structure of the industry that the firms operates in (Porter, 1981; D. J. Teece *et al.*, 1997). As one of the developers of this perspective, Joe Staten Bain's focus in which presented in 1968 was on analysing the barriers of entry to a market, especially the threat of competition and it was argued that, variables such as, advertising, prices capacity or quality can be ignored in firm's decisions (as cited in Seth & Thomas, 1994).

The theory of IO gives value to the decisions about where to position the firm as more important than the capacity to implement such a positioning. There are three main assumptions that are accepted by the approach (White, 2004);

1. The profit maximisation is the main criteria of competition in the market and even though managers are not keen to accept this view the competition in the market forces them to do so.
2. The resources that are possessed by the firms in the industry assumed to be similar and because of that, resource based approaches do not lead firms to different strategies.
3. Markets are characterised by different and changing conditions of competition and the positioning of a firm determines performance in such an environment.

Porter's "Five Forces" framework is accepted as the most dominant framework within the IO literature. It is popularly known as position or positioning approach. Porter (2008b) claims that firms should find a position in the industry regarding the five competitive forces that determine the competitiveness in the industry. Firm's reaction against the five forces determines whether it will achieve competitive advantage or disadvantage. The five forces that the framework is built upon are; (1) Threat of New Entrants, (2) Threat of Substitution, (3) Bargaining Power of Buyers, (4) Bargaining Power of Suppliers and (5) Rivalry among existing firms (Figure 2.2). "Threat of New Entrants" refers the decision of new competitors to enter an industry and the desire to gain market share. It is named as a threat for the existing competitors since the level of profits being earned by each firm will be decreased. "Bargaining Power of Buyers" implies customers' ability to; force down prices, require higher quality or more services, or set competitors against each other. Along with the buyers, suppliers also can present such a bargaining power on competitors by applying changes on prices and quality of the goods and services (Bargaining Power of Suppliers).

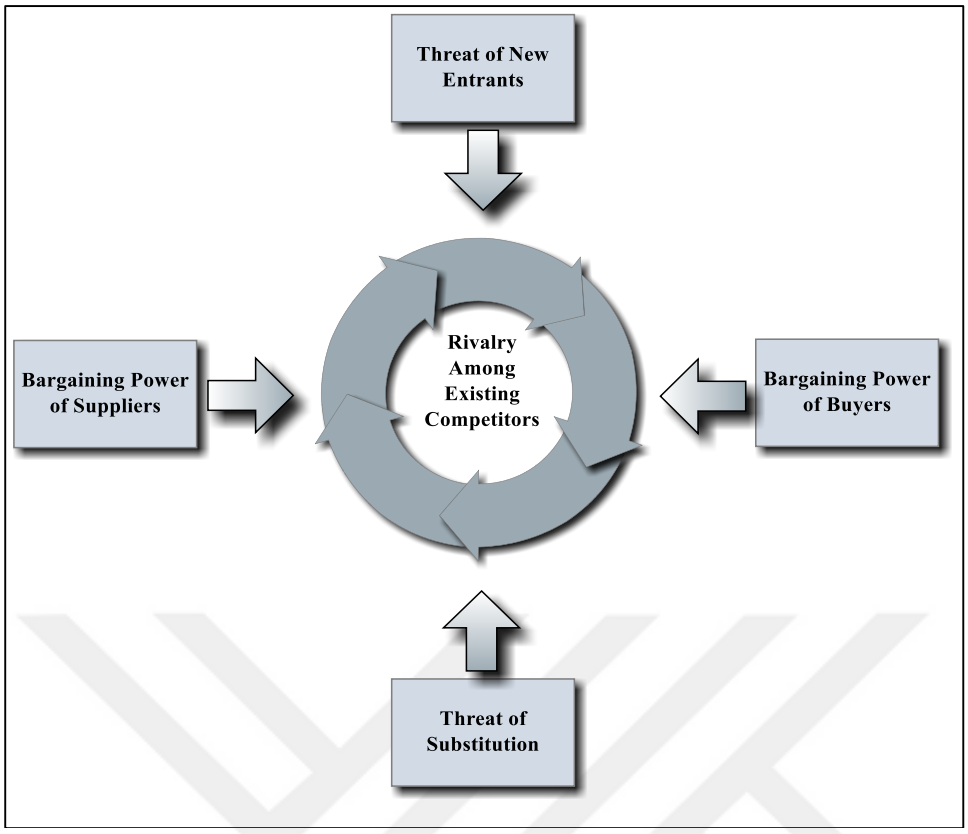


Figure 2.2 : Porter's five competitive forces framework (Porter, 2008b).

Another force that affects the competitive market is the Threat of Substitution. The products or services that appear to be new but can satisfy the same need as existing ones are named as the "substitute" products or services. Since the substitutes can increase the level of competitiveness as a cheaper option, they can also decrease the profit potential for the firms in the industry. As an addition to these dynamics the intensity of the Rivalry among existing firms is the fifth force that affects the profitability of the industry. Even though rivalry is needed to some extend for a better competitive environment, it causes decreases on the profits when it exceeds the optimum level (Porter, 2008b).

The five competitive forces framework was developed to help firms to reach the highest possible profit and develop a strategy that will provide them a unique and valuable position in the industry (Porter, 2008b). Moreover, Porter (1996) notes that firms should decide on the method that they will use to leave their rivals behind, which are named as the generic strategies (Figure 2.3); cost leadership, differentiation and focus.

Figure 2.3 : Generic competitive strategies (Porter 1980).

The firms that choose to adopt cost leadership strategy aim to be the lowest-cost supplier thus to benefit from the price-cost difference. Another method is to present different products or services compared to the rivals in the industry. This difference or uniqueness can cause an effect on the customers and provide a better profit than the average. Or, the firm can choose to apply one of these strategies to a particular segment of the market (Dobson *et al.*, 2004; Porter, 1980).

Despite its valuable contribution to strategic management field, Porter's work has been subject to criticisms as every theory in the social research. First of all, the static nature of the framework, which assumes market structure as stable, has been criticised for not being fit to the dynamic structured industries (Prahalad & Hamel, 1994). Gordon (1997) argued that the framework is not reflecting the competitiveness domain completely and suggested "government" as the sixth force, due to its direct or indirect effect on the industry and the other five forces. Hunger and Wheelen (2003) broadened the scope of the "sixth force" by including government, local communities, creditors, trade associations, special interest groups, shareholders under the title of stakeholders. Another criticism for Porter's theory points out that, the theory's overemphasis on competition harms the cooperation between parties (Nalebuff *et al.*, 1996). Even Porter criticised his own framework for being concerned only with cross-sectional problems (Porter 1991).

In summary, Porter's five competitive forces framework, as the main representative of IO perspective, advocates the importance of external factors over internal factors in achieving competitive advantage and assert that the industrial structure and forces are the main determinants that shape organisational performance. In this sense, the

firm's response to these factors determines its position in the industry in terms of competitiveness. Along with the criticisms that were stated related with the structure of the model, defenders of the Resource Based View asserted that the firms should focus on strategies that exploit existing firm specific resources (internal factors) rather than acquiring necessary resources that are believed to bring the competitive advantage.

2.4.2 Resource Based Theory

The Resource Based View (RBV) believes that the competitive power of organisation comes from its own assets, organisation's resources and capabilities (Barney, 1991; Wernerfelt, 1984).

The roots of RBV research go back to 1930's to the works of Schumpeter (Croitoru, 2012). Soon after Schumpeter, Penrose in 1959 and Selznick in 1957 emphasised the importance of firms internal assets by describing firms as collections of productive resources and claiming the existence of distinctive competences (Penrose, 2009; Rosen, 2011). Wernerfelt (1984) developed a new model of competitive advantage arguing that the emphasis should be given on internal factors rather than external ones. Resources were defined as "anything which could be thought of as a strength and weakness of a given firm" (Wernerfelt, 1984).

Barney (1991) defined firm resources as "all assets, capabilities, organisational processes, firm attributes, information, knowledge, etc. controlled by a firm that enable firm to conceive of and implement strategies that improve its efficiency and effectiveness". Amit and Schoemaker (1993) identified resource as "stocks of available factors that are owned or controlled by the firm" and argued that the assets and bonding mechanisms; such as technology, management information systems or trust between management and labour, convert the resources into final products or services. Grant (2010) argued that resources are the productive assets owned by the firm and classified them under three main themes as; (1) tangible that refer to the financial and physical assets of the organisation; (2) intangible resources that refer to the assets in which value is determined by perception such as culture, reputation and technology; and (3) human resources that represent the organisational workforce, which the organisation can never own but procure under the terms of a contract (Figure 2.4).

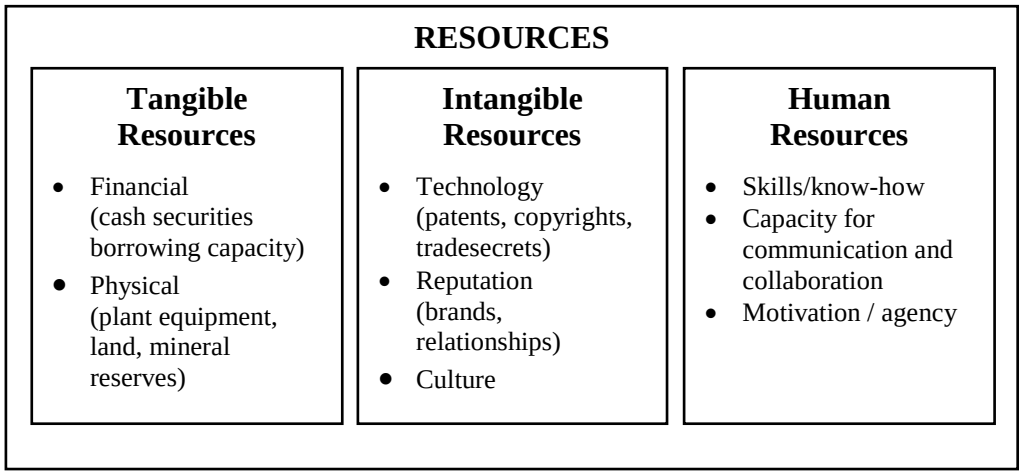


Figure 2.4 : Resource typology adapted from Grant (2010).

As a definition that integrates previous two definitions Helfat *et al.* (2009) defined resource as "an asset or input to production (tangible or intangible) that an organisation owns, controls or has access to on a semi-permanent basis". Helfat *et al.* (2009) claimed that resources that are available and can be used do not necessarily exist within the organisation's boundaries. It refers to the total stock of inputs to production that the organisation can "control" or "has access to on a semi-permanent basis" in order to meet its goals.

Barney (1991) asserts that in order to hold the potential of sustained competitive advantage, a resource must have four attributes; (1) it must be valuable in the sense of enabling organisation to exploit opportunities and/or neutralise threats in the environment, (2) must be rare in the industry, (3) must be inimitable so the rivals cannot possess them and (4) there should not be any resource that will be strategically equivalent to it, in other words the resource should be non-substitutable. In this respect, intangible aspects of the resource base, such as organisational culture and reputation, are the sustenance of competitive advantage since they are not easily accumulated by competitors (Cool *et al.*, 2006; Dierickx & Cool, 1989). These VRIN (valuable, rare, inimitable, non-substitutable) resources are essential to generate great value for the organisation and Peteraf and Barney (2003) argue that this greater value that is generated, is viewed as a rent to these scarce resources.

Even though the resources have such a powerful impact, the organisation should have the ability to manage and organise them in order to create value from them (Ashurst *et al.*, 2008). Organisation's capacity to deploy resources and ability to achieve its goals can be named as organisational capability (Amit & Schoemaker,

1993; Salaman & Asch, 2003). In order to achieve the goal of deploying resources, organisation uses "information-based, tangible or intangible processes that are firm-specific and are developed over time through complex interactions among the firm's resources" and differently from resources, capabilities are based on "developing, carrying and exchanging information through the firm's human capital" (Amit & Schoemaker, 1993). Resources are inputs for the production processes but they are not productive on their own. The cooperation and coordination of teams of resources are provided by capabilities which are defined as "the capacity for a bundle of resources to perform some task or activity". Even though the resources are the foundation for organisation's capabilities, capabilities serve as the main source of competitive advantage (Grant, 1991; Stalk *et al.*, 1992).

While the concept of capability reflect the "extent" of ability, the term "competence" is used to explain the degree of skill, success and efficiency in the task's performance. Even though "capability" mostly refer to skills and abilities, "competence" can be a combination of knowledge, behaviour, attitude and skills. In this sense, the competences serve as the result or the improved version of capabilities (Celine, 2012). Paschke (2009) presented a classification of the Resource Based View concepts (Figure 2.5) using a new version of the model that is presented by Lado *et al.* (1992).

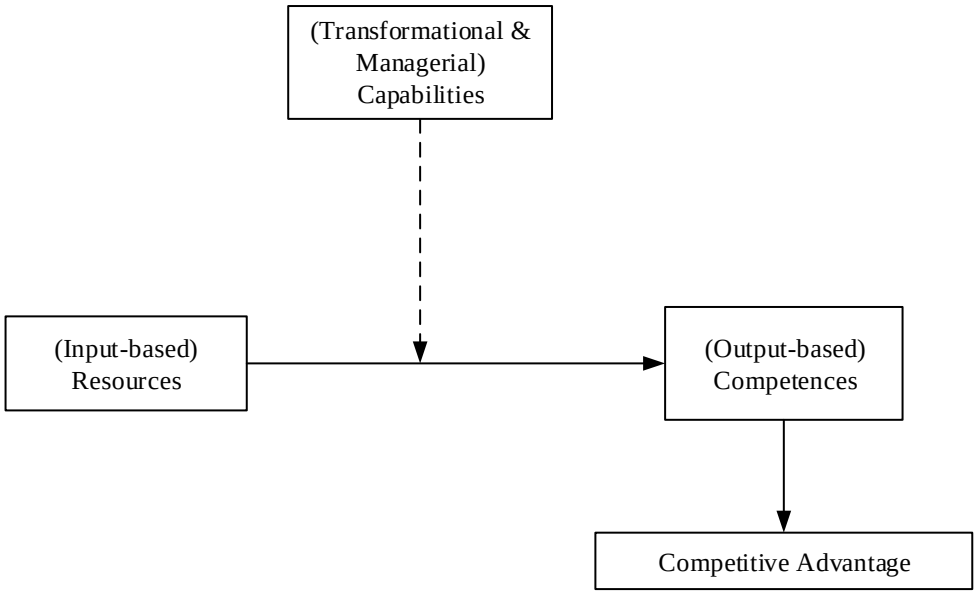


Figure 2.5 : Classification of the resource based view concepts (Paschke, 2009).

The organisation's build new capabilities through learning processes. These processes include; learning over time, accumulating knowledge, progressively undertaking new activities and acquiring new capabilities.

Regarding that building organisational capabilities within the organisation is the only way to have them, top management is responsible for providing an environment that enables capability building and improvement (D. J. Teece *et al.*, 1997).

As the RBV research got mature, researchers tried to develop detailed models in order to provide a better understanding about the concept. In their model Lado *et al.* (1992) claimed that input, transformational, managerial and output competences are the four main components of RBV and proposed a model in which they linked them. In their model they defined; *input-based resources* as the enablers of transformational processes that include physical, capital and human resources; *transformational-based competences*, such as innovation or organisational culture, as organisation's capabilities that transform inputs to outputs; *managerial competences*, as capabilities of strategic leaders to develop and communicate a strategic vision and provide awareness among employees; *output-based competences*, as organisation's visible and invisible outputs (Lado *et al.*, 1992; Lado & Wilson, 1994).

The resources based view of strategic management was introduced as a response that will overcome the shortcomings in the market position view of strategy, which explained the relationship of relative firm performance and market positioning differences in the industry (Porter, 1980, 2008a). However, RBV has also been subject to a number of criticisms.

In order to adapt a Resource Based View, the managers should be able to; identify and classify firm's resources; make a comparison between these resources of their firm's and the competitors' in the market; assess the benefits of using these resources and capabilities; and develop a strategy that will provide optimum utilisation of the firm's resources.

2.4.3 Dynamic Capabilities Theory

As another theory that aims to facilitate organisational response maturity to changing environments, Dynamic Capabilities has evolved from the resources based view and can be described as tools that manipulate resource configurations, which also enable the organisation to add, develop, combine, redeploy and dispose of firm resources,

especially within the change process (Ambrosini & Bowman, 2009; Easterby-Smith *et al.*, 2009; Eisenhardt & Martin, 2000; D. J. Teece *et al.*, 1997; Winter, 2003). "Dynamic capabilities" has been examined by a number of researchers from various perspectives. Some of the researchers describe dynamic capabilities as the ability of organisations to adapt their skills and resources to the changes in the environment (Ambrosini & Bowman, 2009; Barreto, 2010; D. Teece & Pisano, 1994; Wheeler, 2002). Another approach identifies dynamic capabilities as a capacity to create market change that derives from the top management's ability to sense opportunities and reconfigure resources as a response (Augier & Teece, 2009; Newey & Zahra, 2009).

Divergent terminology, inconsistency and overlapping definitions of the literature ave contributed to the main criticisms about dynamic capabilities domain. Some of these definitions are as follows;

> The capacity of an organization to purposefully create, extend, or modify its resource base. (Helfat *et al.*, 2009)
>
> The firm's processes that use resources-specifically the processes to integrate, reconfigure, gain and release resources-to match and even create market change. Dynamic capabilities thus are the organisational and strategic routines by which firms achieve new resource configurations as markets emerge, collide, split, evolve, and die. (Eisenhardt & Martin, 2000)
>
> The firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments. (D. J. Teece *et al.*, 1997)
>
> A dynamic capability is a learned and stable pattern of collective activity through which the organization systematically generates and modifies its operating routines in pursuit of improved effectiveness. (Zollo & Winter, 2002)
>
> A firm's behavioural orientation constantly to integrate, reconfigure, renew and recreate its resources and capabilities and, most importantly, upgrade and reconstruct its core capabilities in response to the changing environment to attain and sustain competitive advantage. (Wang & Ahmed, 2007)

An analysis of the given definitions about dynamic capabilities indicate that;

- Dynamic capabilities have been defined as: capacity, routine, ability and learned patterns.
- All of the definitions indicate that there is a "purpose" for developing dynamic capabilities.

- They are related with; integrating, reconfiguring, gaining, releasing, building, generating, renewing, recreating, resources that the organisations have both internally and externally.

Based on this analysis, the definition of Helfat *et al.* (2009), which has also gained recognition by a number of researchers (Easterby-Smith *et al.*, 2009), is therefore respected. Thus, the following definition of RBV is adopted throughout this thesis.

"A dynamic capability is the capacity of an organisation to purposefully create, extend or modify its resource base."

Further discussions about dynamic capabilities, initially requires the clarification of the concept of "capability". Even though it is not complicated as dynamic capabilities, various definitions and understandings exist, similarly for the concept of capability. According to Helfat *et al.* (2009), "a capability, whether operational or dynamic, is the ability to perform a particular task or activity." Grant (2010) defines organisational capability as "firm's capacity to deploy resources for a desired end result". Regarding this definition, reminding that the the terms capability and competence were used interchangeably, distinctive competence was defined as the things that an organisation does better relative to its rivals and core competences as the capabilities that are fundamental for an organisation's strategy and performance. Amit and Schoemaker (1993) assert that capabilities refer to "a firm's capacity to deploy resources, usually in combination, using organisational processes, to effect a desired end". Cool *et al.* (2006) identify capabilities as "sets of highly routinised and complex activities, which define a set of things the organisation is capable of doing confidently".

Capabilities may be developed in different functions as well as different levels of organisational activity such as departmental, divisional or corporate levels (Schreyögg & Kliesch-Eberl, 2007). Within this construct, as the outcomes of different processes and routines, capabilities identify different abilities of organisation such as operational capability, marketing capability, supply chain management capability etc. proposing that, these broadly defined capabilities can be "disaggregated into more specialist capabilities". Grant (2010) presented a visual representation of the hierarchy of capabilities (Figure 2.6).

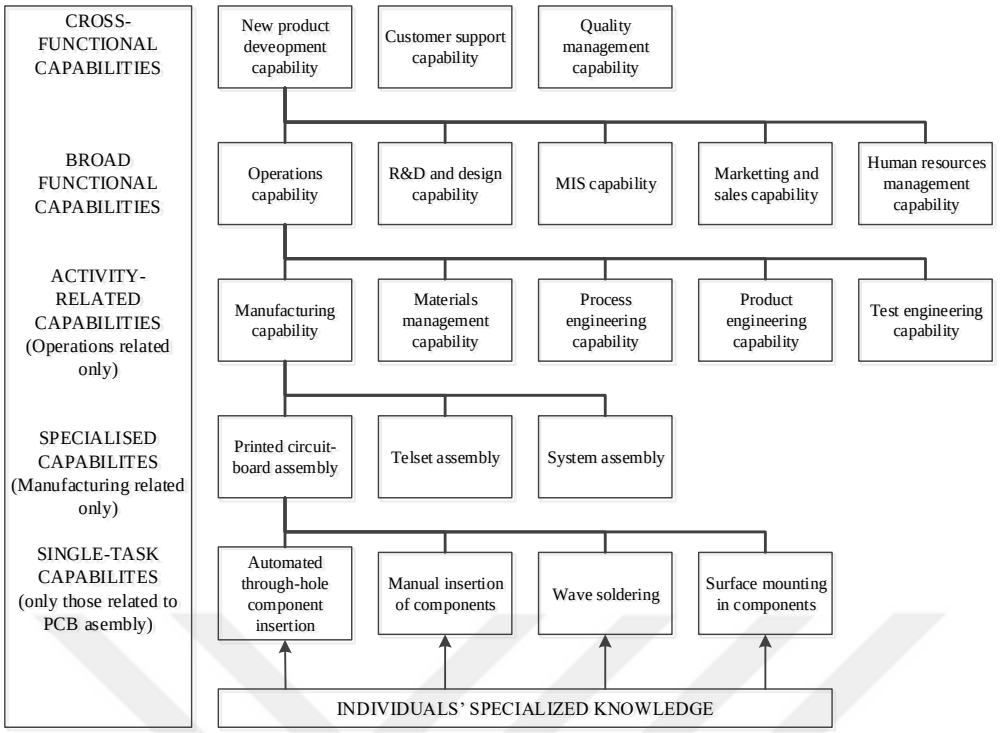


Figure 2.6 : The hierarchical nature of capabilities (Grant, 2010).

Eisenhardt and Martin (2000) stressed that combination of simpler capabilities and routines constitute the dynamic capabilities, which can be named as meta-capabilities. This approach points out the stratified nature of dynamic capabilities, which has been subject to various studies and defined as the hierarchies of dynamic capabilities (Ambrosini *et al.*, 2009; Danneels, 2002; Winter, 2003). Based on the studies on hierarchies of capabilities, Ambrosini *et al.* (2009) proposed three types of dynamic capabilities*; incremental* that refers to continuous development or evolution of the resource base; *renewing* that refers to refreshing and renewing the nature of resource base; and *regenerative* that refers to changing the way that organisation creates extends or modifies its resource base.

Dynamic capabilities should be seen as management processes that are coordinative and based on organisational learning (D. J. Teece *et al.*, 1997). Bititci *et al.* (2011) define managerial processes as "organisational routines that underpin the dynamic capabilities of an organisation by controlling and reconfiguring the organisation's resource base, thus impacting on the organisation's ability to attain, sustain or enhance performance in the long-term" and the coordination nature comes from resource adjusting and reconfiguring efforts for providing the survival and competitive advantage of the organisation. In order to have a better understanding about the concept, the meanings of process and routines should also be understood.

Processes are “collections of activities that, taken together and produce outputs for customers” (Benner & Tushman, 2003). They describe “the way of things are done in a firm” and they serve as mechanisms for both, putting dynamic capabilities into use and developing them (Helfat *et al.*, 2009).

Routines can be defined as stable, behavioural patterns that characterise the reaction of organisation to internal or external stimuli (Zollo & Winter, 2002). They are repetitive and “recognizable patterns of interdependent actions, carried out by multiple actors” (Feldman & Pentland, 2003). Hansen and Martin (2009) defined routines as processes that are context-dependent, embedded and specific. They described the process of routine development in four phases; (1) interpretation and sense-making, (2) coordination and negotiation, (3) transformation and stabilisation and (4) elimination and unlearning.

Various researchers identified a range of processes as dynamic capabilities such as; absorptive capacity, product development, strategic decision making, processes of resource reconfiguration, leverage, learning, integration and etc. (Bowman & Ambrosini, 2003; Eisenhardt & Martin, 2000; Zahra & George, 2002)

Even though dynamic capabilities are valuable assets for gaining the competitive advantage (D. Teece & Pisano, 1994; Wang & Ahmed, 2007) the literature points out some challenges of using them. In spite of their benefits to the organisation, dynamic capabilities often incur a cost to develop and deploy. Addition to this development and deployment costs, firms have to bear the cost of maintaining these capabilities during the times that they are not actively used. This also means the investment of managerial resource of attention and energy into management of dynamic capabilities (Ambrosini & Bowman, 2009; Barreto, 2010; Lavie, 2006; Mahoney, 1995). Dynamic capabilities can be risky for organisations during times of environmental change, as whilst they can provide competitive advantage, they can also quickly become liabilities for the organisation (Schreyögg & Kliesch-Eberl, 2007; Winter, 2003).

At this point the managers’ level of vision, humility and managerial cognition, are vitally important on development and deployment of dynamic capabilities (Benner & Tushman, 2003; D. J. Teece *et al.*, 1997). The inefficient management of the

development and deployment of dynamic capabilities can potentially destroy the valuable extant capabilities (Ambrosini *et al.*, 2009; Zahra *et al.*, 2006).

2.5 Summary of the Chapter

This chapter provided a general overview of the concepts of strategy and strategic management. The orgins of strategy, different perspectives for strategy and strategic management were discussed, including competitiveness and the main theories for achieving competitive advantage. Based on the discussion on different theories, the chapter revealed that development of organisational capabilities is needed for a sustained competitive advantage based on efficient diffusion of new technologies. In this regard, the following chapter investigates the dynamics of technology diffusion and acceptance through main theories that exist in the literature.

3. TECHNOLOGY AND INNOVATION DRIVERS

3.1 Introduction

This chapter investigates the critical factors that affect technology diffusion and acceptance. In this regard, it starts by presenting technology diffusion process form an approach that accepts technology diffusion as a repetitive event, which needs a sustainable efficiency. Subsequently, the chapter investigates the main theories for technology acceptance. For the last step, the chapter discusses the critical factors of technology diffusion process, based on the literature analysis.

3.2 Diffusion Process

Even though the research on diffusion became a popular field for the anthropologists during 1920's and 1930's (Katz *et al.*, 1963; Valente & Rogers, 1995) its origins extend back to 1903, until the European beginnings of social science, with Gabriel Tarde (Rogers, 2010). Among these various research, Rogers' theory about Diffusion of Innovations has been accepted as the most appropriate one to explain the Diffusion Process by the majority (Sahin, 2006).

Rogers (2010) defines diffusion as "the process by which an innovation is communicated through certain channels over time among the members of a social system". He describes it as a special type of communication in which the messages are concerned with new ideas. This definition also gives us the four main elements of the Diffusion of Innovations which are; (1) innovation, (2) communication channels, (3) time and (4) social system.

The theory of Diffusion of Innovations, defines the innovation-decision as a process that "consists of a series of actions and choices over time through which an individual or an organisation evaluates a new idea and decides whether or not to incorporate the new idea into ongoing practice" (Rogers, 2010). This process starts with awareness regarding the existence of innovation, understanding how and why it

works (Knowledge). This stage covers; being aware of the innovation, learning how to use it and the main principles that it's built upon (Figure 3.1).

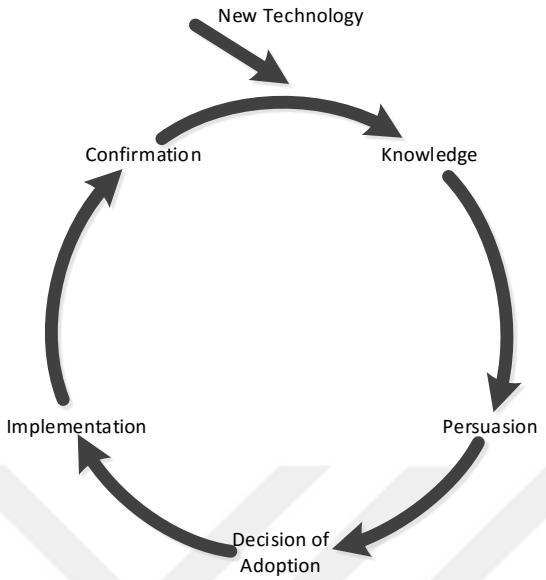


Figure 3.1 : Innovation diffusion process.

After the "Knowledge", formation of the favourable or unfavourable attitudes towards the innovation takes place (Persuasion), in which there is a more detailed investigation about the related information and details. Based on the information coming from the previous two stages the Decision of Adoption or rejection is given. If the decision is positive the Implementation of the innovation takes place, in which the usefulness of the innovation is also evaluated. Based on the evidences that support the usefulness of the innovation, the process is finalised by the Confirmation, which leads to the further use (Rogers, 2010; Sahin, 2006).

During their life cycle, organisations tend to face innovations in various guises depending on their attitude and openness to modernisation, and their ability to scan for inter (whitin the sector) and intra (other sectors) innovation opportunities. In this regard, the diffusion process in an innovative organisation has a continuous nature which comprises repetitive sub process, instead of discrete attempts (Figure 3.2).

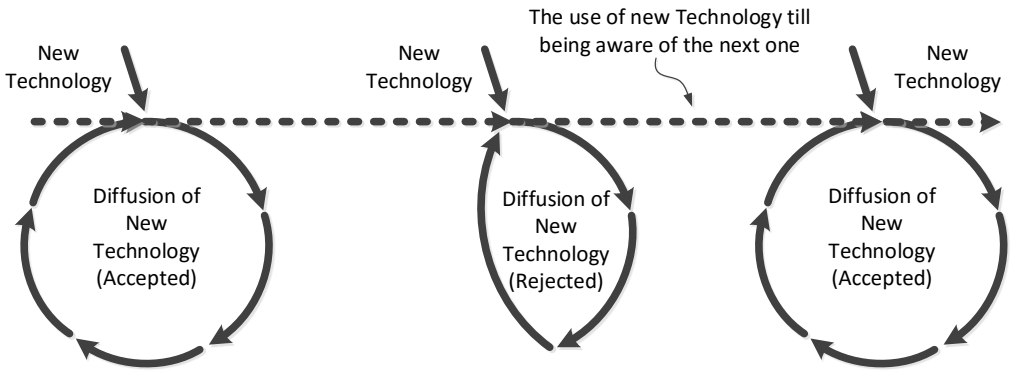


Figure 3.2 : Repetitive nature of technology diffusion.

While describing the innovation diffusion as a process of "uncertainty reduction", (Rogers, 2010) argued that this uncertainty can be reduced according to the degree to which; "an innovation is perceived better than the idea it supersedes" (relative advantage); "an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters" (compatibility); "an innovation is perceived as relatively difficult to understand and use" (complexity); "an innovation may be experimented with on a limited basis" (trialability); "the results of an innovation are visible to others" (observability).

The unit of innovation adoption, which can be described as the person who accepts or rejects innovation, acts as one of the essential elements of the process. This can either be individual's own decision to adopt an innovation or it can be given on behalf of an organisation by senior managers for organisational adoption (Fichman, 1992; Gallivan, 2001). The focus on the organisational innovation adoption, through a unit of adoption lens, makes the processes that intertwine with each other, more apparent. Based on the work of Carlopio (1998) organisational diffusion process can be described as a series of phases that start with the top management's initiation of new technology (Peansupap, 2005). Once the top management gives adoption decision, another adoption process of the staff starts and both processes meet again at the confirmation stage (Figure 3.3). In this regard, Peansupap and Walker (2004) presented a framework about ICT innovation diffusion within an organisation, examined the process in two main phases; initial adoption and actual implementation.

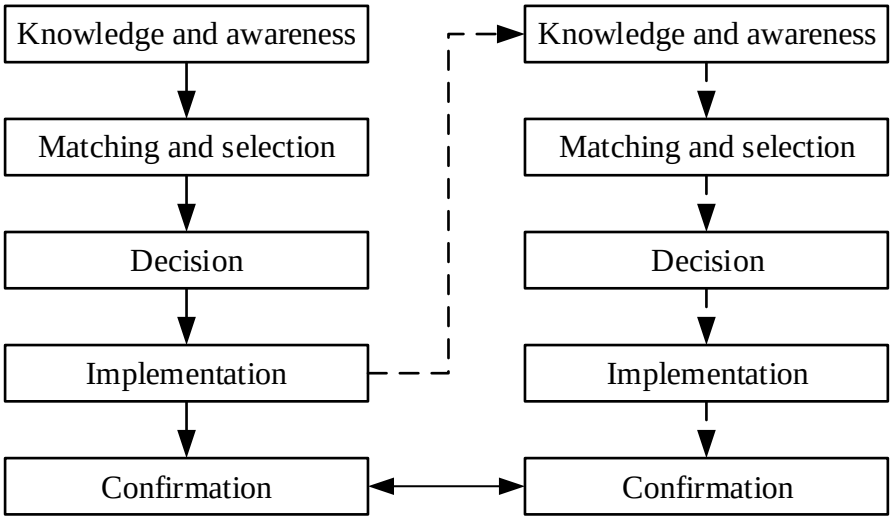


Figure 3.3 : The levels of implementation process of technology diffusion process (Peansupap & Walker, 2004).

The frameworks of Peansupap and Walker (2004) and Fichman (1992), note that the adoption decision for a new technology is usually authorised by a group of senior managers or top management in an organisation. However, the key element for the efficient use is the expected users' approach and acceptance. Therefore, the elements that affect and shape individuals' intentions to use new technology has been another core area that the researchers focussed on (Ajzen, 1985; Bandura, 1986; F. D. Davis, 1989; Fishbein & Ajzen, 1975; Ryan & Deci, 2000b; Venkatesh, 2000; Venkatesh & Bala, 2008). All these research about diffusion revealed the fact that, new technology diffusion is complex process that is affected by factors of intra-personal, interpersonal, organisational and environmental levels (Del Aguila-Obra & Padilla-Melendez, 2006; Hameed *et al.*, 2012b; Jeyaraj & Sabherwal, 2008; Peansupap & Walker, 2005b).

In this regard, the next section examines the theories that explain the nature of technology adoption decisions.

3.3 Theories of Technology Adoption Decision

3.3.1 Theory of Reasoned Action

Theory of Reasoned Action is one of the earliest studies to explain technology acceptance. For example, Fishbein and Ajzen (1975) argued that individuals normally think rationally and they consider the implications of their actions before making a decision to engage in a given behaviour (Figure 3.4).

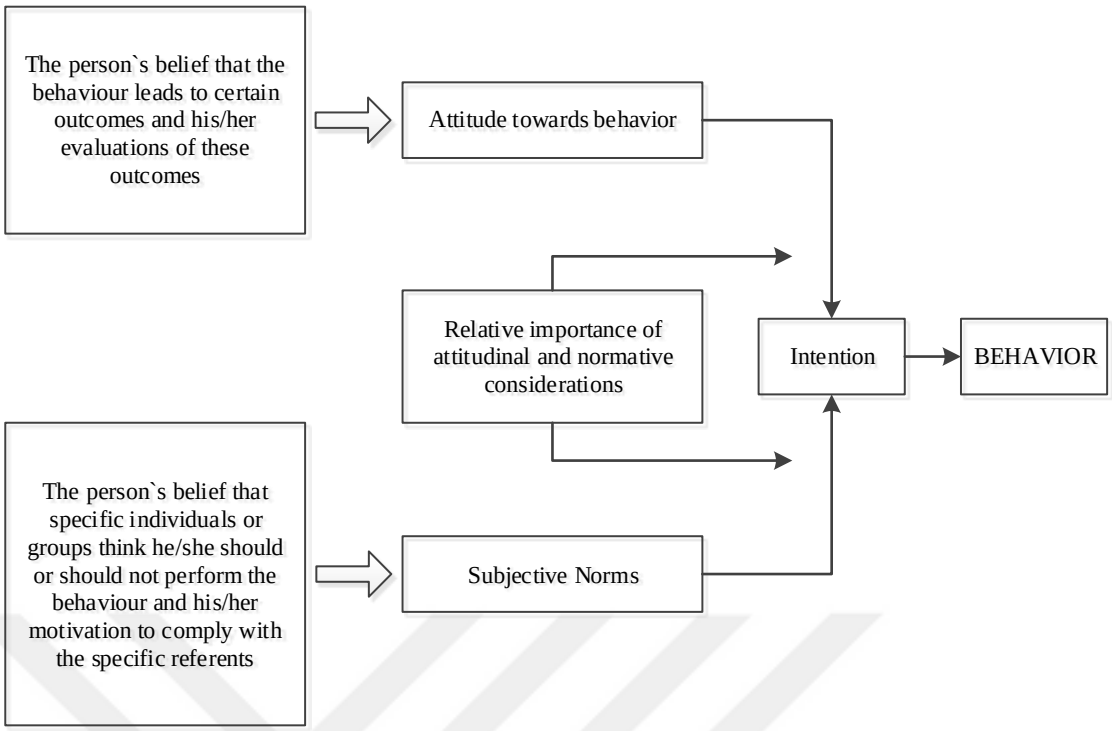


Figure 3.4 : Factors determining a person`s behaviour (Ajzen and Fishbein 1980).

The theory of Fishbein and Ajzen (1975) assumes that; rather than attitudes, behavioural intentions are the main predictors of behaviours and describe an individual's intention to perform behaviour as the combination of attitude towards performance of behaviour and subjective norms. Fishbein and Ajzen (1975) defined attitude toward behaviour as "an individual's positive or negative feelings (evaluative affect) about performing the target behaviour" and subjective norm as "the person's perception that most people who are important to him think he should or should not perform the behaviour in question". The theory has been used to understand a wide range of behaviour including the prediction of goals and activities, and explicit choice among alternatives (Sheppard et al. 1988).

3.3.2 Theory of Planned Behaviour

Theory of Reasoned Action is used to explain the behavioural intention in various domains but its weakness in explaining the volitional behaviours, which individual does not have full control, established the need for an improved model (Ajzen, 1991). In this respect, Ajzen (1985) introduced the Theory of Planned Behaviour (TPB) by adding a new variable "perceived behavioural control" in order to extend TRA to embrace the volitional behaviours and improve the predictive power of the model on behavioural intention and actual behaviours (Figure 3.5).

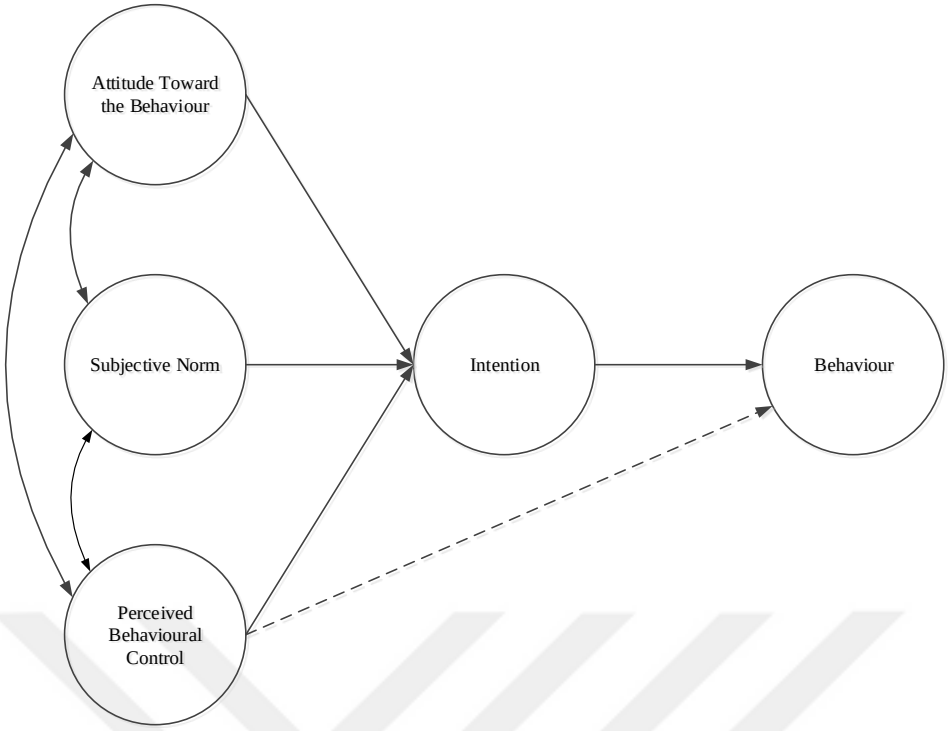


Figure 3.5 : Theory of planned behaviour (Ajzen 1991).

The origin of the new component "perceived behavioural control" is based on Self-Efficacy Theory which was proposed by Bandura in 1977 (as cited in Ajzen, 1985). The Self-Efficacy Theory focusses on the interrelationship among self-efficacy (people's perception that they are capable of successfully performing a behaviour), outcome expectancy (a person's estimate that a given behaviour will lead to certain outcomes) and behaviour (Bandura, 1977; Williams, 2010).

Ajzen (1991) defined perceived behavioural control as "people's perceptions of their ability to perform a given behaviour." He asserted that the perceived power of the control factor determines the strength of each control belief.

The TPB is accepted as an improved solution for predicting health related behavioural intention. Literature acknowledges that the model has a wide range of use from health related fields to environmental psychology and even tourism (Bai *et al.*, 2014; M.-F. Chen & Tung, 2014; Conner *et al.*, 2003; Greaves *et al.*, 2013; Liou & Bauer, 2007; Nguyen *et al.*, 1997).

However, TPB has been viewed that it overlooks the emotional variables which have an important role, especially in health related behavioural situations (Dutta-Bergman, 2005).

3.3.2.1 Decomposition of Theory of Planned Behaviour

Theory of Planned Behaviour has been used in various fields and research to understand and predict individuals' behaviours. Some of the researchers made adaptations on the theory in order to attain advanced results that provide the theory-fit to their domain. S. Taylor and Todd (1995) proposed a decomposition of TPB in which they extended the Theory by adding some constructs from Technology Acceptance Model (TAM) and Diffusion of Innovations (DoI) perspective (Figure 3.6).

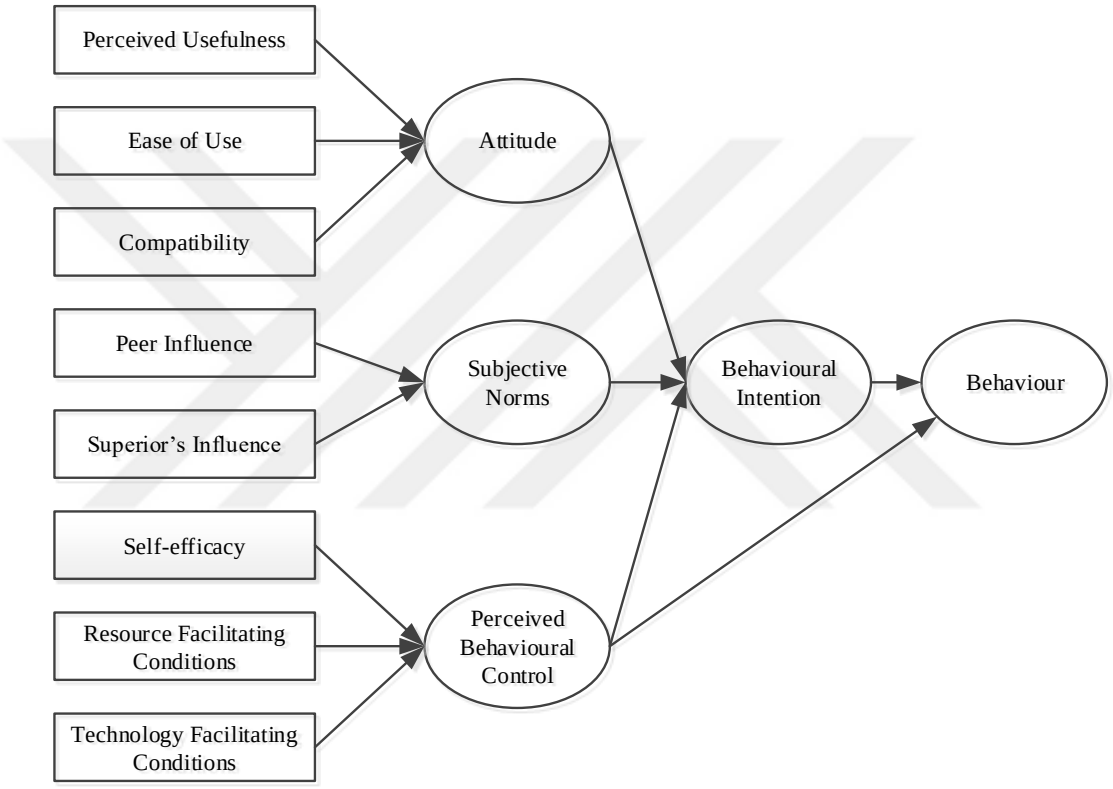


Figure 3.6 : Decomposed theory of planned behaviour (S. Taylor & Todd, 1995).

S. Taylor and Todd (1995) examined the appropriateness of TRA, TPB and DTPB as models to predict individual's behaviour, noting that; even though TRA and TPB were capable of predicting, DTPB was better for explaining individual's behaviour.

Another decomposition of TPB was developed by Pavlou and Fygenson (2006). In their research the extended and decomposed the Theory in order to predict the process of e-commerce adoption. Differently from Taylor and Todd's (1995) decomposition which added an explaining power to TPB, noting that Pavlou and Fygenson's (2006) model acted like a measuring tool.

3.3.3 Self Determination Theory

Self-Determination Theory (SDT) represents a broad framework for the study of human motivation and personality.Ryan and Deci (2000a) defined Self Determination Theory as "an approach to human motivation and personality that uses traditional empirical methods while employing an organismic meta-theory that highlights the importance of humans' evolved inner resources for personality development and behavioural self-regulation". The "organismic" assumption that is mentioned refers to the attempt of human beings to master the forces in the environment and the forces of drivers and emotions in themselves. They asserted that "autonomy", "competence" and "relatedness" are the inherent growth tendencies and innate psychological needs, which serve as the fundamentals of self-motivation and personality integration.

Having "motivation" as the core construct, the Theory approaches it in two different types, which can be defined as; doing something because it is inherently interesting or enjoyable and the activity itself provides spontaneous satisfaction (intrinsic motivation) or doing something because it leads to a separable outcome like tangible or verbal rewards and extrinsic consequences to which the activity leads provides the satisfaction rather than the activity itself (extrinsic motivation) (Gagné & Deci, 2005; Ryan & Deci, 2000a). As an addition to these types of motivation, Ryan and Deci (2000a) designated the state of "lacking intention to act" as "amotivation" and asserted that; not giving value to an activity, not feeling competent to do it or not believing that it will provide the desired outcome are the drivers of amotivation. Apart from the theories that see motivation as a unitary concept, a distinction between amotivation and motivation, SDT claims that the differing degrees of autonomy or self-determination can be reflected with diverse types of motivation. In this respect, Ryan and Deci (2000a) identified four different types of External Motivation. According to their theory, individuals can be externally motivated when; (1) their behaviours are performed to satisfy an external demand or obtain an externally imposed reward of contingency (external regulation); (2) their behaviours are performed with the feeling of pressure that is provided by guilt or anxiety or to achieve ego-enhancements or pride (introjected regulation); (3) the importance of behaviour has been identified by the individual and has thus been accepted as his or

her own (identification) or; (4) the identified regulations has been assimilated fully by the individual (integrated regulation) (Figure 3.7).

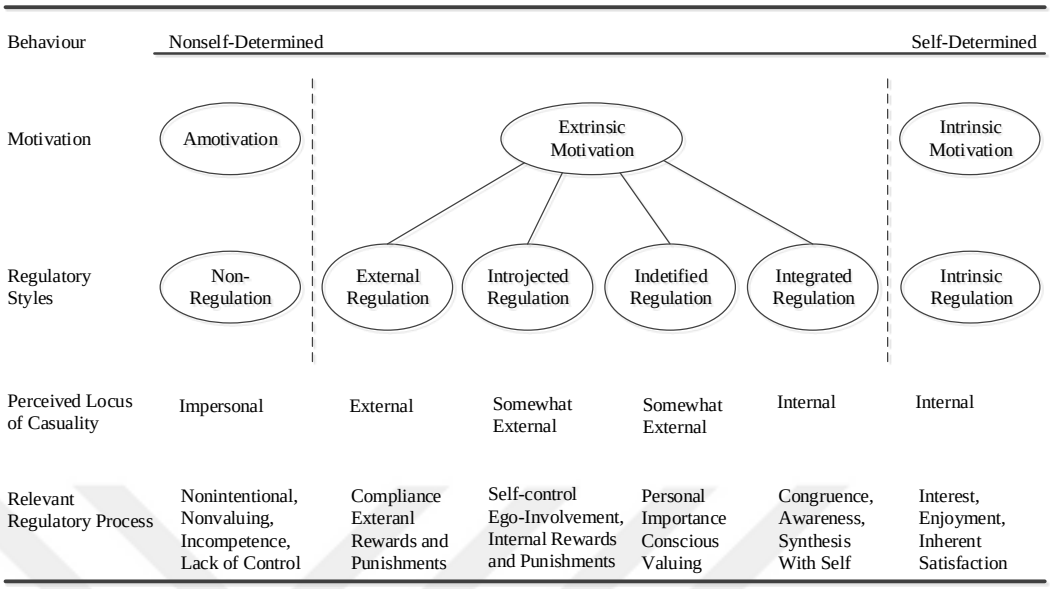


Figure 3.7 : The self determination continuum (Ryan & Deci, 2000b).

The development of SDT is likened to the construction of a puzzle with the new pieces that have been added to it over the years. As parts of the "SDT puzzle" five mini-theories were developed which are namely; Cognitive Evaluation Theory (explaining the effects of external consequences on internal motivation), Organismic Integration Theory (how individuals internalise the external factors by turning them into motivators), Causality Orientations Theory (the nature of choices based on the personal orientations towards autonomy, control and competence), Basic Needs Theory (why autonomy, competence and relatedness are names as the basic psychological needs) and Goal Content Theory (the differences of intrinsic and extrinsic motivations on individuals' perceptions of satisfaction and well-being) (Deci & Ryan, 1985; Vansteenkiste *et al.*, 2010).

SDT has found a great range of implementations embracing; ICT (Goldhaber *et al.*, 2012; Roca & Gagné, 2008), environmental psychology (Webb *et al.*, 2013), socio economics (Pugno, 2008) and healthcare (Power *et al.*, 2011).

Besides having a wide range of implementation areas, SDT has been subject to criticisms from a number of different perspectives. The focus of the theory has been criticised for approaching life from a positive, optimistic side, with a tendency to ignore the negative pessimistic realities that take place in most of the people's everyday life. The three basic needs have been a topic of argument including the

questions about their adequateness in number, consistency in nature, theory's inability in explaining the conflicts between these basic needs, examining their strength, the logic of their prioritisation and how do they change over time for an individual (J. A. Miles, 2012).

3.3.4 Social Cognitive Theory

Social Cognitive Theory's (SCT) origins go back to Social Learning Theory (Bandura, 1986) which posits that learning is a cognitive process and it can occur through observation or direct instruction. After working on and expanding the Social Learning Theory, Bandura (1986) proposed SCT. The theory relies mainly on the assumption that all individual behaviour, cognition and other personal factors, and environmental influences operate as interacting determinants and influence each other bi-directionally (reciprocal determinism) (Figure 3.8) (Bandura, 1988, 1989).

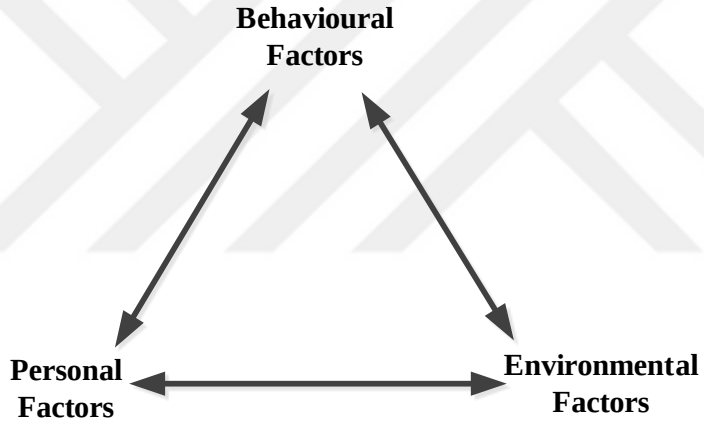


Figure 3.8 : Determinants of human behaviour.

SCT argues that, like direct experience, ability to learn from others (vicarious capacity) is also a powerful method, which helps save time, resources, mobility and provide security. The theory emphasises the importance of individuals' outcome expectations which motivate them and guide their actions (forethought). In addition to this, SCT also posits that; people have the ability to motivate themselves to carry out a behaviour by their internal control mechanisms (self-regulatory capability) which provides them control over their own thoughts, feelings, motivations and actions (Bandura, 1989).

SCT theory highlights the importance of "self-efficacy" and "outcome expectations", which are inseparable because of their synergetic nature, as the determinants of self-motivation with the "feedback" and "anticipated time to goal attainment" (Bandura,

1989; Carillo, 2010). Among these factors, self-efficacy has been subject to various studies and has taken place as a determinant that affects individuals' behaviours in most of the theories/models that focus technology acceptance (Chung *et al.*, 2010; Holden & Rada, 2011; van Dinther *et al.*, 2011). Bandura (1986) defined self-efficacy as *"*people's judgement of their capabilities to organise and execute courses of action required to attain designated types of performances. It is concerned not with the skills one has but with judgements of what one can do with whatever skills one possesses*"* and claimed that it plays a pivotal role in the SCT (Bandura, 2001b).

Its power to explain individuals' behaviours caused the SCT to be subject to numerous research from various fields and disciplines such as; mass communication (Bandura, 2001a), technology skills (Compeau & Higgins, 1995a), physical activity (Short *et al.*, 2013), orthopaedic nursing (Lucas *et al.*, 2013), diet behaviour (Lubans *et al.*, 2012) and etc. On the other hand the theory has faced some critiques emphasising the hardships that are faced in the implementation of the full model caused by the model's complex structure, the little changes in the environment that does not affect the individual's behaviour, the ignored effect of biological and hormonal determinants on individual's decisions and the differences on people's learning abilities (Flamand, 2012).

3.3.5 Technology Acceptance Model

Fred Davis proposed a Conceptual Model for Technology Acceptance in his doctoral thesis in which he claimed that system use is a response that can be explained or predicted by user motivation and the actual system's features and capabilities act as external stimulus that influences user's motivation to use the system (Figure 3.9) (Chuttur, 2009).

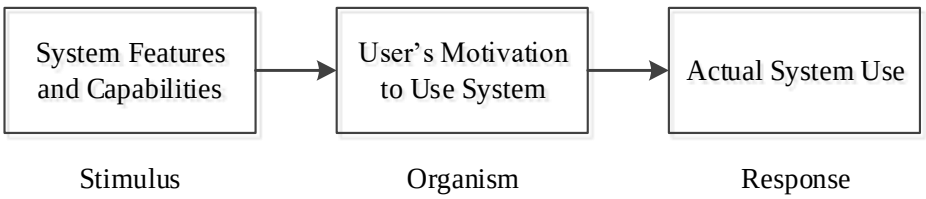


Figure 3.9 : Conceptual model for technology acceptance (F. D. Davis, 1986).

Aiming to explain how individuals accept and use new technology, F. D. Davis (1989) refined his conceptual model and introduced the Technology Acceptance Model as a further extension of TRA. In this refinement he excluded the Subjective

Norm from the model and proposed that user motivation can be explained by three factors; Perceived Usefulness, Perceived Ease of Use and Attitude Towards Using. In his model, F. D. Davis (1989) asserted that external variables affect both; "the degree to which a person believes that using a particular system would enhance his or her job performance" (perceived usefulness) and "the degree to which a person believes that using a particularly system would be free of effort" (perceived ease of use). Later on, with the argument that there would be cases in which the individual might form a strong behavioural intention to use the system without forming any attitude, F. D. Davis *et al.* (1989) added "Behavioural Intention to Use" into the model (Figure 3.10).

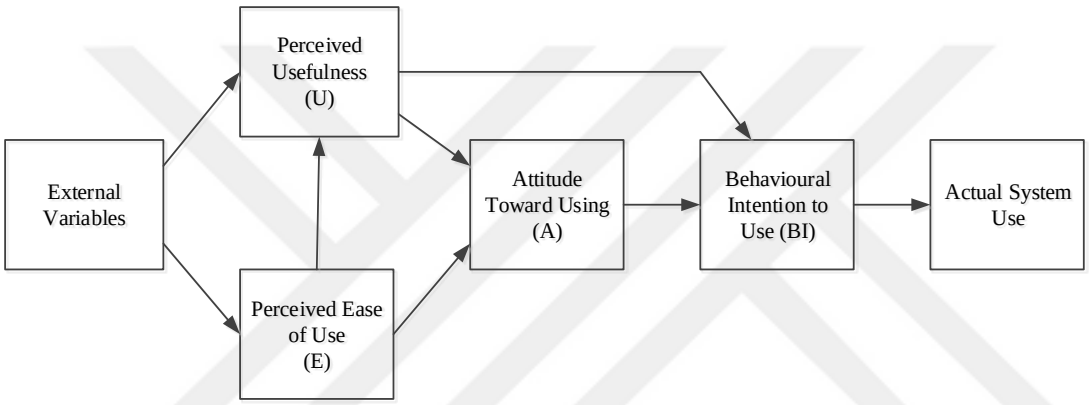


Figure 3.10 : Technology acceptance model (F. D. Davis *et al.*, 1989).

F. D. Davis *et al.* (1989), described TAM as a model which is "capable of explaining user behaviour across a broad range of end-user computing technologies and user populations, while at the same time being both parsimonious and theoretically justified". It is one of the most widely tested models of Technology Acceptance literature (King & He, 2006; Lee *et al.*, 2003; Yousafzai *et al.*, 2007).

In order to measure the model's performance, TAM was compared with both TRA and TPB (Venkatesh 2000). The results showed that both TAM and TRA provide significant results in predicting the intentions of users but TPB provided a more detailed explanation about the participants' intentions to use the system as a result of being a complex model (with several independent variables to capture the different aspects of users' beliefs.)

As a consequence of the criticisms about the weakness in explaining the individuals' intentions to use new technology, there was need of evolvement in order to improve

the Model's validity. In this respect, Venkatesh (2000) proposed an extension of TAM in which he argued the determinants of Perceived Ease of Use (Figure 3.11).

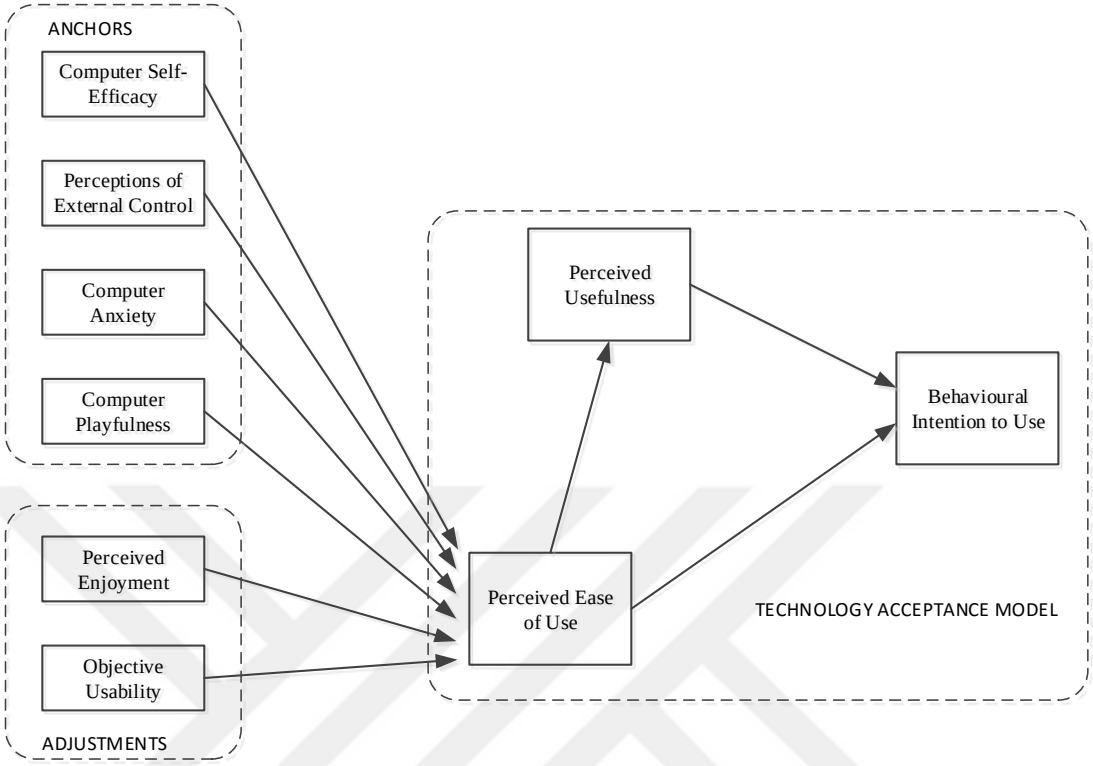


Figure 3.11 : TAM Extension (Venkatesh, 2000).

In the extension TAM, Venkatesh (2000) asserted that Perceived Ease of Use is affected by from (1) general beliefs about computers and computer usage (Anchors) and (2) beliefs that are shaped by direct experience with the new technology (Adjustments). While the determinants of Anchors were defined as the degree of;

- a judgement of one's capability to use computer (Compeau & Higgins, 1995b) - Computer Self-Efficacy
- which an individual believes that an organisational and technical infrastructure exists to support use of the system (Venkatesh *et al.*, 2003) - Perception of External Control
- an individual's apprehension, or even fear, when she/he is faced with the possibility of using computers (Venkatesh, 2000) - Computer Anxiety
- cognitive spontaneity in microcomputer interactions (J. Webster & Martocchio, 1992) - Computer Playfulness

the determinants of Adjustments were identified as;

- The extent to which "the activity of using a specific system is perceived to be enjoyable in its own right, aside from any performance consequences resulting from system use" (Venkatesh, 2000) - Perceived Enjoyment
- A "comparison of systems based on the actual level (rather than perceptions) of effort required to complete specific tasks" (Venkatesh, 2000) - Objective Usability.

Another attempt to "upgrade" TAM was proposed by Venkatesh and Davis (2000) with the name "TAM2" and additional variables compared to the original model (Figure 3.12).

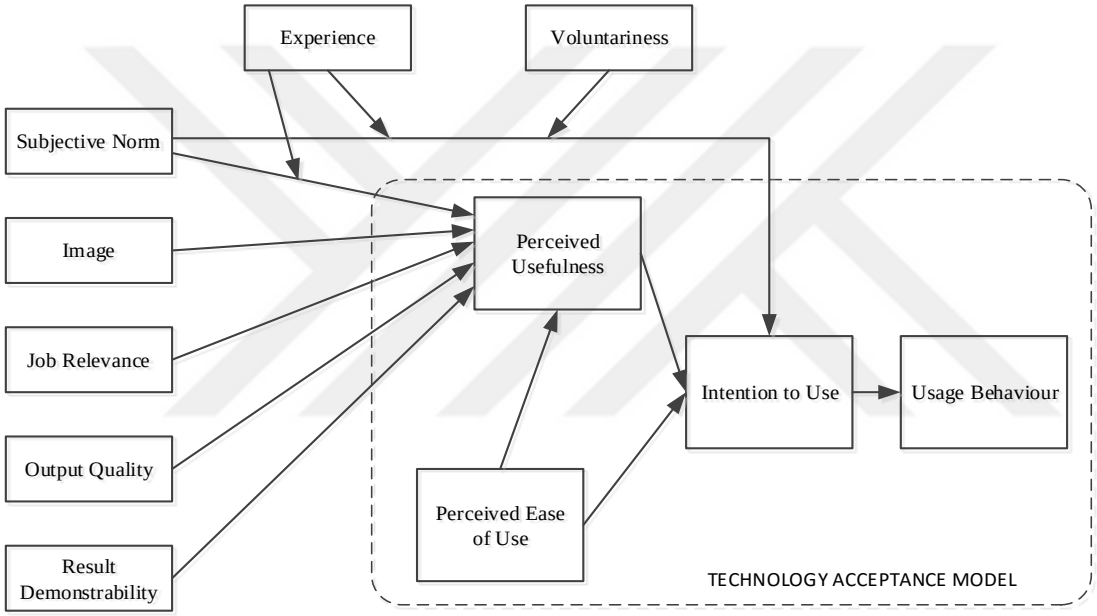


Figure 3.12 : TAM2 (Venkatesh & Davis, 2000).

In TAM2, Venkatesh and Davis (2000) claimed that subjective norm and image would have a positive effect on perceived usefulness through the process of internalisation and identification. They also asserted that, as the users get more experienced with the new technology over time, the effect of subjective norm on both, perceived usefulness and behavioural intention will become weaker (Venkatesh & Bala, 2008). The theory emphasises that individuals "form perceived usefulness judgment in part by cognitively comparing what a system is capable of doing with what they need to get done in their job" (Venkatesh & Davis, 2000) (Table 3.1).

Table 3.1 : Determinants of perceived usefulness (Venkatesh & Bala, 2008).

Perceived Ease of Use	The degree to which a person believed that using an IT will be free of effort (F. D. Davis *et al.*, 1989)
Subjective Norm	The degree to which an individual perceives that most people who are important to him think her should or should not use the system (Fishbein & Ajzen, 1975; Venkatesh & Davis, 2000)
Image	The degree to which an individual perceived that use of an innovation will enhance his or her status in his or her social system (Moore & Benbasat, 1991)
Job Relevance	The degree to which and individual believes that the target system is applicable to his or her job (Venkatesh & Davis, 2000)
Output Quality	The degree to which an individual believes that the system performs his or her job tasks well (Venkatesh & Davis, 2000)
Result Demonstrability	The degree to which an individual believes that the system performs his or her job tasks well (Moore & Benbasat, 1991)

TAM2 argues that, individuals form a perception about usefulness of a new technology regarding the mental assessment of the match between important work goals and the results of performing job tasks using the new technology. In this respect, job relevance, output quality, result demonstrability and also perceived ease of use will be the factors that affecting this mental assessment (Venkatesh & Bala, 2008).

Venkatesh and Bala (2008) suggested three new relationships that were not empirically tested within the previous studies presented by Venkatesh (2000) and Venkatesh and Davis (2000), and presented a new model, TAM3 (Figure 3.13). The model presents experience as the moderator of the relationships between; (1) perceived ease of use and perceived usefulness, (2) computer anxiety and perceived ease of use and (3) perceived ease of use and behavioural intention.

As a result of these evolvement efforts to embrace the relevant factors affecting individuals' perceptions, TAM has been subject to hundreds of studies from all around the World which caused the efforts to reach a cumulative sample size that is over 36.000 people and a large number of factors affecting technology acceptance (Yousafzai *et al.*, 2007).

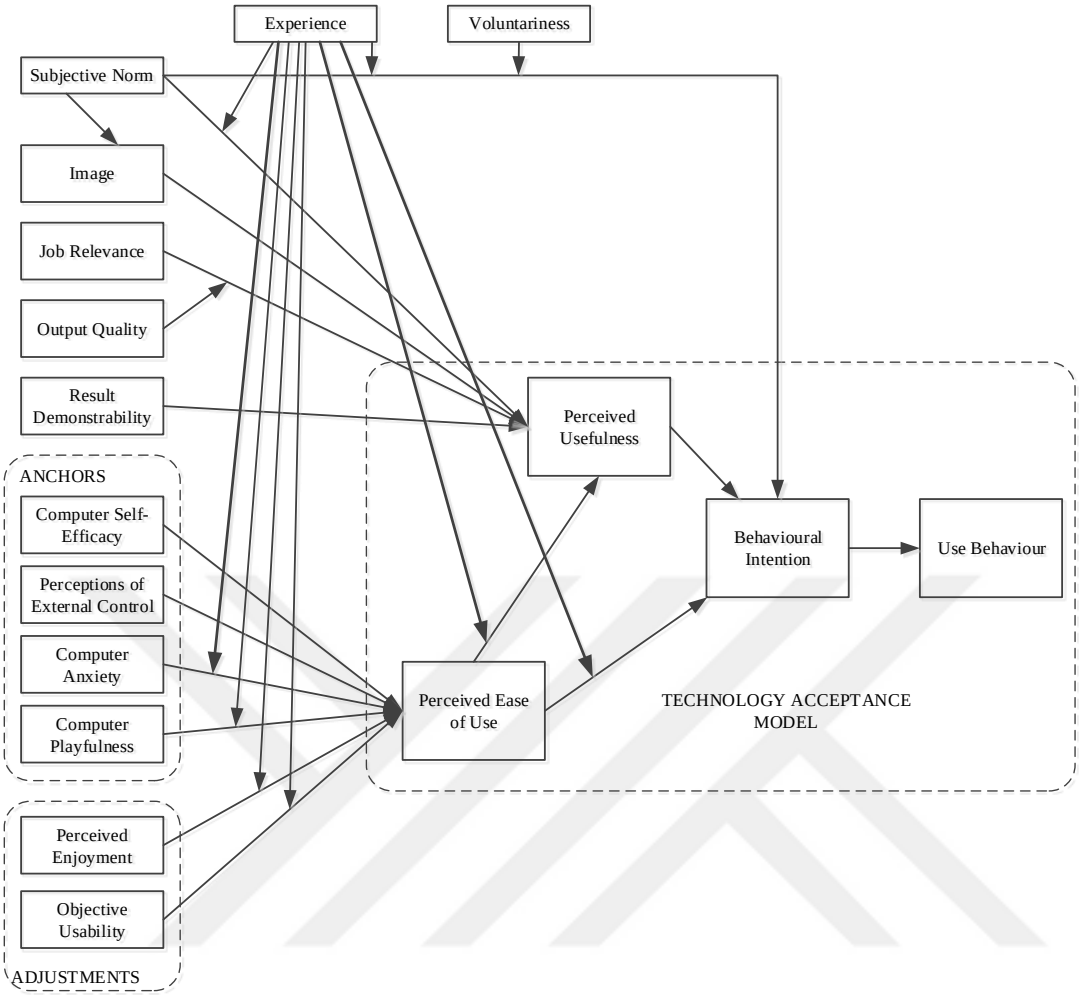


Figure 3.13 : TAM3 model (Venkatesh & Bala, 2008).

TAM has also been subject to various criticism. One of the common critiques has been the lack of actionable guidance to practitioners; which means that the model presents the determinants affecting technology acceptance but does not present a way to assure them (Lee *et al.*, 2003).

In this respect, Chuttur (2009) argued that the critiques for TAM can be examined in three categories;

The methodology used for testing the system: claiming that the model is not reliable since the data used is self-reported instead of real actual use data (Yousafzai et al., 2007); not generalisable since the data was collected form a controlled environment (Lee et al., 2003); and do not reflect reality, since TAM had been tested mostly on voluntary systems (Lee et al., 2003; Yousafzai et al., 2007).

*The variable, and relationships that exists within the TAM model:*claiming that there are gaps in the model, since TAM does not cover some of the external factors that affect system usage (Burton-Jones & Hubona, 2006).

The core theoretical foundation underlying the TAM model: claiming that The theoretical relationships that constitutes TAM are poor (Bagozzi, 2007).

3.3.6 Unified theory of acceptance and use technology

Novelties in Technology Acceptance models usually derived from the need to overcome previous models' limitations and provide a better prediction and understanding about individuals' acceptance behaviour. As one of these efforts, Venkatesh *et al.* (2003) presented a comprehensive synthesis of the constructs from the eight Technology Acceptance Models which are; theory of reasoned action (TRA), technology acceptance model (TAM), motivational model (MTM), theory of planned behaviour (TPB), a combined theory of planned behaviour / technology acceptance model (C-TPB-TAM), model of PC utilisation (MPCU), innovation diffusion theory (IDT), and social cognitive theory (SCT) (Figure 3.14).

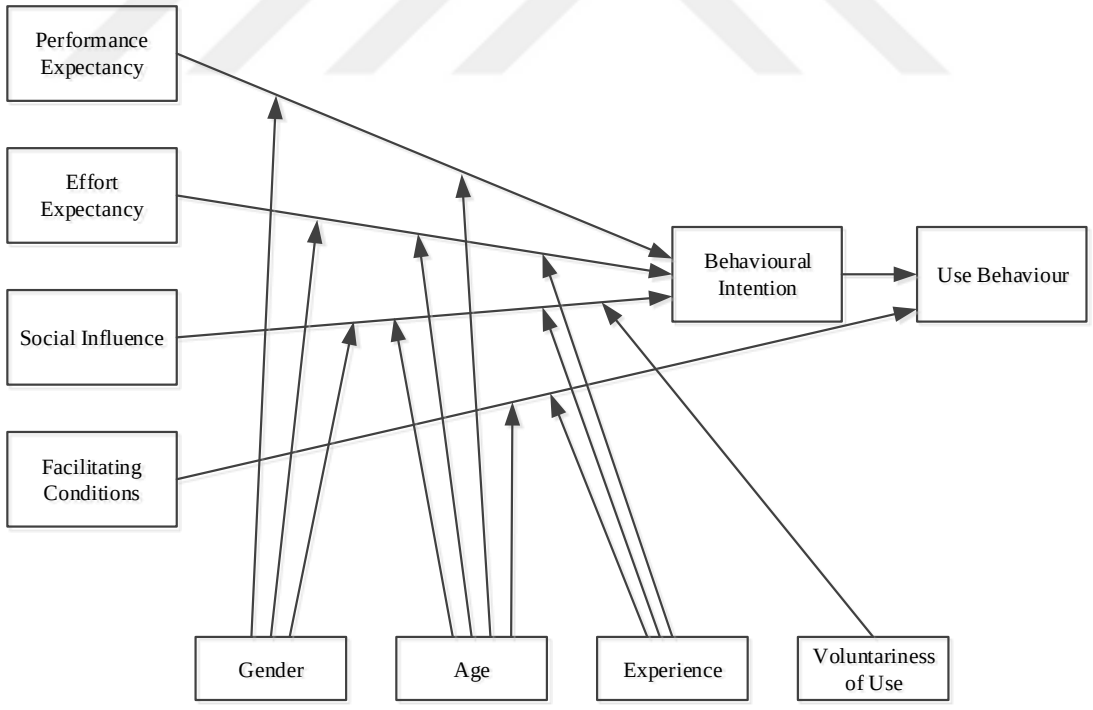


Figure 3.14 : UTAUT (Venkatesh *et al.*, 2003).

The research was carried out as longitudinal field studies in which the measurements were carried at in three different time points; (1) post training, (2) one month after implementation and (3) three months after implementation (Dwivedi *et al.*,

2011).Even though seven constructs appeared to be significant at the end of distilment process, Venkatesh *et al.* (2003) theorised that three of these constructs (attitude towards using technology, self-efficacy and anxiety) are not to be the direct determinants of user intention and left them out of the model. In this respect the Unified Theory of Acceptance and Use Technology (UTAUT), asserts that the variance in intention to use new technology can be explained by measuring the effect of Performance Expectancy, Effort Expectancy, Social Influence and Facilitating Conditions together with the moderating effects of Gender, Age, Experience and Voluntariness to Use (Venkatesh *et al.*, 2003). These constructs can be seen in Table 3.2.

Table 3.2 : Constructs of UTAUT (Venkatesh *et al.*, 2003).

Constructs	Definition	Sub Constructs
Performance Expectancy	"the degree to which an individual believes that using the system will help him or her to attain gains in job performance"	Perceived Usefulness
		Extrinsic Motivation
		Job-Fit
		Relative Advantage
		Outcome Expectations
Effort Expectancy	"the degree of eased associated with the use of the system"	Perceived Ease of Use
		Complexity
		Ease of Use
Social Influence	"the degree to which an individual perceives that important others believe he or she should use the new system"	Subjective Norm
		Social Factors
		Image
Facilitating Conditions	"the degree to which an individual believes that an organisational and technical infrastructure exists to support use of the system"	Perceived Behavioural Control
		Facilitating Conditions
		Compatibility

UTAUT has been applied to both organisational and non-organisational settings and has been subject to various types of extensions / integrations (Chang *et al.*, 2007; Gupta *et al.*, 2008; Sun *et al.*, 2009). Venkatesh *et al.* (2012) presented UTAUT2 (Figure 3.15) as a modification of UTAUT for the consumer technology acceptance and use context.

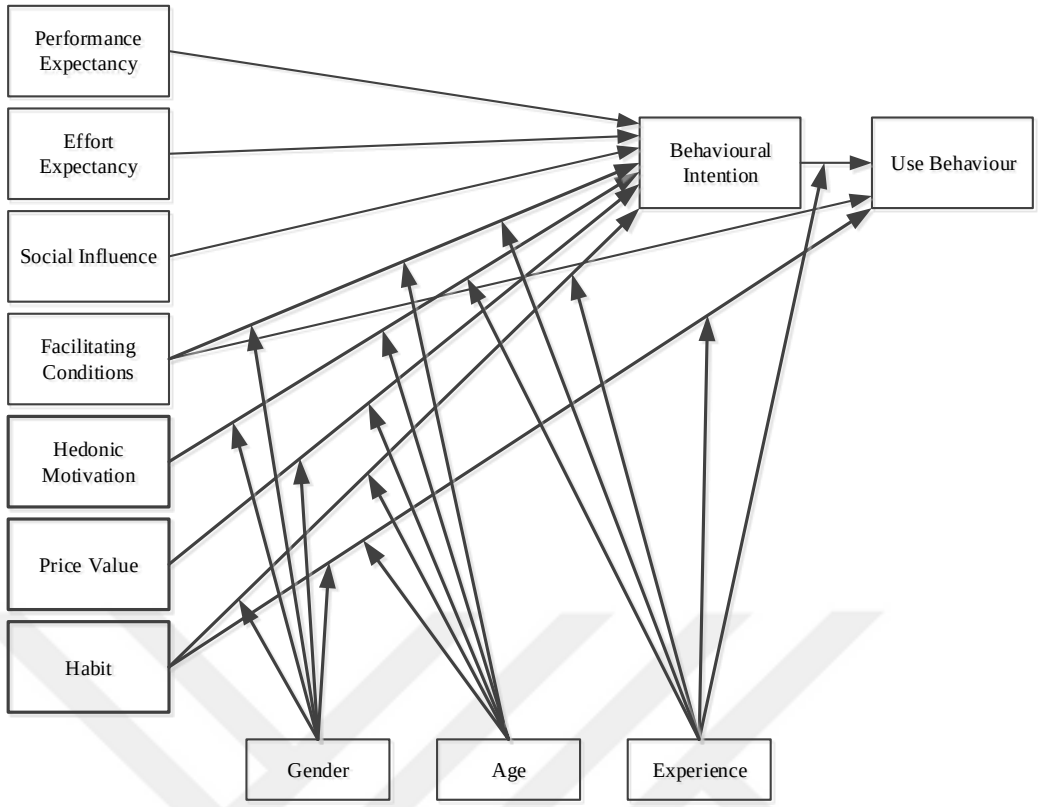


Figure 3.15 : UTAUT2 (Venkatesh *et al.*, 2012).

UTAUT2 identified three key constructs (hedonic motivation, price value and habit) from prior research embracing both general and consumer adoption and use of technologies (Table 3.3). The model reshaped some of the existing relationships in the original UTAUT and introduced new relationships. The results of the study confirmed the important roles of new constructs for describing the intentions in consumer acceptance and use of technology (Venkatesh *et al.*, 2012).

Table 3.3 : New constructs in UTAUT2 (Venkatesh *et al.*, 2012).

Constructs		Definition
Hedonic Motivation	:	The fun or pleasure derived from using technology
Price Value	:	Consumers' cognitive trade-off between the perceived benefits of the applications and the monetary cost for using them.
Habit	:	The extent to which people tend to perform behaviours automatically because of learning

3.4 Drivers of Technology Diffusion Process

Once the organisation (top management) gives the decision of implementation, the new technology is introduced to the members of the staff. At this point the impact of

new technology on the organisation changes according to the characteristics of the; technology, individual, organisation and the environment that organisation takes place.

3.4.1 Technology

There are several different approaches, definitions and characteristics of technology. These nuances can be gathered under two main factors; the usefulness of new technology, and its ease of use (F. D. Davis *et al.*, 1989).

"Usefulness" of new technology embraces a variety of factors including the benefits, quality, compatibility and reliability. The aim of using a new technology is to achieve a better benefit from it in comparison to the previous one. In other words, the new technology should fit to the business strategy (Beaudry & Pinsonneault, 2005) and provide a relative advantage (Jeyaraj & Sabherwal, 2008; Peansupap & Walker, 2005b) to its users. Technology impact is an important factor that can affect the efficiency of its assessment by staff (Venkatesh & Davis, 2000; Yousafzai *et al.*, 2007). The relative advantage can be in terms of: security (Daim *et al.*, 2008), functionality (Kamal, 2006), risks (Hameed *et al.*, 2012b), cost (Verdegem & De Marez, 2011) and etc.

The maturity, capacity and output of the new technology are all elements that affect users' perception about the quality of the new technology (Legris *et al.*, 2003; Sepasgozar & Bernold, 2013). In addition to these, reliability (Verdegem & De Marez, 2011) and compatibility (Russell & Hoag, 2004), also have a positive impact on the perceptions of users, regarding the 'usefulness' of new technology.

For example, even if a technology possessed a high level of quality and benefits, both for the staff and the organisation, it could still be rejected if it was not easy to use. Ease of use is an important factor that affects the adoption decision. While user friendly systems (Markus, 1983) that are easy to use (Jeyaraj & Sabherwal, 2008; Venkatesh & Bala, 2008) are typically desired by staff, the complexity of the system (Frambach & Schillewaert, 2002; Hameed *et al.*, 2012a) could have a negative impact on their decision of implementation.

3.4.2 Individual

The factors that typically affect the adoption decision of an individual (faced with the use of new technology) can be examined under four main groups; motivation, personality, competence and demographics.

Similarly, the personality of the individual who is faced with the decision of adopting new technology, can play an important role in this decision. For example, an individual who has a low tolerance to change (K. Davis & Songer, 2008) and ambiguity (Patterson, 1999), negative attitude towards technology use (Yousafzai *et al.*, 2007), and low level of risk propensity (Tabak & Barr, 1999) may be more close to rejection of innovation than a person, who is not (Yousafzai *et al.*, 2007) or with high levels of self-confidence (Barron & Harrington, 1981), self-efficacy (Venkatesh & Bala, 2008) or propensity to change (Peansupap & Walker, 2005b).

In addition to personality, the motivation of an individual to use new technology can also affect the adoption decision (Talke & Hultink, 2010). This motivation can either be provided by fear and anxiety or the benefits of the new technology. Notwithstanding, receiving tangible or intangible rewards (Peansupap & Walker, 2005b), satisfaction or the increase in tenure (Jeyaraj & Sabherwal, 2008) through the use of new technology, the enjoyment of exploring new tools, learning from others (Peansupap & Walker, 2005b) or the innovation itself (Talukder, 2012) can provide motivation of benefits for users. However, there are also factors that cause negative impact on individuals' motivation, especially the fear and anxiety these can bring (if not appropriately managed). At this juncture, it must be noted that new technology can also effect change in the actual process of organisations. This can include changes in the roles of the staff (Jeyaraj & Sabherwal, 2008), fear of job rotation (Hameed *et al.*, 2012a) and security (Yousafzai *et al.*, 2007), power concerns (Attygalle *et al.*, 2010), anxiety about the technology use (Venkatesh & Bala, 2008).

Another important variable to note is, individual's perceptions and attitude towards change can also differ according to their level of competence in the field. This is in addition to the experiences of technology use (Beaudry & Pinsonneault, 2005; Hameed *et al.*, 2012a) and openness to new experiences (Patterson, 1999), users' education (K. Davis & Songer, 2008), skill level (Yousafzai *et al.*, 2007) and

capability to learn ICT (Peansupap & Walker, 2005b) as these have been shown to have a positive impact on individuals' acceptance to implement new technology.

Finally, factors like, age (Venkatesh *et al.*, 2003) and gender (Ahuja & Thatcher, 2005) of the users can impinge on the diffusion process, the consequences of which should be taken into consideration by the organisation, especially in the development of diffusion strategies.

3.4.3 Organisation

The technology diffusion process, includes an organisation's ability to: reach out to international markets (Del Aguila-Obra & Padilla-Melendez, 2006), and embrace market analysis and monitoring (Verhaeghe & Kfir, 2002) as these are important abilities that affect the awareness of the organisation. Similarly, organisational innovativeness and the level of IT capability (Kamal, 2006), can also influence the diffusion process.

Other major contributors include organisation culture, as this also embrace individual culture (O'Reilly *et al.*, 1991). Organisations should have a climate that facilitates innovation (Becan *et al.*, 2012), where it believes in the importance of information sharing (Hameed *et al.*, 2012a), and supports shared ICT experience (Peansupap & Walker, 2005b). Organisation should also have clearly defined policies (Yousafzai *et al.*, 2007). Given this, management should be positive in sharing their power with the other staff, preempt risks and conflicts (Jeyaraj & Sabherwal, 2008), underpin the importance of participation in decision making (Ke & Wei, 2008), and provide rewards and recognition (Shane, 1993) for the effective use of new technology. Along with these elements that positively supports innovation diffusion, feel of pressure to be effective in using ICT (Peansupap & Walker, 2005b), individualism (Dinev *et al.*, 2009), uncertainty avoidance (Jeyaraj & Sabherwal, 2008), and high degree of power distance (Srite & Karahanna, 2006) are the factors that have negative impact on the diffusion process.

In addition, CEO characteristics (Hameed *et al.*, 2012a), top management's attitude towards change (Laumer, 2011), level of IT knowledge (Del Aguila-Obra & Padilla-Melendez, 2006), risk perception (Jeyaraj & Sabherwal, 2008) and management style (Kamal, 2006) can all have an impact on the success of the technology diffusion process. This extends to include support for the employees (Russell & Hoag, 2004).

However, this support should not be limited to top management it should include middle managers (Jeyaraj & Sabherwal, 2008), and colleagues/coworkers to share their information on using ICT knowledge (Peansupap & Walker, 2005b). Organisation should also provide internal technical support (Del Aguila-Obra & Padilla-Melendez, 2006) and external technical support (Kamal, 2006), when needed.

In order to facilitate the implementation of new technology; top management should be able to develop a clear business strategy and an IT strategy aligned to it, embracing strategic motives for ICT adoption (Bocquet & Brossard, 2007; Spencer *et al.*, 2012). Management levels should be able to lead the staff during the diffusion process (Ozorhon *et al.*, 2013), encourage them in learning and IT training, including decision making (Allahyari & Ramazani, 2012; Markus, 1983). They could also engage incentives (Daim *et al.*, 2008) to simulate motivation (Yousafzai *et al.*, 2007). At this point the existence of innovation champions is needed to lead this process (Damanpour, 1991). In addition the encouragement of staff for IT training, the organisation should develop training plans (Venkatesh & Bala, 2008) for both managerial and user levels (Jeyaraj & Sabherwal, 2008) and provide the participation of employees in these trainings (Legris *et al.*, 2003).

The use of novel technologies requires the availability of infrastructure (Jeyaraj & Sabherwal, 2008) in terms of people process and technology. The organisation should have the required level of maturity in IS and IT infrastructure to support new technology and should be ready invest on the areas that need improvement (Hameed *et al.*, 2012a; Jeyaraj & Sabherwal, 2008; Kamal, 2006). The processes should be reengineered to fit the demands of technology and process integration, both backward and forward, should be provided (Becan *et al.*, 2012; Daim *et al.*, 2008; Jeyaraj & Sabherwal, 2008; Magni & Pennarola, 2008). Along with the technology and processes, IT ready employees and supervisors with the IT expertise and prior experience is needed (Del Aguila-Obra & Padilla-Melendez, 2006; Legris *et al.*, 2003; Pan & Jang, 2008). The implementation of new technology will demand changes on the organisational resources. The staff can show resistance to these demands either because they are satisfied with the existing system (Hameed *et al.*, 2012a) or the change in the distribution of power that these demands will bring (Shane, 1993).

Since the implementation of new technology has impact on the whole organisation, a high level of collaboration of the employees is needed. In this regard, top management should be able to develop inter-organisational trust between employees. They should feel safe on openly discusses about ICT problems and trust to their supervisors when making mistakes (Kamal, 2006; Peansupap & Walker, 2005b). High level of communication, both vertical and horizontal, is needed to facilitate this (Hivner *et al.*, 2003; Shane, 1993; Tolba & Mourad, 2011). Along with the internal communication, the organisation should be able to develop efficient communication links with the external parties as well (Del Aguila-Obra & Padilla-Melendez, 2006).

Organisational structure and the hierarchical levels have a significant impact on decision system of the organisations (Fredrickson, 1986) and so the diffusion process (Jeyaraj & Sabherwal, 2008; Yousafzai *et al.*, 2007). In addition to these, firm size is another determinant that is affective on the implementation process (Naranjo-Gil, 2009).

3.4.4 Environment

The organisational environment can act as one of the four main determinants in the technology diffusion process. Impact can include industry characteristics, market dynamics, government policies etc.

Market forces tend to compel companies to react to demand in order to achieve and/or maintain their competitive advantage (Zhu *et al.*, 2006). This includes governmental regulations (Hameed *et al.*, 2012a) and pressure (Hall & Khan, 2003) as there are considered as determinants that change and shape the dynamics of the market (and organisations operating in it). At this point, the number of competitors (Hameed *et al.*, 2012a) and their use of new technology (Mitropoulos & Tatum, 2000) are considered elements that should be taken into consideration on the adoption decision. In this regard, the awareness of market conditions, dynamism, uncertainty and the possible business opportunities that may arise with the implementation of new technology are also important variables for reflection (Jeyaraj & Sabherwal, 2008; Kamal, 2006; Mitropoulos & Tatum, 2000; Naranjo-Gil, 2009).

Finally, it should be acknowledged that the characteristics of the industry viz fragmentation (Egan, 1998, 2002; Latham, 1994) are also important determinants in the acceptance and understanding of new technologies (Hall & Khan, 2003; Sheffer

& Levitt, 2010); as is the readiness of the partner companies (Hameed *et al.*, 2012a), and organisational readiness (Goulding, Lou 2013).

3.5 Summary of the Chapter

This chapter provided an overview for the technology diffusion process. It presented the nature of diffusion process and emphasised that technology diffusion in organisations is a process that should not be taken into consideration as a descrete, one time event. The nature of its repetitiveness and the efficiency needs that arise as a result of this was highlighted. Technology adoption is fundamentally an individual decisions. The dynamics that affect individuals' decision to adopt technologies were investigated through the main theories of technology acceptance. The chapter concluded with a detailed discussion of the factors and dynamics that affect technology diffusion process.

Based on the arguments that were presented in this chapter, the next chapter presents an approach for improving the efficiency of technology diffusion process.

4. AGILE DIFFUSION

4.1 Introduction

Ability to deal with unpredictable, dynamic and constantly changing environments successfully has been a crucial need for the organisations in the industry. In order to provide this, various solutions have been proposed both in industry and academia. This chapter introduces Agility as one of these solutions and provide a detailed background about the concept. Subsequently, the capabilities of agile technology diffusion were presented which are provided by a approaching innovation diffusion factors from an agility lens.

4.2 Agility

The origins of the word “agile” go back to Latin word; agilis. It is either used to define the ability “to move quickly and easily” or “having a quick resourceful and adaptable character” (Merriam-Webster, 2014) . The first use of agility, in business context, goes back to the early 1990s, to a research report in which a group of researchers from Iaccoca Institute of Lehigh University proposed an approach to regain USA’s predominance in manufacturing industry. In their report, which was published as “The 21st Century Manufacturing Enterprise Strategy”, they asserted that the manufacturing paradigm should be given a new nature with the implementation of agility principles (Nagel, 1992). After the presentation of “agility” as a new capability for organisations, the term has been subject to numerous studies and has been defined by various researchers (Table 4.1).

Table 4.1 : Definitions of Agility.

(Goldman *et al.*, 1995)	Agility is the ability to thrive in a competitive environment of continuous and unanticipated change and to respond quickly to rapidly changing, fragmenting global markets that are served by networked competitors with routine access to a worldwide production system and are driven by demand for high-quality, high-performance, low-cost, customer-configured products and services.
(Yusuf *et al.*, 1999a)	Successful exploration of competitive bases (speed, flexibility, innovation, proactivity, quality and profitability) through the integration of reconfigurable resources and best practices in a knowledge-rich environment to provide customer-driven products and services in a fast-changing market environment.
(Z. Zhang & Sharifi, 2000)	Agility is primarily concerned with the ability of enterprises to cope with unexpected changes, to survive unprecedented threats from the business environment, and to take advantage of changes as opportunities.
(Dove, 2001)	The ability of an organisation to thrive in a continuously changing, unpredictable business environment.
(Hooper *et al.*, 2001)	The ability of an enterprise to develop and exploit its inter- and intra-organisational capabilities.
(Ramasesh *et al.*, 2001)	Agility is the successful exploration of competitive bases (Speed, flexibility, innovation, pro-activity, quality, and profitability) through the integration of reconfigurable resources, and best practices, in a knowledge rich environment to provide customer-driven products and services in a fast-changing market environment.
(Conboy & Fitzgerald, 2004)	Agility is the continual readiness of an entity to rapidly or inherently, proactively or reactively, embrace change, through high quality, simplistic, economical components and relationships with its environment.
(Sambamurthy *et al.*, 2003)	The ability to detect opportunities for innovation and seize those competitive market opportunities by assembling requisite assets, knowledge, and relationships with speed and surprise.

Table 4.1 (continued) : Definitions of Agility.

(James, 2005)	Ability to respond to change, uncertainty and unpredictability in the business environment, whatever its source—customers, competitors, new technologies suppliers, or government regulation.
(Holsapple & Li, 2008)	Agility is the result of integrating alertness to changes (recognising opportunities/challenges) – both internal and environmental – with a capability to use resources in responding (proactive/reactive) to such changes, all in a timely, flexible, affordable, relevant manner.

Even though the concept has been described in different ways, all definitions agree that; agility is the ability that enables an organisation to "respond" quickly and effectively to the "change" that is unanticipated and continuous, in order to "thrive" in a competitive environment.

After the introduction of agility as a solution for competitiveness for manufacturing, researchers' focus moved to understanding the ways of achieving agility. In this respect, various frameworks were developed (Goldman *et al.*, 1995; Gunasekaran, 1999; M. Jackson & Johansson, 2003; Sharifi & Zhang, 1999; Yusuf *et al.*, 1999b). For example, Goldman *et al.* (1995) argued that, (1) enriching the customer, (2) cooperating to enhance competitiveness, (3) organising to master changes and (4) leveraging the impact of people and information are the strategic dimensions of agility. Since the people skills, knowledge and experience are accepted as the main differentiators between the companies, the framework includes the importance of a detailed training strategy that is aligned with business strategy.

Gunasekaran (1999) proposed a framework for the design of agile manufacturing system. In his framework he stressed the importance of four key dimensions (Figure 4.1); (1) the importance of long term decisions in order to achieve and maintain the competitiveness of the organisation by reconfiguring and managing the resources of the organisation (strategy); (2) key technologies to achieve agility based on strategies (technology); (3) an information system that will facilitate the need to manage and control information flow (system); and (4) management and motivation of the workforce to support flexibility and responsiveness.

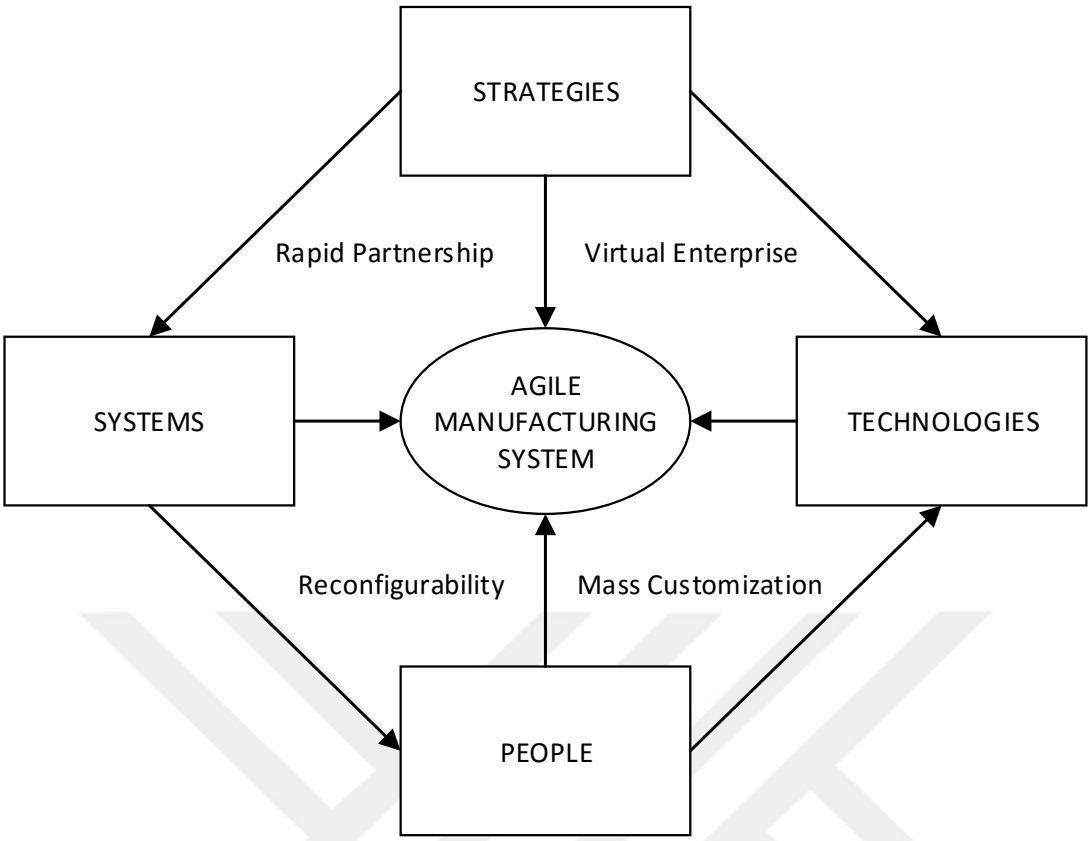


Figure 4.1 : Development of an agile manufacturing system (Gunasekaran, 1999).

M. Jackson and Johansson (2003) asserted that agility is a necessity for every organisation that are aiming to maintain the competitiveness in the market, characterised by uncertainty and change. They identified the dimensions of agility as; (1) product-related change capabilities, (2) change competency within operations, (3) internal and external co-operation, and (4) people, knowledge and creativity.

Yusuf *et al.* (1999b) labelled; speed, flexibility, innovation, proactivity, quality and profitability as the competitive foundations of agility. They identified a list of attributes and practices that an agile organisation should possess (Table 4.2).

In order to clarify the dynamics of manufacturing agility, Sharifi and Zhang (1999) proposed a conceptual model, which was upgraded and presented as a more comprehensive framework (Sharifi *et al.*, 2001) later (Figure 4.2). In their framework, four key aspects were discussed; agility drivers, strategic abilities, agility providers and the capabilities necessary to become agile.

Table 4.2 : Attributes and practices of agile organisation (Yusuf *et al.*, 1999b).

Decision Domain	Related attributes
Integration	Concurrent execution of activities Enterprise integration Information accessible to employees
Competence	Multi-venturing capabilities Developed business practice difficult to copy
Team building	Empowered individuals working in teams Cross functional teams Team across company borders Decentralized decision making
Technology	Technology awareness Leadership in the use of current technology Skill and knowledge enhancing technologies
Quality	Quality over product life Products with substantial value addition First time right design Short development cycle time
Change	Continuous improvement Culture of change
Partnership	Strategic relationship with customers Close relationship with suppliers
Market	New product introduction Customer driven innovations Customer satisfaction Response to market changes
Education	Learning organization Multi-skilled and flexible people Workforce skill upgrade Continuous training and development
Welfare	Employee satisfaction

The model argues that, in order to make an appropriate response to changes taking place in the business environment an organisation should have; “the ability to identify changes and respond fast to them, reactively and proactively, and recover from them” (responsiveness); “the extensive set of abilities that provide productivity, efficiency, ad effectiveness of activities towards the aims and goals of the company” (competency); “the ability to process different products and achieve different

objectives with the same facilities" (flexibility) and; "the ability to carry out tasks and operations in the shortest possible time" (quickness) (Sharifi & Zhang, 1999) .

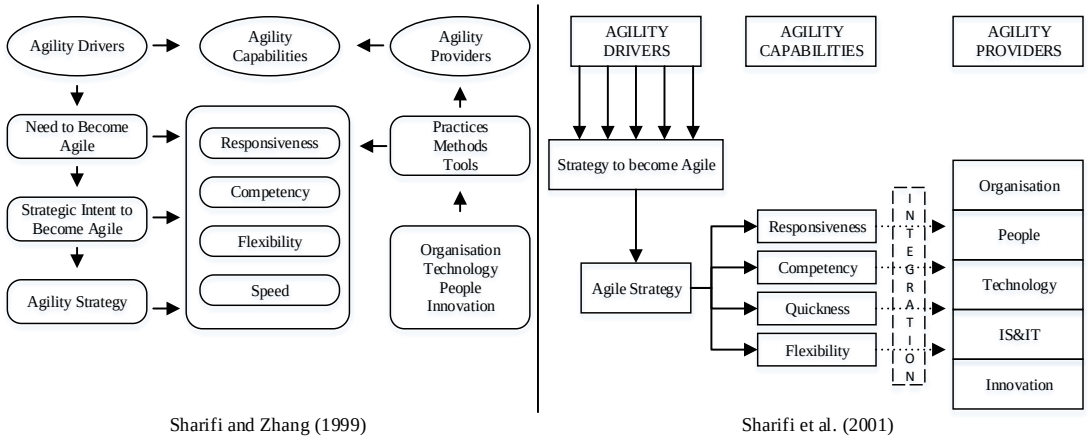


Figure 4.2 : Conceptual model for agile manufacturing.

The next section provides a new perspective of technology diffusion process using an agility lens, which is based on the work of (Sharifi & Zhang, 1999).

4.3 Agility in Technology Diffusion

Agility is recognised as one of the most important dynamic resources and capabilities of an organisation to achieve competitive advantage in the dynamic markets that feature risks and uncertainties (Helfat *et al.*, 2009; Sambamurthy *et al.*, 2003; Sherehiy *et al.*, 2007). Even though "agility" is a capability that mainly focuses on the business processes, the positive impact of IT on business, drives organisations to develop their abilities in showing quick reactions to technological changes, which is named as "technology agility" by Dunlop-Hinkler *et al.* (2011). This impact on business increases in direct proportion to the diffusion level of the ICT in an organisation (Hall & Khan, 2003). The blend of these two approaches leads organisations to the fact that; they should not only develop their skills to diffuse novel technologies, but also be capable of doing it agilely, in order to survive in the market which has an increasing dynamism and competitiveness. In other words, organisations should be responsive to emergent technologies, be flexible in terms of their resources, and competent to manage the process (Figure 4.3).

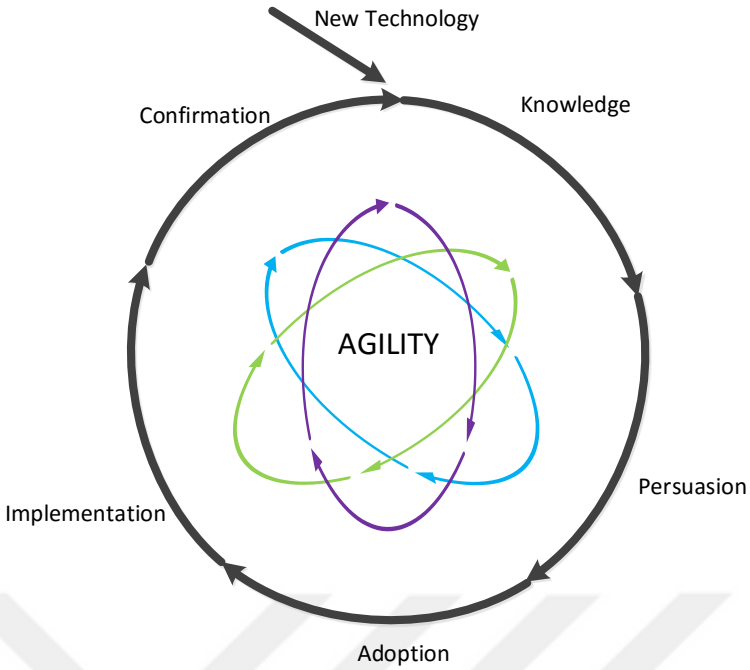


Figure 4.3 : Agility in Technology Diffusion.

4.3.1 Responsiveness

The literature provides different definitions for 'responsiveness' due to sector differences. While Holweg (2005) defines responsiveness as the "ability of the manufacturing system or organisation to respond to customers' requests in the market place", Catalan and Kotzab (2003) argues that responsiveness is the "ability to respond and adopt time-effectively based on the ability to read and understand actual market signs". A more competitive based definition by Barclay *et al.* (1996) claims that responsiveness is "the ability to reach purposefully and within an appropriate timescale, to significant events, opportunities or threats (especially from the external environment) to bring about or maintain competitive advantage".

However, in this research, the definition of Sharifi and Zhang (1999) which they provided in their conceptual framework of Agile Manufacturing, is accepted as the most suitable approach to be used. Sharifi and Zhang (1999) define responsiveness as "the ability to identify changes and respond quickly to them, reactively or proactively, and to recover from them". Given this, from the technology diffusion agility perspective, the changes that the organisation should identify and respond can be defined as the emerging technologies and trends in the market. This definition provides three core capabilities for being responsive; sense, perceive and anticipate

changes and risks in the environment (Malik, 2013), showing immediate reaction to change and its demands (Holweg, 2005) and recovery from change (Stuart, 1996).

Organisations tend to monitor the market conditions and dynamics in order to understand the reasons and develop a strategy for the "unexpected", which is called "active scanning" (Day, 1994). In order to sense, perceive and anticipate changes and risks in the environment, construction organisations should be aware of the emerging technologies, trends and changes in the industry. This is the initial step for an organisation to develop a strategy, but not enough. The organisation should also be aware of itself, its capabilities, or in other words; the level of its resources (Kritchanchai & MacCarthy, 1999).

When the organisation knows and recognise the changes, their meanings and impacts should be interpreted. This necessitates the awareness of links and interdependencies of the organisation, both internal and external (Bernardes & Hanna, 2009). Only after being aware of these internal and external links and dependencies, the organisation could be able to carry out an assessment to predict the potential risks and consequences that will arise as a result of new technology's impact on the organisational resources (Volkoff *et al.*, 2007).

After sensing and being aware of the changing environment, the organisation should be capable of showing immediate reaction to change and its demands. Kritchanchai and MacCarthy (1999) asserts that speeding up the flow of information, improved decision making and a strategic vision that will lead the direction provides this reaction in organisations. In this regard the sub capabilities that will grant the immediate reaction to change and its demands can be determined as; strategic vision and outcome expectancy, information and knowledge management and devolved and responsive decision making.

The immediate reaction to change and its demands means going out of the standard processes of the organisation and this brings the need for recovery, which can be named as recovery from change. Merriam-Webster dictionary defines recovery as " the act or process of returning to a normal state after a period of difficulty". In this regard, organisational recovery can be described as the process in which the organisation recuperates its efficiency and improves it to the standard that it used to have after a period of difficulty (Allen & Toder, 2004; Rumelt, 1995). Given these,

the recovery from change in this research is identified as the organisational recovery from the negative impact of change that new technology implementation obligates. Organisation's ability to recovery from change necessitates the existence of three capabilities which can also be accepted as three consecutive steps. As the initial step the organisation should be capable to assess the recovery needs of the resources that came up due to impact of sudden or planned change. As the next step the organisation should be capable of developing a recovery plan that embraces the priority areas and steps to be followed. As the last step of the recovery process, the organisation should be capable to implement the recovery plan and reorganise the resources according to the required state (Allen & Toder, 2004; Stuart, 1996).

4.3.2 Flexibility

The Oxford dictionary defines flexibility as "the quality of bending easily without breaking" and "the ability to be easily modified". Both of the definitions emphasise that flexibility is an ability to change state according to the desired state, without "breaking". In business context there are different approaches to define flexibility (eg., Ni, 2007; Volberda & Rutges, 1999). While Kozica and Kaiser (2012) define flexibility as "an ability of an organisation, to cope with the dynamics and uncertainty of their environments by the quick changes in their resources bases and organisational routines" Holweg (2005) claims that it is a "generic ability to adapt to internal and/or external influences". Given these, flexibility capability in technology diffusion agility is defined as the organisations ability to adjust its resources according to the change needs of the new technology to be implemented. This approach, points out the need of flexibility in; human resources, IT infrastructure and the processes of the organisation.

Wright and Snell (1998) define HR flexibility as "the extent to which the firm's human resources possess skills and behavioural repertoires that can give a firm options for pursuing strategic alternatives in the firm's competitive environment, as well as the extent to which the necessary HR management practices can be identified, developed, and implemented quickly to maximise the flexibility inherent in those human resources". Based on this definition, this research adopts the approach of Roca-Puig *et al.* (2008) which identifies the three components of HR flexibility as; ability to work on different tasks and under diverse circumstances and

that the costs and time needed to mobilise employees into new duties or jobs are low (functional flexibility), ability to assimilate new skills and abilities, easily and quickly (skill malleability) and ability to adapt responses to new circumstances based on improvisation and not on fixed patterns of action (behaviour flexibility) (Bhattacharya *et al.*, 2005; van den Berg & van der Velde, 2005). In this regard the sub capabilities of HR flexibility in this research were determined as; the ability to switch different positions and responsibilities, quickly learn new procedures and solve specific problems, and change work habits as a response to changes in demands.

In order to understand the IT Infrastructure Flexibility, the meaning of infrastructure must be defined. Duncan (1995) argues that infrastructure is defined in the literature in two levels; (1) the basic technology components of which it is comprised and (2) resource planning and management factors that may affect the design and capabilities of infrastructure. He emphasises that the literature defines IT infrastructure as "a set of shared, tangible, IT resources that provide a foundation to enable present and future business applications" and Flexibility as "the ability of a resource to be used for more than one end product". Terry Anthony Byrd and Turner (2000) provided a more detailed definition of IT infrastructure in which they defined it as "the shared IT resources consisting of a technical physical base of hardware, software, communications technologies, data, and core applications and a human component of skills, expertise, competencies, commitments, values, norms, and knowledge that combine to create IT services that are typically unique to an organisation. These IT services provide a foundation for communications interchange across the entire organisation and for the development and implementation of present and future business applications." In this regard they defined IT Infrastructure Flexibility as "the ability to easily and readily diffuse or support" a wide variety of information systems, technologies and services (Terry Anthony Byrd & Turner, 2000; Masrek & Jusoff, 2009). Later, Terry A Byrd (2001) broadened the definition by adding the aim of this "diffusion and support" as "to distribute any type of information (data, text, voice, image, video) to anywhere inside of an organisation and beyond, and to support the design, development and implementation of a heterogeneity of business applications."

IT Infrastructure flexibility is characterised by: the ability of technology components to connect to each other inside and outside of the organisation (connectivity); the ability of information to flow seamlessly throughout the organisation (compatibility); reusability of software modules and ease of altering applications and processes (modularity) and IS/IT employees' knowledge and skills (IT personnel competency). In this approach connectivity and compatibility are accepted as resources while IT personnel competency and modularity are seen as firm-specific capabilities (Duncan, 1995; J. Zhang *et al.*, 2009). Chanopas *et al.* (2006), based on expert views, extended these components by adding; Scalability, Continuity, Rapidity, Facility and Modernity (Table 4.3).

Table 4.3 : Components and definitions of IT Infrastructure Flexibility (Chanopas *et al.*, 2006).

Components	Definition
IT personnel competency	The degree to which IT personnel possess relevant skills and experience to effectively perform IT activities
Scalability	The degree to which hardware/software can be scaled and upgraded on existing infrastructure
Continuity	The degree to which hardware/software/data/IT personnel can seamlessly serve the users in an organization without disruption
Compatibility	The degree to which hardware/software can share any type of information both inside and outside the organization
Connectivity	The degree to which hardware/software can connect to others both inside and outside the organization
Rapidity	The degree to which hardware/software can deliver information whenever it is needed
Modularity	The degree to which hardware/software/data can be separated and recombined to support new system development
Facility	The degree to which hardware/software can be used with ease
Modernity	The degree to which hardware/software are based on well-known products and technological trends

In the light of these definitions, in order to possess the IT flexibility capability, an organisation should possess the ability to;

- Develop an IT infrastructure design that can work efficiently despite the changes in the number of users, workloads and transactions ,
- Develop an IT infrastructure which uses well known modern hardware/ software and can be used by ease,
- Develop an IT infrastructure that will enable advanced communication by the electronic linkages among all departments, branches and external parties that it possesses.

Schonenberg *et al.* (2008) define process flexibility as "the ability to deal with both foreseen and unforeseen changes, by varying or adapting those parts of the business process that are affected by them, whilst retaining the essential format of those parts that are not impacted by the variations". Another approach to by Saidani and Nurcan (2006) argues that process flexibility is "the capacity of making a compromise between, first, satisfying, rapidly and easily, the business requirements in terms of adaptability when organisational, functional and/or operational changes occur; and, second, keeping effectiveness". In this research, process flexibility capability can be seen as the ability to vary or adapt the process in order to address the change demands of new technology implementation, to keep and improve effectiveness.

In this regard, in order to provide process flexibility capability, organisations should be able to: provide a range of different solutions, pre-designed or just-in-time designed, within optimum time and cost difference, and achieve similar results within the alternative solutions, as a response to change (Koste & Malhotra, 1999).

4.3.3 Competence

Besides being responsive and flexible, the organisation should also be competent to manage the process, which Sharifi and Zhang (1999) defined as having the "extensive set of abilities to provide a basis for productivity, efficiency, and effectiveness of a company's activities". In this research competence can be defined as the organisation's ability to manage the diffusion process in order to diffuse and use new technologies easily and efficiently. In this regard, the organisation should be capable of developing organisational strategies, leading and managing this change process (Ozorhon *et al.*, 2013; Spencer *et al.*, 2012).

As it was discussed in detail in the previous chapter, technology diffusion is a complex process that is affected by various factors from different levels. The acceptance of new technology or the adoption decision is individual processes in which the motivational dynamics are highly efficient. In order to lead this process efficiently, the managerial levels should be capable of motivating staff to implement new technology (Gupta *et al.*, 2008). Development of a culture that supports new technology implementation (Allahyari & Ramazani, 2012) is important both for facilitating the employees' acceptance to use new technology and to overcome the managerial level's resistance to change. Along with the innovative culture, top management also should foster the collaboration between the staff. This collaboration needs the development of Trust between employees and management levels (Kamal, 2006). Along with trust, development of communication abilities (Hivner *et al.*, 2003), which is required for the efficient management of change processes, is also needed for an efficient collaboration. The management of diffusion, necessitates a powerful knowledge of reengineering the processes (Magni & Pennarola, 2008) that are forced to change in order to give a successful response to demands of new technology related change. Along with this, the organisation should be able to provide internal technical support to the staff or should assess the need for hiring consultants to have external support, in order to provide efficiency in the implementation of new technology and the changes in the actual processes of the organisation (Legris *et al.*, 2003).

Business strategy encompasses the actions or activities that are designed and carried out to accomplish specified objectives, which are clearly defined, articulated and serve as the basis steps that lead the organisation towards its aims (Thompson & Martin, 2005). In this regard, the organisation should be capable of developing or revising its business strategy according to the changes and emerging trends in the industry, in order to achieve competitive advantage. In this research three main capabilities were determined as to define an efficient strategy for new technology diffusion and use. These capabilities are given below;

- Ability to develop and implement an IT/IS Strategy that is covering the diffusion plan of new technology and aligned with Business Strategy (Albeladi *et al.*, 2014),

- Ability to develop and implement an HR Strategy that is focussed on both, employing IT and Innovation ready staff and developing strategies to improve the performance of staff in new technology implementation (Gholamzadeh & Jalali, 2013),
- Ability to develop and implement a Training Strategy that is focused on not only improving staff's skill, knowledge and attitude towards new technology, but also increasing top management's knowledge about the new technology and its possible impacts on business (Jeyaraj & Sabherwal, 2008).

4.4 Summary of the Chapter

This chapter provided a detailed discussion on agile technology diffusion. The agility concept, was presented, including details of agile technology diffusion approach, and an examination of the technology diffusion factors (through an agility lens). Chapter presented three core capabilities: responsiveness, flexibility and competence.

5. RESEARCH METHODOLOGY

5.1 Introduction

This chapter discusses the methodology of the research starting from philosophical positioning and approach adopted to achieve the aim and objectives of this research. The chapter discusses the steps of the research with supportive justification.

5.2 Definition of Research

Understanding the meaning of "research" can be accepted as the first step of the research methodology process. The word "research" comes from French, the word *recerche,* derived from + *cerchier* 'to search' with an expressing intensive force *re-* at the front, meaning "again, anew and over again" (Oxford Dictionary, 2014) . Therefore, "re-search" can been defined as an investigation, a process of steps that is used to collect and analyse information with the aim of increasing our understanding, establish facts and reach new conclusions to contribute to knowledge (Creswell, 2012; ESCR, 2010). Creswell (2012) claims that a research, in general level, should; (i) pose a question, (ii) collect data to answer the question and (iii) present an answer to the question.

These definitions, point out the essentiality of existence of certain characteristics to name an investigation process as "research". Kumar (1999) claims that a research should be set up in a way that minimises the effects of the other factors that may influence the variables (controlled); with an investigation procedure that follows a certain logical sequence (systematic); by a researcher with a critical scrutiny approach (critical); who is scrupulous in ensuring that the procedures followed are relevant, appropriate and justified (rigour); that has a conclusion based on correct findings that can be verified by the researcher or others (valid and verifiable) and concluded on the basis upon hard evidence gathered from information which comes from the real life experience or observations (empirical).

Gadamer (2006) argues that "the path of all knowledge leads through a question". Therefore the research questions can be accepted as the starting point of the path for the research process (Mats Alvesson, 2013) and the facilitators that help the researcher to define research problems (Booth *et al.*, 2008). Within the path of solving the research problem, how the aim will be met are specified by the research objectives. In this regard, along with being researchable and precise, a research question and so the linked research problem, should lead the researcher to a research that is appropriately designed and structured to fulfil the aim of contribution to knowledge (ESCR, 2010; Mats Alvesson, 2013). The aim of providing "contribution to knowledge", necessitates the cognisance of the philosophy of research, which embodies the ontological and epistemological underpinnings as the first step. This initial step will be discussed in the next section.

5.3 The Philosophical Foundations and the Research Approach

Thomas Kuhn (1970) was the first one to use the term research paradigm which he defined as "universally recognized scientific achievements that, for a time, provide model problems and solutions for a community of practitioners". Guba and Lincoln (1994) defined paradigm as a set of beliefs that represent "a worldview that defines, for its holder, the nature of the world, the individuals placed in it and the possible relationships to that world and its parts". Weaver and Olson (2006) argued that these set of beliefs and practices "regulate inquiry within a discipline by providing lenses, frames and processes through which investigation is accomplished" and provide "mechanisms to bridge a discipline's requirements for knowledge and its systems for producing that knowledge".

Kuhn (1970) claimed that a scientific approach that is guided by a paradigm would be "incommensurable" with another scientific approach that is developed under a different paradigm. In other words, the philosophical foundations influences the research methods used to investigate the problem and collect, analyse and interpret data (Cohen *et al.*, 2007; Dainty, 2008).

The paradigms of research philosophy have been subject to various studies and has been classified under diverse categorisations. These approaches show changes according to the answers of ontological and epistemological questions (Krauss, 2005; Saunders *et al.*, 2009)

The ontological question focuses on the object of investigation; what we study. It questions if the world of social phenomena is real and independent from the individuals' interpretations or subjective and socially constructed by the individuals (Corbetta, 2003; Runeson & Skitmore, 2008). The term ontology derives from the ancient Greek word *onto* meaning "being" and *logos* meaning "science" or "study of"; so it can be defined as the science or study of being (Lawson, 2004).There are two main approaches in ontology. Objectivism (or foundationalism or realism) illustrates that the world is composed of discrete objects which possess properties that are independent form the observer/researcher and as a result of this all the observers that possess the necessary skills and good judgement should see and understand the world in the same way. On the other hand, constructivism (or anti-foundationalism/relativism) claim that reality is not discovered but socially constructed by the individuals. In other words this approach asserts that objective reality does not exists (Marsh & Furlong, 2010).

The origins of the term epistemology came from the Ancient Greek words *episteme*, which means "knowledge or understanding". In this respect, epistemology means the study of knowledge or theory of knowledge. Its aim is to understand the nature of knowledge and how it is acquired. In other words, epistemology tries to find the answer for the question "what is knowledge?" and "how we can acquire knowledge?" (Knight & Turnbull, 2008; Steup, 2014). Corbetta (2003) asserts that epistemology regards the knowability of social reality and it focuses the relationship between the observer and the reality to be observed. The answer of epistemological question depends on the answer of ontological question. The two main approaches in epistemology, which are emphasised as the two polars of the paradigm "continuum" by G. D. Holt and Goulding (2014), are positivism and interpretivism (Table 5.1).

Based on the objectivist ontology, positivists claim that the world exists independently of knowledge. They seek rigorous exact measures and test hypothesis by carefully analysing the numbers from these measures. The aim of positivism is to discover and confirm the causal laws that form the social world and predict general patterns of human behaviour. Interpretivism asserts that the world is socially constructed and accept the constructivist approach as the ontological basis. Interpretivists argue that, there is no objective truth, social phenomena cannot be understood independently of our interpretations and these interpretations affect the

outcomes. The intention of the interpretivist tradition is to develop an understanding of social life, discover and explain the meaning of social behaviour (Marsh & Furlong, 2010; Neuman, 2008).

Table 5.1 : Differences of two research paradigms (Neuman, 2008).

	POSITIVISM	INTERPRETIVISM
Reasons for Research	to discover natural laws so people can predict and control events	to understand and describe meaningful social action
Nature of Social Reality	stable pre-existing patterns or order that can be discovered	fluid definitions of a situation created by human interaction
Human Nature	self-interested and rational individuals who are shaped by external forces	social beings who created meaning and who constantly make sense of their worlds
Human Agency	powerful external social pressures shape people's actions; free will is largely illusion	people have significant volition; they develop meanings and have freedom to make choices
Role of Common Sense	Clearly distinct from and less valid than science	powerful everyday theories used by ordinary people
Theory looks like	a logical, deductive system of interconnected definitions axioms and laws	a description of how a group's meaning system is generated and sustained
An explanation that is true	is logically connected to laws and based on facts	resonates or feels right to those who are being studied
Good evidence	is based on precise observations that others can repeat	is embedded in the context of fluid social interactions
Relevance of knowledge	an instrumental orientation is used; knowledge enablers people to master and control events	a practical orientation is used; knowledge helps us embrace/share empathetically others' life, worlds and experiences
Place for values	science is value free, and values have no place except when choosing a topic	values are an integral part of social life: no group's values are wrong, only different

In social research, ontological and epistemological underpinnings provide a worldview, which guides the researcher to selection of the research approach that will be used to fulfil the research aim and objectives (Gajendran *et al.*, 2011).This research aims to understand the factors and mechanisms that affect people's behaviour towards using and implementing new technologies in construction organisations. In this regard, based on the assumption that social reality is constructed by individuals, an interpretivist approach was adopted in order to deliver the research objectives.

5.4 Theory and Research

According to Kerlinger and Lee (2000), a theory is "a set of interrelated constructs (variables), definitions and propositions that presents a systematic view of phenomena by specifying relations among variables, with the purpose of explaining natural phenomena". Blaikie (2009) argues that a theory is "an answer to why question; it is an explanation of a pattern or regularity that has been observed, the cause or reason for which needs to be understood".

The research that will be conducted to deliver research objectives could either test an existing theory (deductive proof) or develop/build one (inductive discovery). While inductive approach aims to construct generalisations, relationships and theories based on the collected data, deductive approach tests if an established theory or generalisation can be applied to specific instances (Gray, 2014; Hyde, 2000). The differences between deductive and inductive approaches to research are given in Table 5.2.

Table 5.2 : Major differences between deductive and inductive approaches to research (Saunders *et al.*, 2009).

Deduction emphasises	Induction emphasises
• scientific principles • moving from theory to data • the need to explain causal relationships between variables • the collection of quantitative data • the application of controls to ensure validity of data • the operationalisation of concepts to ensure clarity of definition • a highly structured approach • researcher independence of what is being researched • the necessity to select samples of sufficient size in order to generalise conclusions	• gaining an understanding of the meanings humans attach to events • a close understanding of the research context • the collection of qualitative data • a more flexible structure to permit changes of research emphasis as the research progresses • a realisation that the researcher is part of the research process • less concern with the need to generalise

Even though deduction and induction approaches seem like they are opposites, it is possible and also advantageous to combine them in the same piece of research (Gray, 2014; Saunders *et al.*, 2009).

As this research, aims to understand the links and interdependencies that constitute the reactions of the organisations towards new technology, an inductive approach was adopted.

5.5 Research Design

Clarification of the ontological and epistemological assumptions of the research and the determination of the research approach are the initial steps of the research process. Subsequently, the general plan to address the research objectives should be developed (Blaikie, 2009). These "plans and the procedures for research that span the decisions from broad assumptions to detailed methods of data collection and analysis" can be named as Research Design (Creswell, 2008).

In this section, general information about the elements that shape the research design will be discussed and the main phases of the research design in this study will be introduced.

5.5.1 Type of research

Along with the philosophy and approach, purpose of the research is an important determinant that shapes the research design. The purpose of a research may be; to describe or provide information about a situation, problem, phenomenon or attitudes towards an issue (descriptive research); to discover or establish the existence of relationship/association/interdependence between two or more aspects of a situation (correlational research); to clarify why and how there is a relationship between two aspects of a situation or phenomenon (explanatory research); or to investigate the possibilities of undertaking a particular problem or research study (exploratory research) (Kumar, 1999).

Another element that is affective on the research is "time". Research designs can be classified into three categories according to the number of contacts of the researcher with the study population. When conducting a research; the researcher can contact with the research sample only once and present an overall picture of the time of the study (cross-sectional); can conduct two observations and measure the difference between them (before and after); or in order to study the pattern of change by time, the researcher can have observations at regular intervals usually over a long period (longitudinal) (Kumar, 1999).

According to the research purpose, the method to be used, should be determined. Creswell (2008) emphasises that the selection of the research method also leads the research to the selection of research strategy which is defined as "types of

qualitative, quantitative, and mixed methods designs or models that provide specific direction for procedures in a research design". Quantitative research is mainly related with positivism and aims to test objective theories by examining the relationship among variables, which can be measured and analysed using statistical procedures. It presents a deductive approach in which the phenomena are reduced to simplest elements for formulating. On the other hand, Qualitative research is based on interpretivism and targets exploring and understanding the meaning that individuals or groups ascribe to a social or human problem. The data analysis and discussion presents an inductive approach that begins with concrete empirical evidence and works toward more abstract concepts and theoretical relationships (R. F. Fellows & Liu, 2009; Neuman, 2008).

Construction management is a research discipline that can be evaluated somewhere between the natural and social sciences and has been under the influence of positivism and quantitative approaches for many years (Fellows & Liu, 2009). However, the importance of "people" issues and the necessity of different research paradigms to understand and describe the environment were highlighted by various researchers (eg., Fellows & Liu, 2000; Seymour &Rooke, 1995), emphasising that the interpretive process had been underestimated in the construction management domain (Dainty, 2008). As it has already been in other sciences (Runeson, 1997), this caused a long argument within the research domain. However Seymour et al. (1998), concluded this debate by revealing the weaknesses of positivism and claiming that embracing theory does not mean one is "anti-scientific" (Holt & Goulding, 2014).

Compared to quantitative, the strength of qualitative data comes from its "focus on naturally occurring ordinary events in natural settings", which provides strong evidence on what "real life" is like (Miles et al., 2013) and "how people cope and thrive in that setting", by using multiple sources of evidence and capturing "the contextual richness of people's everyday lives", through the views and perspectives of people that take place in the study (Yin, 2011).

While quantitative research gives broader trends, broader generalisations with a larger population, qualitative research provides more detailed perspectives about individuals, groups within the setting they engage in the problems. There may be times that neither qualitative or quantitative data may not give a full understanding of the problem or the researcher may want to benefit from both of them to reinforce the

quality of the research (Creswell, 2010). This type is called as mixed methods research and it is an "intellectual and practical synthesis based on qualitative and quantitative research" and "it offers a powerful third paradigm choice" (Johnson *et al.*, 2007). In their detailed analysis, G. D. Holt and Goulding (2014) emphasises that mixed methods is the integration of Qualitative and Quantitative methods that is established to complete each other with the aim of achieving robustness of outcome that could not be provided by the adoption of one method in isolation.

The types of the Mixed Methods Research change according to the weight of the qualitative and quantitative data and approaches in the overall research. Johnson *et al.* (2007) argue that the type of Mixed Methods Research can be named as Qualitative Mixed (Qualitative Dominant), Pure Mixed and Quantitative Mixed (Quantitative Mixed). G. D. Holt and Goulding (2014) proposed the term "Ambiguous Mixed Methods Research" for the ones "whose design does not make such explicit, but which does so in its application" pointing out the domination of one approach despite the use of both of them, concurrently or sequentially.

This research adopted the philosophical assumption that for every individual, social reality is constructed by the subjective meanings of their experiences, which are formed through; interaction with other individuals and historical and cultural norms that operate in their lives (Creswell, 2007). In other words, "there is no single, observable reality. Rather, there are multiple realities, or interpretations of a single event" (Merriam, 2009). In this regard, this research aimed capture individuals' own perceptions and understandings regarding the existence of the social constructs and dynamics in the organisations, through their own words and descriptions. Hence, the qualitative approach is dominant in this research. However, quantitative data was also captured in order to support the rich qualitative data and provide a more complete and "thick" description (McGinn, 2010). The research flow that gives the steps and detail of the research is given in Figure 5.1.

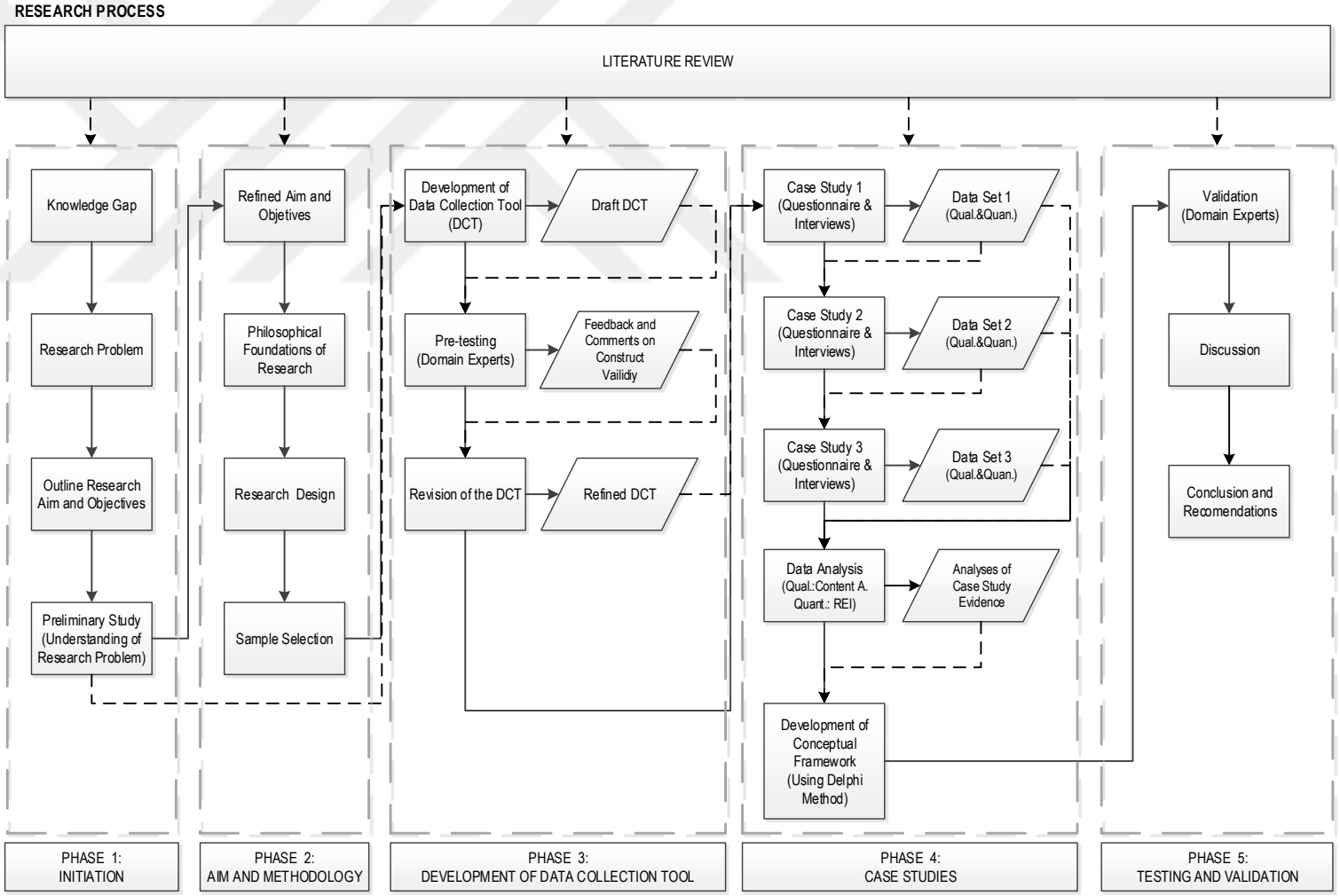


Figure 5.1 : Flow chart of the research process.

5.5.2 Research strategy

Yin (2003) argues that each strategy has peculiar advantages and disadvantages and Saunders *et al.* (2009) emphasises that none of them is "inherently superior or inferior to any other". Even though the choice of strategy is mainly guided by research aim and objectives; the extent of existing knowledge, time and other resource are also serve as important determinants (Saunders *et al.*, 2009).

As previously mentioned, the selection of the research method also leads the researcher to a group of possible research strategies. The most commonly used quantitative strategies can be mentioned as; experimental designs and non-experimental designs (such as surveys). *Experiments,* as experimental designs, test the relationships between identified variables in controlled environments and tend to be used in exploratory and explanatory research (R. F. Fellows & Liu, 2009; Saunders *et al.*, 2009). *Survey* strategy is used to achieve a numeric description of trends, attitudes and opinions of a population by studying a sample that is determined using statistical methods and believed to represent the original population. The intention is to make generalisations from a sample to a population by using questionnaires or structured interviews as the tools for data collection (Cohen *et al.*, 2007; Creswell, 2008).

Qualitative research strategies have been categorised by various researchers in different disciplines (e.g., Denzin & Lincoln, 2005; Yin, 2011). In his research, in which these categorisations were analysed, Creswell (2007) proposed; narrative research, phenomenological research, ethnography, grounded theory and case study research as the five main strategies for qualitative research. The strategy of this research was selected and adopted, based on this categorisation of Creswell (2007).

Narrative research is a strategy that is concerned about analysing and criticising the stories of individuals (L. Webster & Mertova, 2007). Elliott (2005) emphasises the key features of the narratives as; being chronological, meaningful and produced for a specific audience. It provides a synthesis of the stories, enriched by researcher's experience, knowledge and perspective (Creswell, 2008). While narrative research reports the story of individual, *Phenomenological Research* focusses on the description of the lived experiences of several individuals in order to understand what do they have in common as they experience a phenomenon (Creswell, 2007).

Rooted firmly in the inductive approach, the origins of *Ethnography* originate to anthropology. The research is conducted in a cultural group in its natural settings with the aim of describing and interpreting the shared values, behaviours, beliefs, primarily based on the data gathered from observations and interviews (Creswell, 2007)

Although, *Grounded Theory* can be ascribed as the best example of inductive approach with its aim to develop a theory through the data analysis, Saunders *et al.* (2009) highlight that this theory building process embraces a combination of induction and deduction with multiple stages of data collection, refinement and establishing the links and relationships of various types of information (Charmaz, 2006; C. Goulding, 2002).

Case Studies are preferred to have a deeper understanding about "how" and "why". Despite the approaches that see case study as not a methodology but a choice of what is to be studied (Stake, 1995), case study is accepted as a methodology and a comprehensive research strategy (Denzin & Lincoln, 2005) that;

> "..investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident. The case study inquiry copes with the technically distinctive situation in which there will be many more variables of interest than data points, and as one result, relies on multiple sources of evidence, with data needing to converge in a triangulation fashion, and as another result benefits from the prior development of theoretical propositions o guide data collections and analysis" (Yin, 2013).

The definition points out that the researcher explores a bounded system or systems, through an in-depth (detailed) data collection process in which the data is gathered from multiple sources, which gives the researcher the chance to benefit from triangulation (Creswell, 2007; Saunders *et al.*, 2009).

Case Study research has been shown to be a valuable research strategy in the investigation of complex environments such as construction industry, with its ability to capture rich and in-depth information (Sutrisna & Barrett, 2007). As a result of the shift from positivistic (hard) approaches to interpretivistic (softer) ones, that has been witnessed (R. Fellows, 2010), this approach have been used frequently in PhD studies in construction management domain (eg., Erdogan, 2008; Fernando, 2011; O'Laocha, 2012; Ogunbiyi, 2014; Pathirage, 2007). Case Study Research can be used to provide description, generate theory or test theory (Eisenhardt, 1989) and it is a

common strategy that is used for development of a conceptual framework (Figure 5.2) (eg., Alsudiri et al., 2013; Gohil et al., 2011; Peansupap & Walker, 2005).

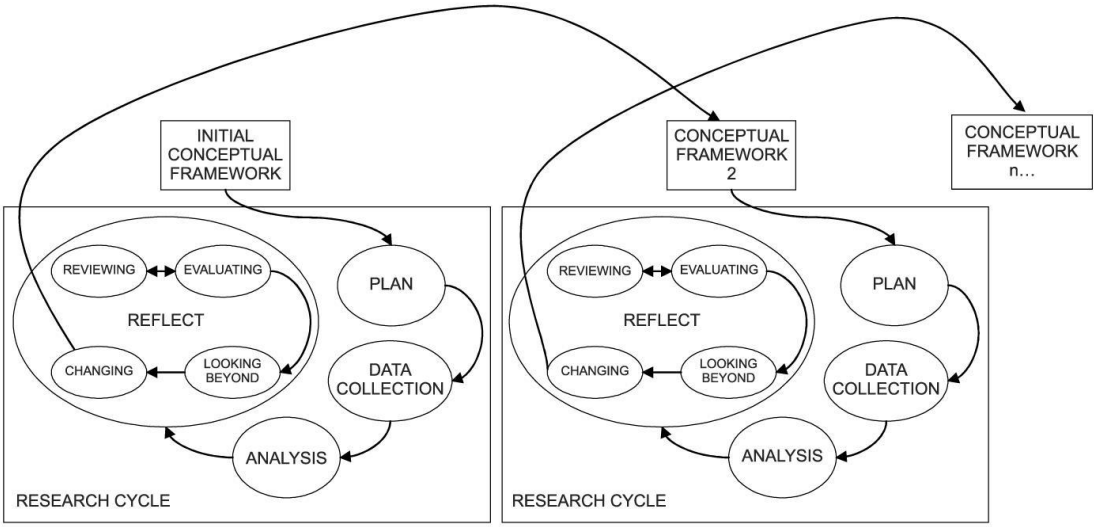


Figure 5.2 : Conceptual Frameworks and Research Cycle (Cepeda & Martin, 2005).

Diffusion of emerging technologies is a process that is affected by intra-personal, inter-personal, organisational and environmental dynamics. Hence, a research that aims to uncover the constructs and understandings that affect this process should be conducted within its real-life context, reinforced by the evidence from different perspectives. Given this, Case Study strategy was chosen in this research, in order to develop an in-depth understanding to deliver the research objectives.

5.5.3 Unit of analysis

Subsequent to the selection of the research strategy, the source for data needed to achieve research aim and deliver research objectives should be determined. In this regard, the initial step of the Case Study is to identify what should be named or accepted as a case for the study (unit of analysis). This identification should be aligned with research aim and objectives, and can be defined as "the subject of study" (Long, 2004) or "the species of observations" (Gerring, 2007) which is to be analysed. The case that is identified and the source of information to be collected (unit of observation) may be different in some research (Boyd, 2008; Long, 2004). Yin (2013) proposes the relationship between the data collection source (unit of observation) and the research design as follows (Figure 5.3)

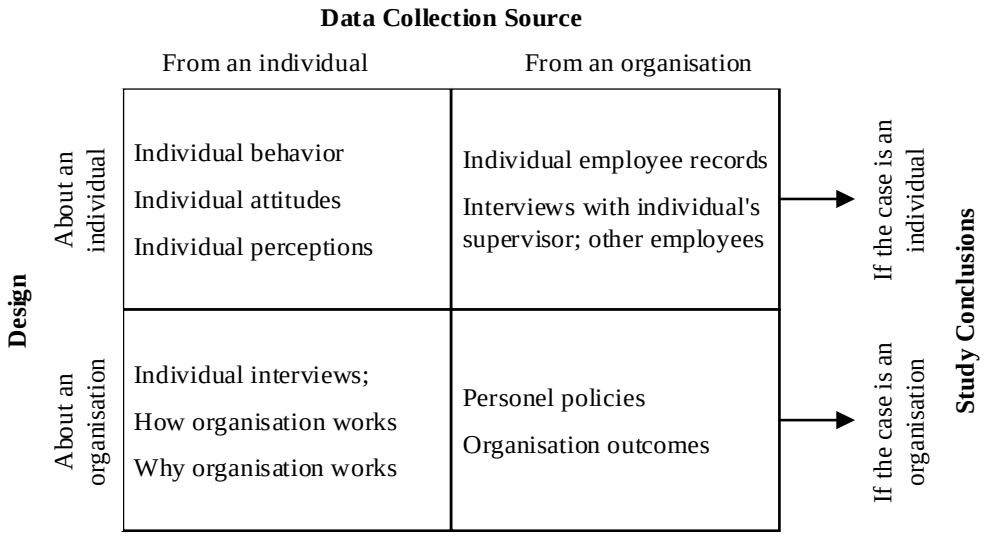


Figure 5.3 : Design versus data collection: different units of analysis.

The focus of this research is to understand the factors that affect agility of technology diffusion in construction organisations. So the unit of analysis or the cases are; construction organisations. In order to understand the links and dependencies that have impact on the agility of the technology diffusion process, individuals were chosen as the data collection sources.

Along with the determination of what the case will be, the boundaries of the case should also be clarified in order to keep the research in a reasonable scope (Stake, 1995; Yin, 2013). The cases of this study are chosen as the Turkish construction companies, which are; internationally competitive, providing contracting services in various types of construction projects (residential, infrastructure, energy, etc.), possessing the technology diffusion experience of an organisation wide used information management tool and possessing upper management personnel who come through the ranks with the corporate culture of the company.

The determination of the case and its boundaries, brings out the question on whether to use single or multiple cases to have a better understanding about the research problem. The major rationales for selecting a single-case design might be to focus on; critical, unusual, common, revelatory or longitudinal cases (Yin, 2013). Even though single case design provides an in-depth and intense analysis of the phenomena, multiple-case design adds confidence to findings with adding strength in precision validity, stability and trustworthiness (Chmiliar, 2010). Another advantage that that multiple case design provides is increased generalisability and the

reassurance that the events and processes that are witnessed in one setting are not completely sui generis (M. B. Miles *et al.*, 2013).

5.5.4 Sampling

Once the data collection source for the research was defined, the next step is to collect the data that is needed to achieve research aim and deliver research objectives. However, if it is not possible to collect and analyse data from every possible case and/or respondent, a sample should be selected (Saunders *et al.*, 2009).

A perfect sample can be defined as a "grand view"; a scaled version of the population, mirroring every characteristic of the whole; a representative from which the characteristics of interest in the population can be estimated from, with a known degree of accuracy (Lohr, 2010). A population can be defined as a group of individuals who have the same characteristics. In this respect, a target population (sampling frame) can be defined as the population that is identified by the researcher as the complete collection of observations that are to be studied. Within this target population, a subset (sample) is selected by the researcher, in order to examine and come up with generalisations about the target population (Creswell, 2012; Lohr, 2010).

Even though there are different classifications for sampling strategy in the literature, the basics of sampling draw a similar profile for all of them. There are two main methods in sampling; probability (random) sampling and non-probability (random) sampling. Probability sampling is accepted as the most rigorous form of sampling in quantitative research as it's been drawn from a wider population randomly. It has different types, in which; each element in the population has the equal and independent chance of selection in the sample (simple random sampling), (ii) the selections are made in a systematic rather than a random fashion (systematic sampling), (iii) the population is divided into homogenous groups to reduce heterogeneity and use simple random sampling (stratified sampling) to guarantee the involvement of specific characteristics in the sample or (iv) if the population is too large for random sampling, it can be divided into groups called clusters (cluster sampling) and the randomly selected clusters can be used to make a generalisation. Non-probability sampling is preferred by researchers when a particular group is targeted. This group can be selected when; (i) they are the nearest available

individuals (convenience sampling), (ii) they represent the significant characteristics of the wider population (quota sampling), (iii) a random sample cannot give in-depth information about the specific purpose of the researcher (purposive sampling), (iv) only the other people in the network can reach these specific group of people and include them into the sample (snowball sampling), or (v) the access is difficult and the researcher may have to rely on the volunteers (volunteer sampling) (Cohen *et al.*, 2007; Creswell, 2012; R. F. Fellows & Liu, 2009; Kumar, 1999).

As the focus of this research was the Turkish construction organisations, a purposive sampling strategy based on defined boundaries (under unit of analysis section) was adopted. However, along with the determined boundaries, the replication strategy is also an important determinant in the selection of cases. In multiple case designs there are different types of replication strategies. In this research, similar cases selected purposively in order to provide a "literal replication", based on the determined criteria, since the aim was to have a more detailed and in-depth understanding of the phenomena (Fletcher & Plakoyiannaki, 2010; Yin, 2013).

Even though, research aim and objectives are important determinants to decide the number of cases, there are no precise rules for determining this number (Fletcher & Plakoyiannaki, 2010). However, Yin (2013) suggests to have 3-4 cases in multiple-case designs that adopt literal replication. Another useful evidence comes from the results of the work of Marshall *et al.* (2013) in which they examined the number of cases used in multiple case research designs in IS domain and revealed that using 2 and 3 cases are the most common choices (43,3%) among others. In this respect, the number of cases was determined as "three" for this research.

Since the target of the research was analysing internationally competitive Turkish construction companies, a shortlist was established from the Top 250 International Contractors list of Engineering News Record (ENR), which made a number of 42 Turkish construction companies, for the year 2014 (ENR, 2014). Since the aim was to analyse the companies that are experienced in the market, the shortlist was reorganised according to the foundation year and the year of getting into act in the international construction market. Top three companies were selected.

Subsequent to the selection of cases, again a purposive sampling strategy was adopted for within-case sampling covering three management levels to provide a

balanced view of employees. This strategy replicated in all three cases. With the intention of improving the richness of data that is captured in each case, both qualitative and quantitative data collected using the same respondents (identical sampling), at the same time which is a method that is frequently used (Collins *et al.*, 2007) in case study research, especially in convergent mixed methods research (Creswell & Clark, 2010; Onwuegbuzie & Collins, 2007). As Harris and Brown (2010) also stressed, the data collected by two methods were not assumed as similar even though they came from the same participants. Instead, they were considered to complement each other (Smith, 2012) to provide the empirical knowledge that was used to construct the conceptual framework.

Bryman (2012) indicates that the sample size in qualitative research is based on the "saturation" level, which can be defined as "the point in data collection when no new or relevant information emerges" with respect to the phenomena that is being examined (Saumure & Given, 2008). In this regard, 10 people selected for each case, which makes a number of 30 participants in total, covering all three levels of management.

After determining the number of interviews for each case, the distribution of respondents for each level were identified, accordingly. While the views of First Line Management (FM) and Middle Management (MM) levels were taken in order to have an in depth understanding about the processes and impacts on the organisation by having 4 respondents for each level, 2 respondents were deemed appropriate for Top Management (TM) level as the expectation from them was to uncover strategic leadership, thought and direction of the company as the ones who give the implementation decision and more things forward with an entrepreneurial perspective .

Unlike the quantitative research, qualitative research, work with small samples. This causes some misunderstandings about the value of qualitative research and so for the case study research. In order to have a better understanding about the sampling strategy of this research, the logic of generalisation should be clarified. Unfortunately, Case study as a research methodology often confused with a specific data collection method and criticised for lack of rigour (Flyvbjerg, 2006; Shah & Corley, 2006). It has often been criticised for not providing a scientific contribution claiming that findings cannot be generalised, since the case or cases are too small in

numbers to be accepted as a sample that represents a population (Firestone, 1993; Flyvbjerg, 2006). However, based on the philosophical assumptions, the aim of the case study research is not to infer results from a sample and apply them to a population (statistical generalisation). Instead, the intention is to expand and generalise theories by the identification of the evidence that supports them (analytic generalisation). In this sense, the generalisations that are provided by case study research are similar to the ones that are delivered from single experiments (M. B. Miles *et al.*, 2013; Polit & Beck, 2010; Yin, 2009).

5.5.5 Collecting case study evidence

Case study evidence can be collected from various sources. The data that is needed to conduct the research can already be available (secondary data) or needed to be collected (primary data) by using the data collection tools that have been designed for this purpose. While the secondary data can be collected by using the document archives such as; earlier research, government archives, personal records, etc., collection of primary data is based on three main tools/methods, namely; observation, interviewing and questionnaire. *Observation* can be defined as a "purposeful, systematic and selective way of watching and listening to an interaction or phenomenon as it takes place" (Kumar, 1999). When conducting and observation, the researcher can focus on understanding "why" (participant observation) or "how often" (structured observation) things happen (Saunders *et al.*, 2009).

In order to explain the role of the researcher in observation, Gill and Johnson (2010) developed a fourfold categorisation in which they claim that the observer can; become a member of the group (complete participant), stay out of the group and only observe without revealing his or her purpose (complete observer), make observations revealing his or her purpose (observer as participant) or participate in the group while the group is aware of the observation (participant as observer) (Figure 5.4).

Besides watching and listening, researchers can talk with people in order to take the answers or the data that are needed to answer the research questions. In these conversations, researchers can use; (i) questionnaires with pre-coded answers (structured interviews), (ii) a list of themes and questions to be covered (semi-structured interviews) or (iii) just conduct the interview without using any predetermined question (unstructured interviews) in order to explore in depth a

general area (Saunders *et al.*, 2009). Seidman (2012) claims that the main purpose of interviewing is not getting answers to questions nor to test hypothesis but to understand the lived experience of other people and the meaning they make of that experience.

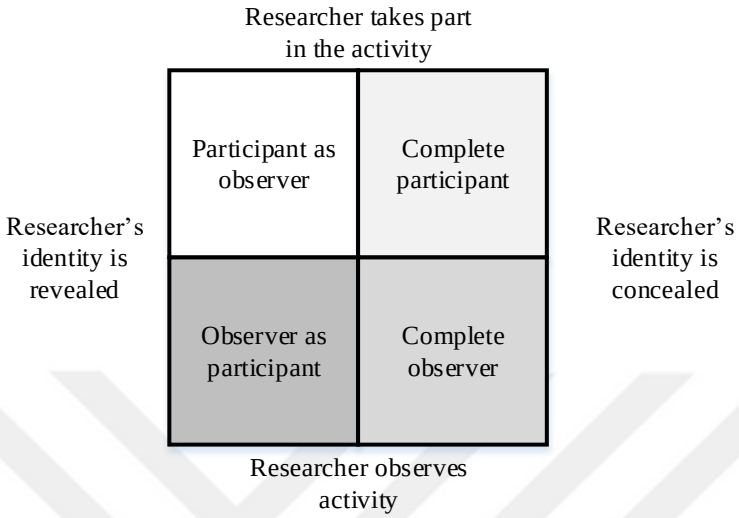


Figure 5.4 : Researcher's position in research (Gill & Johnson, 2010).

Along with the structured-interviews, questionnaires are tools of data collection for survey researchers (Creswell, 2012). A questionnaire can be defined as a list of questions in which the answers are recorded by the respondents (Kumar, 1999). This record can either be done by writing out their answers or selecting from the existing ones (Dörnyei & Taguchi, 2010). The questionnaires can be classified under different types according to how they are administered (Figure 5.5).

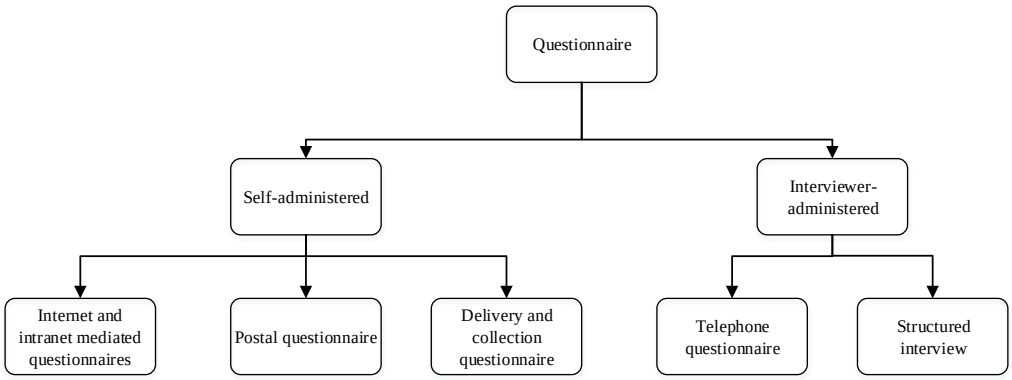


Figure 5.5 : Types of questionnaire (Saunders *et al.*, 2009).

The questionnaires that are completed by the respondents (self-administered) can either be administered through internet (internet-mediated questionnaires) or posted to respondents who post them back after completion (postal or mail questionnaires),

or delivered personally to each respondent by hand (delivery and collection questionnaires).The other option to collect data from respondents is recording them by an interviewer on the basis of each respondent's answers (interviewer-administered). The interviewer can either conduct the questionnaire through telephone (telephone questionnaires) or can meet respondents physically and ask questions (structured interviews) (Saunders *et al.*, 2009).In order to collect the case study evidence, this research adopts two main methods; questionnaire and interviews. With each participant, two methods have been implemented at the same meeting. Each participant filled the questionnaire that is prepared to capture the priorities and existence levels of agile diffusion factors, and subsequently the interviews, as the main source of case study evidence, were carried out to have in-depth information. The evidence that was collected by the aforementioned methods was validated and supported by the documents that were delivered from the cases and the observations of the researcher and used in the conceptual framework development phase of the research. The details of the questionnaire development and the interviews will be explained in detail, in the following sections.

5.5.5.1 Structure of the questionnaire

The questionnaire was designed with the aim of determining the priority areas that an organisation should focus, in order to facilitate agile technology diffusion. The questionnaire used, consists of two main parts. The first part targets to investigate respondents; experience in AEC field, level of management, experience in the level that he is working (Table 5.3).

The questions about the experience level of the respondents (1,3) were asked to understand their ability to assess the environment and the management level that they were working.

Table 5.3 : Organisation of the first part of the questionnaire.

Aim of the question	Question No.
Experience in AEC field	1
Level of management	2
Experience in that management level	3

The second part of the preliminary questionnaire was based on agile technology diffusion parameters that were established through the literature. The factors that affect technology diffusion and adoption were analysed and grouped under core drivers. Afterwards, these core drivers were evaluated through an agility capability lens (Figure 5.6) based on the three main capabilities of Agility.

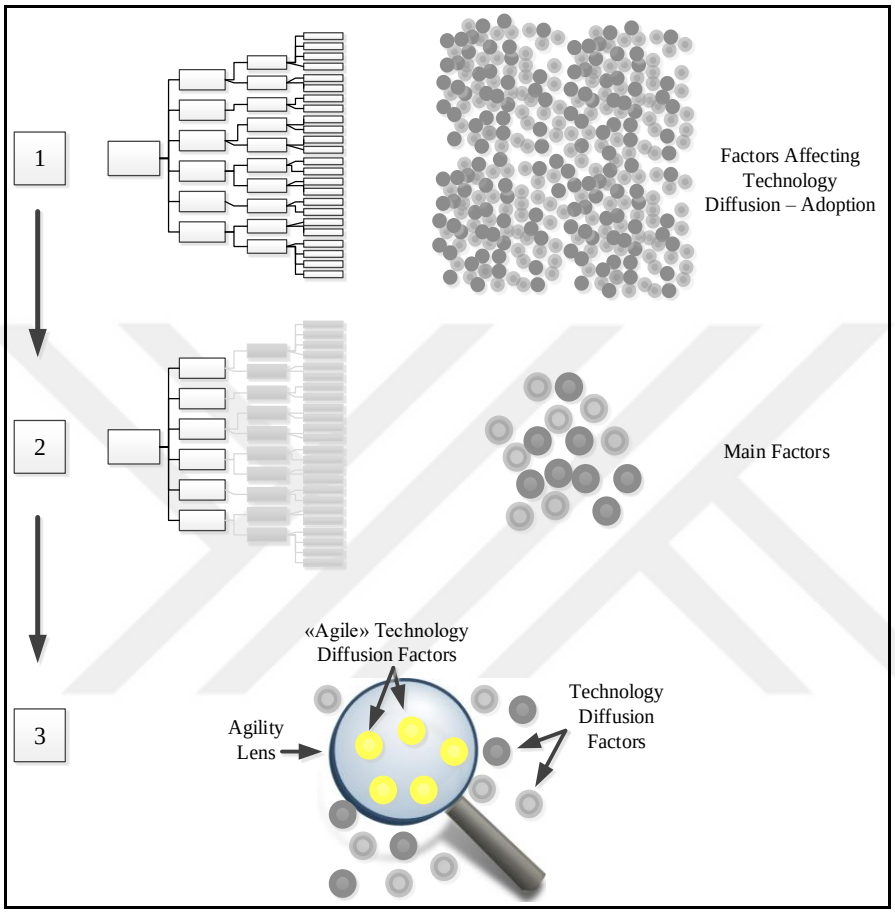


Figure 5.6 : Distilment process of the agile technology diffusion factors.

Respondents were asked to rate the level of existence of the given criteria, based on a Likert scale of 1-5, which is frequently used in construction management research (G. Holt, 2013) and aims to capture the respondents' opinion on a bi-polar continuum from negative (absolutely disagree) to "positive" (absolutely agree).

The theoretical framework that was developed to map the Agile Technology Diffusion (ATD) capabilities was shaped by the development team, in order to provide a balanced, coherent and bias free coverage. The distribution and level of detail in this structure, which also constitutes the foundation of the data collection tool (Table 5.4), was established as the output of the process, which blended the relevant literature with the academic discussions and validates it by domain experts.

Table 5.4 : Organisation of the second part of the questionnaire.

CAPABILITIES	**QUESTION NO.**
R / RESPONSIVENESS	
RA / Sense, perceive and anticipate changes and risks in the environment	
Monitoring and Reporting the changes	
RA1 / Ability to be aware of emerging technologies, trends and changes in the industry	4.1
RA2 / Ability to be aware of level of organisation's resources	4.2
Connectivity Awareness	
RA3 / Ability to be aware of organisation's external connectivity	4.3
RA4 / Ability to be aware of organisation's internal connectivity	4.4
Analyse Risks and Consequences	
RA5 / Ability to analyse the potential risks of change on organisational resources	4.5
RA6 / Ability to analyse the potential consequences of change on organisational resources	4.6
RC / Show immediate reaction to change and its demands	
Strategic Vision and Outcome Expectancy	
RC1 / Ability to define a clear strategic vision for organisation	4.7
RC2 / Ability to direct the organisation in sudden change and crisis	4.8
Information and Knowledge Management	
RC3 / Ability to manage knowledge efficiently	4.9
RC4 / Ability to ensure successful decisions by sharing knowledge efficiently	4.10
Devolved and Responsive Decision Making	
RC5 / Ability to make tough decisions quickly	4.11
RC6 / Authorise staff to make decisions in case of sudden changes	4.12
RR / Recovery from change	
Assessment of Recovery Needs	
RR1 / Ability to assess recovery needs in sudden/unpredicted change	4.13
RR2 / Ability to assess recovery needs in planned change	4.14
Development of Recovery Plan	
RR3 / Ability to develop a recovery plan in sudden change.	4.15
RR4 / Ability to develop a recovery plan for planned change	4.16
Reorganisation	
RR5 / Ability to quickly reorganise the resources in sudden change	4.17
RR6 / Ability to implement the recovery plan	4.18
F / FLEXIBILITY	
FH / Human Resources Flexibility	
Ability to switch different positions-responsibilities	
FH1 / Staff's ability to work in different positions and responsibilities	4.19
FH2 / Staff's enthusiasm to develop skills and abilities	4.20
Quickly learn new procedures and solve specific problems	
FH3 / Ability to learn new procedures quickly	4.21
FH4 / Being eager to share information to learn from other	4.22
Change work habits as a response to changes in demands	
FH5 / Ability to change work habits as a response to changes in the demands	4.23
FH6 / Ability to act efficiently even under uncertain and ambiguous conditions.	4.24
FI / IT Flexibility	
IT infrastructure design can handle changes in number of users, workloads and transactions.	
FI1 / Scalability of IT infrastructure	4.25
FI2 / Modularity of IT infrastructure	4.26

Table 5.4 (continued) : Organisation of the second part of the questionnaire.

CAPABILITIES	**QUESTION NO.**
IT infrastructure which is modern and can be used by ease.	
FI3 / Facility of IT infrastructure	4.27
FI4 / Modernity of IT infrastructure	4.28
IT structure that possesses electronic linkages among departments, branches and external parties.	
FI5 / Connectivity of IT infrastructure	4.29
FI6 / Compatibility of IT infrastructure	4.30
FP / Process Flexibility	
Provide range of possible solutions	
FP1 / Ability to develop a range of possible solutions in a sudden change	4.31
FP2 / Ability to develop range of possible solutions in planned change	4.32
Provide Mobility	
FP3 / Ability to provide solutions within optimum time and cost difference in sudden change.	4.33
FP4 / Ability to provide solutions within optimum time and cost difference in planned change.	4.34
Provide Uniformity	
FP5 / Ability to provide similar results in sudden change.	4.35
FP6 / Ability to provide similar results in planned change	4.36
C / COMPETENCE	
CL / Leadership	
Motivate Staff to implement new technology	
CL1 / Empower staff to take their decisions	4.37
CL2 / Provide incentives for efficient use of new tech.	4.38
Development of Culture that supports new technology implementation	
CL3 / Development of an innovative culture	4.39
CL4 / Development of a collaborative culture	4.40
Development of Trust	
CL5 / Ability to develop trust to enable information sharing	4.41
CL6 / Ability to develop trust to superiors	4.42
CM / Management of Change Process	
Reengineering Processes	
CM1 / Ability to reengineer the processes	4.43
CM2 / Ability to clarify changes in roles and responsibilities	4.44
Provide Services and Support	
CM3 / Ability to provide service and technical support within the company	4.45
CM4 / Ability to provide technical support from outside of the company	4.46
Development of Communication	
CM5 / Ability to develop a powerful internal communication.	4.47
CM6 / Ability to develop a powerful external communication.	4.48
CS / Strategy Development	
CS1 / Ability to develop an IT strategy aligned with business strategy	4.49
CS2 / Ability to develop diffusion program for new technology.	4.50
Development of HR Strategy	
CS3 / Ability to employ IT and innovation ready staff	4.51
CS4 / Ability to develop plans to encourage staff to use new technology	4.52
Development of Training Strategy	
CS5 / Ability to improve staffs' skill, knowledge and attitude towards new tech.	4.53
CS6 / Ability to improve top management's knowledge about new tech.	4.54

5.5.5.2 Interviews

After collecting the respondents' views regarding the ATD capabilities' level of existence in their organisations, semi-structured interviews, that use the same foundation that is used in questionnaire, were conducted. In the interviews the same respondents were asked to explain their reasons that lead them to determine the ratings, especially the negative ones. Each interview took approximately 90 minutes time. All of the interviews were taped and transcribed by the researcher and participants' confirmations were taken for the salient points of content for validation.

5.6 Quality of Research Design

When the data collection method has been determined, an instrument for data collection should be established. At this point it is possible to use; an existing tool, which has been used in previous studies, or develop a new one to capture the data needed for the research. Whether the intention is to collect qualitative or quantitative data, the data collection tool should be able to capture (or measure) what it is developed to capture (validity) and it should work precisely (should be calibrated) through this capture/measurement process (reliability) (Creswell, 2012; R. F. Fellows & Liu, 2009; Kumar, 1999).

Validity in research refers to "the trustworthiness of instruments, data and findings" (Bernard, 2006). It is a requirement for both qualitative and quantitative research. In qualitative data, it might be addressed through "honesty, depth, richness and scope of data archived, the participants approached, the extent of triangulation and the disinterestedness of objectivity of the researcher". The requirements for quantitative data validity can be provided by careful sampling, appropriate instrumentation and analysis of the data. In other words the findings of the research must describe accurately the phenomena being researched (internal validity) and the results could be generalisable to wider population (external validity) (Cohen *et al.*, 2007).

Regarding its importance there are various kinds of validity mentioned in the research methodology literature. Based on the relevant literature, in order to provide the validity of the data collection instrument; the operational indicators of the concept should make sense (face validity), the appropriate content for measuring the concept or construct should be provided (content validity), the instrument should be

able to measure the presence of the construct that is intended to be measured (construct validity) and questions should be able to make accurate measures and predictions (criterion validity) (Bernard, 2006; Cohen *et al.*, 2007; Saunders *et al.*, 2009).

In quantitative research, reliability is the synonym for dependability, consistency and replicability over; time, instruments and groups of respondents. The reliability in quantitative research can be achieved by; providing consistency over time and over similar samples (reliability as stability/ test, re-test); using equivalent forms of a data collection instrument (reliability as equivalence / parallel forms); high level of correlation between two halves of the group of respondents (reliability as internal consistency) (Cohen *et al.*, 2007; Kumar, 1999).

The reliability of the questionnaire that is developed was tested and approved using Cronbach's Alpha coefficient of reliability, which is a very common measure that is used for testing the internal consistency (Cohen *et al.*, 2007; Field, 2009). Cronbach's Alpha values that were calculated using SPSS 22 statistical software are presented in Table 5.5.

Table 5.5 : Cronbach's Alpha Values.

CAPABILITIES	α
Agility	0.931
Responsiveness	0.820
Sense, perceive and anticipate changes and risks in the environment	*0.612*
Show immediate reaction to change and its demands	*0.629*
Recovery from change	*0.768*
Flexibility	0.862
Human Resources Flexibility	*0.643*
IT Flexibility	*0.806*
Process Flexibility	*0.813*
Competence	0.874
Leadership	*0.755*
Management of Change Process	*0.618*
Strategy Development	*0.774*

Cronbach's Alpha value can be calculated using the given formula (Equation 5.1)

$$\propto = \frac{k}{k-1}\left(1 - \frac{\sum S_i^2}{S_T^2}\right) \qquad (5.1)$$

where k is the number of items, S_i^2 is the variance of the ith item and S_T^2 is the variance of the total score formed by summing all the items (Bland & Altman, 1997; Cronbach, 1951). Pallant (2007) claims that for the Cronbach's Alpha values, which are equal or higher than 0.60, the scale can be accepted as reliable.

The criteria to ensure trustworthiness in qualitative research and provisions to provide them have been subject to various studies (eg., Guba, 1981; M. B. Miles et al., 2013; Shenton, 2004). This research adopts the approach in which Yin (2013) argued that; in order to ensure the quality of a case study research; operational measures should accurately reflect the concepts being studied (construct validity); the findings should be congruent with reality (internal validity-credibility); the findings of the study could be applied to other situations (external validity-transferability); and the processes should be explained in enough detail to enable the future users to repeat the same processes and gain the same results (reliability-dependability) (Guba, 1981; M. B. Miles et al., 2013). Along with definitions, researchers (Merriam, 2009; M. B. Miles et al., 2013) also discussed and presented the provisions to meet these requirements.

In order to meet the requirements to ensure quality in case study research, this study adopted the appropriate approaches that fit the research settings, among the tactics that Yin (2013) and (Riege, 2003) proposed in their research. The tactics that were implemented, are presented below;

Construct Validity

- The research used both qualitative and quantitative data. The data, which was collected from the respondents, was supported and confirmed by the documents taken from companies and the observations of the researcher.
- The chain of evidence starting from aim and objectives and ending with the research report was maintained through the process.
- For each company, case study reports were prepared and presented to the key informants.

Internal Validity

- Within case analysis and cross case analysis were conducted in the data analysis phase

- The research questioned if the predefined measures fit the actual implementation (pattern matching) and aimed to build an explanation to the organisational links and dependencies that affect ATD with the proposed conceptual framework.

External Validity

- Replication logic was used in multiple case analyses in which the boundaries of the unit of analysis, sampling strategies, the background of the cases were described in detail in order to provide thick description and so the level of transferability.

Reliability

- A case study protocol was developed and followed all through the research.
- A case study database was established and used all through the data collection and analysis phases.
- The interviews were taped using a digital recorder.

5.7 Analysis of the Case Study Evidence

5.7.1 Quantitative data

In social research, quantitative data analysis is usually conducted for testing the significance of a hypothesis, which can be defined as "a supposition or proposed explanation made on the basis of limited evidence as a starting point for further investigation" (Oxford Dictionary, 2014). However, in this research quantitative data was collected from the identical sample of respondents in each case, with the aim of complementing and supporting the qualitative data, rather than testing the existence of certain variables and/or relationship between them (Blaikie, 2009; R. F. Fellows & Liu, 2009). In this regard, as the first step, the data of each case analysed separately. Subsequently a cross-case analysis was conducted.

In order to determine the rankings of the areas to be focussed, Relative Importance (RI) approach, which have been used frequently in recent studies of construction management domain (e.g., Gündüz *et al.*, 2012; Polat *et al.*, 2012) to analyse response scales (G. Holt, 2013), was used. Emphasising the inefficiency of descriptive statistics, such as mean scores, in comparing the levels of different

categories, RI approach has been acknowledged as an efficient method to be used for ranking variables (Ahmed & Hassan, 2003; Doloi *et al.*, 2012).

Even though they are based on the same logic of ranking relative importance, the method has been used in different names to reflect the application like; Severity Index, Relative Agreement Index and etc. (Ying Chen *et al.*, 2010; Chileshe & Dzisi, 2012; G. Holt, 2013). In this regard, the term "Relative Existence Index" is used in the study to determine the rankings, as the level of existence is questioned by the questionnaire. The following formula (Equation 5.2) is used to determine the index:

$$\text{Relative Existence Index (REI)} = \sum_{i}^{5} \left(\frac{\omega i.fi}{a.n}\right) \qquad (5.2)$$

i = is the point given to each criterion by the respondent,
ωi = is the weight for each point
fi = is the frequency of the point i by all respondents
n = is the total number of responses
a = is the highest weight (which is 5 in this study)

Since the aim of the analysis was to prioritise the weak points that need attention, the results of the analyses were ranked, from negative the positive existence. When two or more factors have the same score, the one with the lowest standard deviation was assigned the highest importance ranking (Chileshe & Dzisi, 2012). In order to calculate the index values for groups, the mean values were used, which was also adopted by Odeh and Battaineh (2002) and Gündüz *et al.* (2012) in their studies.

Once the REI values were calculated, the results were transformed to a five levelled scale of importance. Various studies (eg., Singhaputtangkul *et al.*, 2013; Waris *et al.*, 2014) that had adopted the same approach, used the levels of importance within the ranges that were defined by Ying Chen *et al.* (2010); High (H) ($0.8 \leq SI \leq 1$), High–Medium (H–M) ($0.6 \leq SI < 0.8$), Medium (M) ($0.4 \leq SI < 0.6$), Medium–Low (M–L) ($0.2 \leq SI < 0.4$), and Low (L) ($0 \leq SI < 0.2$). However, the REI values that were calculated in cases were not suitable for an assessment using the scale of Ying Chen *et al.* (2010). In this regard a normalisation procedure (N1) was implemented, in order to determine the ranges for existence levels.

After calculating the REI values for a case, the mean and the standard deviation values were calculated. Taking the mean value as the midpoint, standard deviation

value was used to determine a 5 point scale and identify the range values for importance levels (Figure 5.7). The same process was repeated for all tree cases. The existence level values that were determined, were presented in the within case analysis of each case.

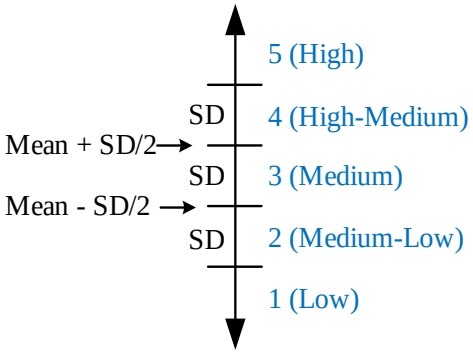


Figure 5.7 : Normalisation 1- determination of the ranges of existence.

In the cross-case analysis phase, another normalisation technique (N2) was used to synthesise the existence levels of three cases into one output. The existence level values (between 1-5) were taken as the responses of each case and a total index values, representing three cases, were calculated using equation 2. Using the same normalisation technique (N1) that is used in within case analysis, the range values for the total index and the related importance levels were determined and used in the development of final framework. Since the priority should be given to the weak areas, the priority or importance levels were identified as the opposite of existence values (Figure 5.8). A visual abstract of the normalisation process is presented in Figure 5.9.

Level of Existence	High	5	Low	Level of Importance
	High-Medium	4	Medium-Low	
	Medium	3	Medium	
	Medium-Low	2	High-Medium	
	Low	1	High	

Figure 5.8 : Conversion of level of existence to level of importance.

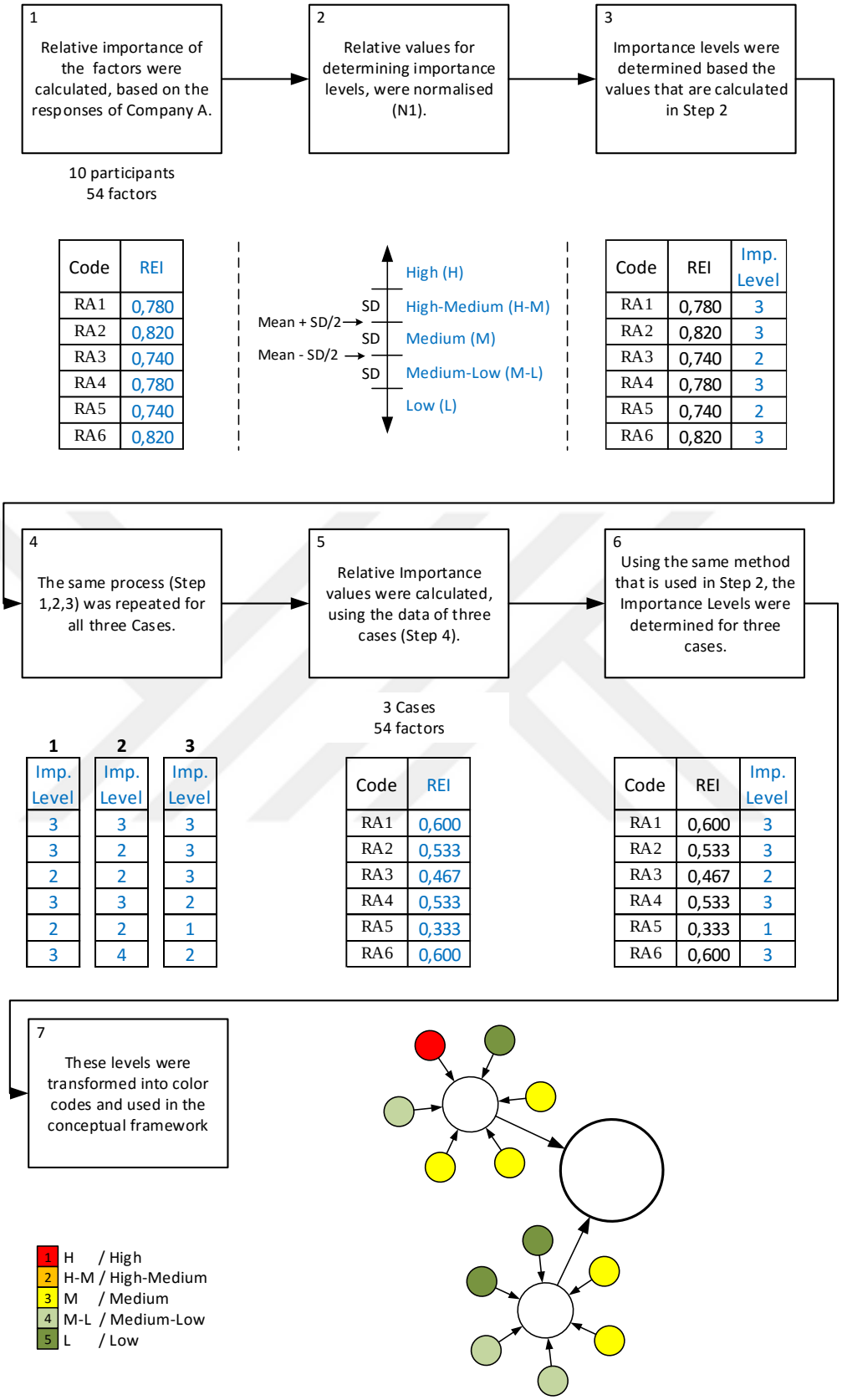


Figure 5.9 : Visual abstract of the quantitative analysis process.

5.7.2 Qualitative data

The qualitative data was collected with the aim of capturing the perceptions and understandings of the participants. Since the aim was to understand and describe the meaning of qualitative data (Schreier, 2013), content analysis method was used to analyse the qualitative evidence gathered from the cases. Content Analysis can be described as "a research technique for making replicable and valid inferences from texts or other meaningful matter) to the contexts of their use" (Krippendorff, 2004). Along with the approaches that accept content analysis as the "fastest growing technique in quantitative research" that systematically quantitise the message characteristics (Neuendorf, 2002), qualitative content analysis is "a research method for subjective interpretation of the content of text data through the systematic classification process of coding and identifying themes or patterns" (Hsieh & Shannon, 2005).

Merriam (2009) argues that "in one sense, all qualitative data analysis is content analysis in that it is the content of interviews, field notes, and documents that is analyzed". As in all types of qualitative data analysis, qualitative content analysis can be seen as process consisting of three concurrent flows of activity: (1) data condensation, (2) data display, and (3) conclusion drawing. The qualitative data that is collected should be analysed and labelled to assign a symbolic meaning aligned with the aim of analysis. This labelling, which is called "coding" in qualitative research, is done iteratively. While segments of data are summarised with the first cycle coding, the second cycle is used to group them into a smaller number of categories, which can be seen as a sort of meta-code. These meta-codes, which can also be named as pattern codes, can be used to in various ways according to the needs of the study to develop brief descriptions in either narrative or visual displays (M. B. Miles *et al.*, 2013; Saldaña, 2009). Schreier (2013) claims the coding frame can be the main result in qualitative content analysis

In this research, interviews that were conducted were recorded, using a digital recorder. Even though, qualitative data analysis software called NVIVO (v.10) was used in some parts of the analysis, the data coded manually for the ease and flexibility of the analysis. Two cycles of coding was applied in order to find the factors that are affecting the agile diffusion process (Table 5.6).

Table 5.6 : Coding frame for RA1 capability.

RA1 / Ability to be aware of emerging technologies, trends and changes in the industry				
Meta Codes	**FC Codes**	**CA**	**CT**	**CS**
Awareness	*Overconfidence based on experience*			+
Awareness	*Taking technical specifications as the only guide for the IT need*	+	+	+
Culture	*Corporate culture does not support this*	+		+
Process Management	*Lack of a specified unit/person to track these changes*	+	+	+
Process Management	*Lack of defined procedures for this*	+	+	+

In order to provide consistency and increase the reliability (dependability) of the data collection and analysis period, the case study protocol that is given below was developed and used in all three cases.

Case Study Protocol

1. Introduction to the case study
    a. Send the letter of invitation and brief introduction the gain the commitment from key person of the possible case.
    b. Request a date for a meeting to conduct pilot interview and determine the list of participants.
2. Data collection procedure
    a. Contact participants from the list
    b. Arrange time/date/place for interview
    c. Send the brief introduction of the case study objectives
    d. Prepare voice recorder and blank questionnaire for each interview
    e. Conduct the meetings with each participant
    f. Create a Case Study Database for each case
3. Analysis of the case study
    a. Within- case analysis
        i. Case study background
        ii. The priority areas to be focussed (quantitative data analysis)

iii. Organisational needs to provide agility (qualitative data analysis)

b. Cross-case analysis

i. The priority areas to be focussed (synthesis of the quantitative data analysis)

ii. Determination of the organisational dynamics that affect agility

iii. Comparison of the qualitative data based on organisational dynamics that affect agility

4. Development of the framework

5.8 Development of the Framework

A conceptual framework can be defined as written or visual presentation that "explain either graphically, or in narrative form, the main things to be studied - the key factors, concepts or variables - and the presumed relationship among them" (Miles *et al.,* 2013). Claiming that the researcher is the instrument of the research Maxwell (2005) argues that "the conceptual framework is something that is constructed, not found. It incorporates pieces that are borrowed from elsewhere, but the structure, the overall coherence, is something that you build, but something that exists ready-made".

This research gathered different pieces of information from different phases of the research process, with the aim of developing a conceptual framework which will lead organisations to be agile in diffusing and using emerging technologies in the market by capturing perceptions and understandings of the professionals working in the Turkish Construction Industry. While quantitative data was used to understand the priority areas to be focussed in order to provide agility, the analysis of qualitative data provided the organisational dynamics that hinder the development of agile technology diffusion. However, in order to provide a successful strategy to overcome the barriers of agility, a consensus on the rankings of these dynamics (due to their importance to deliver agility) was also needed. In order to provide this consensus and construct the conceptual framework, Delphi Technique was used.

The Delphi Technique is a methodology that is used to collect expert opinion on a particular subject through a series of sequential questionnaires, panel sessions or

"rounds", with the aim of gaining the "most reliable consensus of opinion" (Linstone & Turoff, 1975). It is a technique used to derive judgement especially useful when statistical or model-based methods cannot be used due to the lack of appropriate data, hence human "judgemental" input is needed (Rowe & Wright, 1999). The technique provides a type of group communication that overcomes the problems such as time, distance and etc., which make it unlikely or impossible for a group of experts to meet and work together in the same physical location (Yousuf, 2007).

The Delphi approach is highly flexible and adaptable; moreover, capable of being modified to the task (eg., Keil *et al.*, 2013; Quyên, 2014). In its original form, the Delphi process usually begins with a questionnaire (round one), which aims to clarify the critical issues that will be addressed in later rounds. Based on the feedback gathered from this round the respondents, (referred as panellists of the study) typically engage in a second questionnaire (data collection tool). During the second round, panellists are required to quantify their earlier findings, usually through a ranking or rating technique. In each subsequent round the panellists are given feedback from the previous rounds, and asked if they would like to revise their decisions in line with other panel members. The technique therefore provides a consensus of panellists through these iterative rounds which is built on the results of previous one (Keeney *et al.*, 2001; Powell, 2003).

Based on the relevant literature, Rowe and Wright (2011) argues that;

- Improving the recruitment and retention of the panellist over Delphi rounds,
- Creating useful heterogeneity in panel membership,
- Enhancing information exchange between panellists,
- Improving question formulation to provide easy and understandable questions,
- Combining Delphi with other techniques,

would ensure the credibility and efficiency of the method.

Cognisant of the need to engage multiple viewpoints and positions, the Delphi technique was used in this research as an iterating process of developing the conceptual framework. Compared to other consensus seeking methods, the advantage of anonymity and iteration supported by controlled feedback, played an important

role in the selection of this method (Gnatzy *et al.*, 2011; Hanafin, 2004). Based on its highly flexible and adaptable nature, a modified Delphi technique that would fit to the actual research setting was implemented. The details of this implementation were discussed in the 8th Chapter of this thesis.

5.9 Summary of the Chapter

This chapter explained the details of research methodology chosen to fulfil the research aim and objectives.

Starting from the philosophical underpinnings of the research methodology, the steps of research design, selection of research strategy, unit of analysis, data collection and analysis were explained and justified. The approaches used were defended vis-a-vis the appropriateness to the task.

The following chapter presents the findings from the within cases analyses.

6. WITHIN CASE ANALYSES

6.1 Introduction

The philosophical underpinnings of the research, justification of the chosen research strategy and steps to be taken to meet the research objectives were explained in detail, in the previous chapter. This chapter focuses on the findings of the data collection phase that were conducted in the cases. The chapter presents the evidence that are collected from three cases namely; Company A, T and S. Both quantitative and qualitative data, which were collected from each case, were analysed and presented separately. The analysis of each case starts with the background information of the company. Subsequently the quantitative data findings and analysis results are presented. As it was explained in the previous chapter, the quantitative data was used to determine the priorities for each case. Afterwards, the chapter presents the qualitative data analysis, in which the barriers of Agile Technology Diffusion in each case were determined.

6.2 Company A

6.2.1 Background

Company A (CA) is one of the pioneer contractors in the Turkish construction industry. It was founded by two young entrepreneurs in 1954. CA has an extensive operation area in which the projects were completed in; Refinery, Chemical and Petrochemical Plants; Industrial Plants; Power Plants; Pipe lines; Water and Waste Water Transportation Pipelines and Treatment Plants; Transportation Projects; Housing Projects and Public Service Buildings. The international focus of the company has been mainly on Turkey, Russia (The Russian Federation, Kazakhstan, Turkmenistan etc.) and MENA region.

6.2.2 Quantitative data analysis

As it was stated in the Research Methodology Chapter (Chapter 5), both quantitative and qualitative data was collected in each case. The proportions of the respondents from CA are presented in Table 6.1, below.

Table 6.1 : Distribution of respondents in CA according to management level and year of experience.

Management Level	Year of Experience					TOTAL
	0 - 5	6 - 10	11 - 15	16 - 20	21 -	
Top Management	-	-	-	-	2	2
Middle Management	-	-	-	1	3	4
First Line Management	2	2	-	-	-	4
TOTAL	2	2	-	1	5	10

As it was for each of the three cases, the respondents in CA were selected from three different management levels. While four professionals participated from First Line Management and Middle Management levels (for each), two respondents from Top Management level made contribution to this research.

The distribution of the respondents' level of experience demonstrated that 50% of the respondents had more than 21 years of experience in the field. Along with the two respondents of TM, three of the MM level were included in this 50%. Only half of the FM level had less than 6 years of experience in construction domain. The distribution shows that the respondents from CA possessed a high level of experience which is supposed to provide a positive impact on the accuracy of their perceptions and understandings.

The quantitative data that was collected from the case was analysed using REI approach (Chapter 5). Findings were ranked and importance levels were determined using the normalisation technique (N1), which was explained in the detail in Chapter 5. The values that were used in the normalisation technique to determine the importance levels of the agile technology diffusion capabilities are presented on Table 6.2.

Table 6.2 : Values that are used in determining the importance level ranges of CA.

CA			
Mean			0.800
Stand.Dev.			0.073
IL		**Max.**	**Min.**
H	1	0.691	0.000
H-M	2	0.764	0.691
M	3	0.837	0.764
M-L	4	0.910	0.837
L	5	1.000	0.910

When the responses of the participants were analysed (Table 6.3), ability to make quick decisions appears as the most problematic area, compared to the others. The lack of authorisation of the staff to make decisions, in case of sudden changes (2), points out the need to develop the ability of delegation in the organisation.

Table 6.3 : Importance levels of the Responsiveness capabilities based on REI.

CC	Capability	Mean	S.D.	REI	Rank	Imp. Level
RA1	Ability to be aware of emerging technologies, trends and changes in the industry	3.90	0.738	0.780	8	M
RA2	Ability to be aware of level of organisation's resources	4.10	0.876	0.820	14	M
RA3	Ability to be aware of organisation's external connectivity	3.70	1.059	0.740	5	H-M
RA4	Ability to be aware of organisation's internal connectivity	3.90	1.197	0.780	10	M
RA5	Ability to analyse the potential risks of change on organisational resources	3.70	0.823	0.740	4	H-M
RA6	Ability to analyse the potential consequences of change on organisational resources.	4.10	0.738	0.820	12	M
RC1	Ability to define a clear strategic vision for organisation	4.50	0.707	0.900	18	M-L
RC2	Ability to direct the organisation in sudden change and crisis.	4.30	0.483	0.860	17	M-L
RC3	Ability to manage knowledge efficiently	3.90	0.876	0.780	9	M
RC4	Ability to ensure successful decisions by sharing knowledge efficiently	4.00	1.155	0.800	11	M
RC5	Ability to make tough decisions quickly	3.70	1.054	0.600	1	H
RC6	Authorise staff to make decisions in case of sudden changes.	4.10	0.843	0.680	2	H
RR1	Ability to assess recovery needs in sudden/unpredicted change	4.20	0.632	0.840	16	M-L
RR2	Ability to assess recovery needs in planned change	4.10	0.994	0.820	15	M
RR3	Ability to develop a recovery plan in sudden change.	3.50	0.707	0.700	3	H-M
RR4	Ability to develop a recovery plan for planned change.	4.10	0.738	0.820	13	M
RR5	Ability to quickly reorganise the resources in sudden change	3.80	0.789	0.760	7	H-M
RR6	Ability to implement the recovery plan	3.70	1.160	0.740	6	H-M

It is possible to say that lack of delegation also has a negative impact on the speed of decision making. Participants' responses showed that, company's ability to develop a

recovery plan for sudden change has the third place to be focussed, in order to improve the response ability. The analysis of the data captured, points out the fact that the company has weakness in terms of analysing the potential risks of change on the organisational resources (4) and is not aware how it will be affected by the changes in the market (5). Along with these, the respondents believe that, the company possesses the ability to define a clear vision (18) and act according to it even in sudden changes or crisis (17). The responses show that the company is aware of the recovery needs that are caused by sudden or planned changes. However, taking action for recovery is problematic.

When the responses that assess the Flexibility of CA were analysed (Table 6.4), improving staff's enthusiasm to develop their skills and abilities become prominent in terms of areas to be focused.

Table 6.4 : Importance levels of the Flexibility capabilities based on REI.

CC	Capability	Mean	S.D.	REI	Rank	Imp. Level
FH1	Staff's ability to work in different positions and responsibilities	4.00	0.816	0.800	7	M
FH2	Staff's enthusiasm to develop skills and abilities	3.20	0.919	0.640	1	H
FH3	Ability to learn new procedures quickly	3.80	0.789	0.760	4	H-M
FH4	Being eager to share information to learn from other	4.00	1.155	0.800	8	M
FH5	Ability to change work habits as a response to changes in the demands	3.50	1.080	0.700	2	H-M
FH6	Ability to act efficiently even under uncertain and ambiguous conditions.	3.90	0.738	0.780	5	M
FI1	Scalability of IT infrastructure	3.70	1.059	0.740	3	H-M
FI2	Modularity of IT infrastructure	3.90	0.994	0.780	6	M
FI3	Facility of IT infrastructure	4.30	0.675	0.860	14	M-L
FI4	Modernity of IT infrastructure	4.20	0.919	0.840	13	M-L
FI5	Connectivity of IT infrastructure	4.40	0.966	0.880	17	M-L
FI6	Compatibility of IT infrastructure	4.20	0.789	0.840	12	M-L
FP1	Ability to develop a range of possible solutions in a sudden change	4.10	0.568	0.820	9	M
FP2	Ability to develop range of possible solutions in planned change	4.40	0.516	0.880	15	M-L
FP3	Ability to provide solutions within optimum time and cost difference in sudden change.	4.10	0.738	0.820	10	M
FP4	Ability to provide solutions within optimum time and cost difference in planned change.	4.40	0.516	0.880	16	M-L
FP5	Ability to provide similar results in sudden change.	4.10	0.876	0.820	11	M
FP6	Ability to provide similar results in planned change	4.60	0.516	0.920	18	L

The analysis results show that there is a gap in staff's ability to change their work habits as a response to change demands and to learn new procedures quickly. This

shows that staff cannot harmonise with the changes in the company, easily. Even though the company is generally capable of providing IT flexibility, providing scalability and modularity of IT infrastructure are still problematic. Yet, the participants generally claimed that the company is capable of providing IT flexibility.

Even though the results (Table 6.3) point out the capability of CA in managing processes and providing technical support to ensure the seamless flow, it is possible to say that company lacks leadership capabilities to successfully manage the diffusion process

Table 6.5 : Importance levels of the Competence capabilities based on REI.

CC	Capability	Mean	S.D.	REI	Rank	Imp. Level
CL1	Empower staff to take their decisions	4.10	0.876	0.820	9	M
CL2	Provide incentives for efficient use of new tech.	3.50	1.354	0.700	2	H-M
CL3	Development of an innovative culture	3.70	1.337	0.740	5	H-M
CL4	Development of a collaborative culture	4.00	0.471	0.800	6	M
CL5	Ability to develop trust to enable information sharing	3.70	1.059	0.740	4	H-M
CL6	Ability to develop trust to superiors	3.70	0.823	0.740	3	H-M
CM1	Ability to reengineer the processes	4.30	0.483	0.860	13	M-L
CM2	Ability to clarify changes in roles and responsibilities	4.40	0.516	0.880	15	M-L
CM3	Ability to provide service and technical support within the company	4.20	0.632	0.840	12	M-L
CM4	Ability to provide technical support from outside of the company	4.10	0.568	0.820	8	M
CM5	Ability to develop a powerful internal communication.	4.50	0.527	0.900	16	M-L
CM6	Ability to develop a powerful external communication.	4.60	0.516	0.920	17	L
CS1	Ability to develop an IT strategy aligned with business strategy	4.10	0.994	0.820	10	M
CS2	Ability to develop a diffusion program for new technology.	4.00	0.667	0.800	7	M
CS3	Ability to employ IT and innovation ready staff	4.30	0.949	0.860	14	M-L
CS4	Ability to develop plans to encourage staff to use new technology	3.30	1.337	0.660	1	H
CS5	Ability to improve staffs' skill, knowledge and attitude towards new technology	4.70	0.483	0.940	18	L
CS6	Ability to improve top management's knowledge about new tech.	4.10	1.197	0.820	11	M

The responses demonstrate that the employees are not encouraged to use new technology; neither by providing career development plans (1) nor incentives (2). The company has weaknesses in providing an innovative (5) and collaborative (6) culture that supports the diffusion of new technologies. Unfortunately, top management needs to develop skills in developing trust both horizontally (4) and vertically (3).

6.2.3 Agile diffusion in company A

6.2.3.1 Responsiveness

The interview findings that are related with the responsiveness capability were analysed under three sub-capabilities, which are namely;

(a) Sense, perceive and anticipate changes and risks in the environment

(b) Show immediate reaction to change and its demands

(c) Recovery from change

In this section, findings for each capability will be presented in detail, based on the sub capabilities that constitute them.

(a) Sense, perceive and anticipate changes and risks in the environment

The findings of this capability analysed under six sub capabilities which will be presented respectively;

Ability to be aware of emerging technologies, trends and changes in the industry

The participants emphasised that the organisation has to be aware of emerging technologies, trends and changes in the industry, in order to thrive in the competitive environment. However, it was remarked that these activities of monitoring and tracking emerging technologies are pursued on departmental basis, up to their own will and there isn't any department or staff that are responsible for conducting this process for the whole company.

> e.g."..departments track emerging technologies that may be useful for them, on their own..this is not a process that is officially followed up by a department or an authorised personnel, based on the defined procedures.."

The technical specifications that are required in bid documents are taken as a guide for the company's approach in using new technologies.

> e.g. "..since we have to follow the technical specifications in bid documents, we bound to the limits that are specified in these documents and do not go for something else..."

Yet, especially the younger participants (FM level) emphasised that the company would never want to upgrade or change anything, as long as it works.

> e.g. " I do not think that the company conducts a search or investigation to track emerging technologies that may be useful for us. They think that the one that is working is enough..".

Ability to be aware of level of organisation's resources

Within the context of this awareness, it was stated that the assessment of actual level of the resources (people, process and technology) and the possible needs, are being conducted both for the annual budget works, and for the bid preparations of each project, in which a series of very detailed examinations are carried out. However, the participants highlight that there is not any particular procedure for this assessment.

> e.g. "..however, this is not conducted through a process that is defined by procedures.."

While most of the participants from all levels agreed that the organisation is aware of its resource base, there were also some, that point out the need for conducting these assessments not only at the pre-design and design phases but also during the construction phase of the projects.

> e.g. "..the assessment of the resources base is either conducted for yearly budget preparations or for the bid preparations of each project.."

Ability to be aware of organisation's external connectivity

Even though the participants believed that the organisation has a good understanding about how quickly it will be affected if it cannot keep in pace with the changes in the industry, it was also emphasised that this perspective is not shared by all the staff, as a part of corporate culture.

> e.g. "..this is not something that is transformed into a corporate philosophy..it is pursued by the efforts of some individuals.."

Along with the cultural issues, participants (especially from the MM level) were believing that the organisation focusses on its projects too much and as a result of this misses the bigger picture. This causes gaps in awareness and lags in responses.

> e.g. "..when we asked top management why the company is not involved more in housing projects, they told us that the company had fallen behind and lost the competitive advantage.."

Being active in various fields and having different priorities, were also offered as another reason for the awareness gap of organisation's external connectivity.

> e.g. "..they are usually late to be aware of it..they cannot respond quickly..the company has lots of project in various sectors..and probably have different priorities..".

It was emphasised that the organisation has fallen behind in some segments of the market, which also causes question marks about the organisation's awareness.

Ability to be aware of organisation's internal connectivity

Participants had some concerns about the level of internal connectivity of the organisation. Despite the clearly defined procedures, they admitted that the organisation may not always act as if it is aware how a change in one department can affect the whole organisation.

The sources of this gap were identified from different perspectives. Participants believed that the organisation neglects the links between the different parts and how a change in one part can have an impact on the others. Especially the FM level participants claimed that the organisation does not have a people oriented approach and does not care about the motivation of the staff.

> e.g."..we have problems with this..the company needs to solve this problem asap..they do not draw a vision for the staff for future..no career planning..no projections..we cannot hold the valuable staff within these conditions..company disregards the comments or needs of the staff when making changes.."

> e.g. "..there isn't a people oriented approach..staff can be sacked very easily..company does not care if this will affect other units or staff's motivation.."

They highlighted that the perspectives of the sites and headquarters do not match and stressed that the headquarters aims to have the highest productivity rate without making any investments, if possible.

> e.g. "..the needs of the sites and approach of headquarters do not match..the aim of the headquarters is always getting the highest efficiency without making any investment.."

It was asserted that as a result of these approaches, the staff is concerned about the future and do not have a sense of belonging towards the company. This leads them to move to other companies, in which they would feel safe. MM level participants stated that these critical loses, have a negative impact on all the departments that are inter-linked.

Ability to analyse the potential risks of change on organisational resources

Participants argued that the organisation, generally, analyses the potential consequences of a new technology before giving the adoption decision. Yet, it is not a detailed analysis that is based on defined procedures but an assessment that is conducted based on the prior experiences of the management level.

e.g. "..even if it is not a detailed one, we assess the pros and cons of the implementation of new technology.."

Even though an analysis is conducted, participants emphasised that the organisation disregards the impacts of this change on staff.

e.g. "..however this assessment do not include the impact on the people issues..".

The lower levels (FM level) declared that they have not witnessed or taken place in such an analysis. However, based on the organisation's approach to other issues, they believed in the existence of such an analysis. In this regard, FM level participants believed that the problems that are faced during implementation are results of top management's approach to the problem, which was described as "not solution oriented" by the participants. It was also emphasised that this approach has caused big amounts of losses in terms of workforce productivity to the company.

Ability to analyse the potential consequences of change on organisational resources

The participants claimed that the organisation, especially the IT department analyses the potential consequences of change on organisational resources. However, as it is in risk analysis, this analysis mainly focusses on the interactions between existing IT infrastructure and the new technology that will be used.

e.g. "..the clashes and interactions between different software are taken into consideration.."

e.g. "..the company aims for quality in production however the resources are not allocated accordingly..everyone has additional responsibilities..sometimes the equipment infrastructure does not support these multi-tasks.."

(b) Show immediate reaction to change and its demands

The findings of this capability analysed under six sub capabilities which were presented respectively;

Ability to define a clear strategic vision for organisation

The organisation gives importance to Strategic Management. TM asserted that the aim and objectives of the company are always up to date and announced to staff. The strategies and the objectives are determined / revised on a yearly basis period, announced to all departments of the company and taken as a guide throughout the year. Even though it is hard to say that the aim and objectives of the company is

understood by all management levels and the staff, they believed that top management puts serious effort on this.

The MM and FM levels also agreed that a clear strategic vision is defined by top management however, they underlined that it would be assertive to claim that the business strategy is internalised by the whole organisation. They argued that the culture and the "spirit" that is dominant in the company once, do not exist anymore. Most of the employees do not have a sense of belonging. Participants emphasise that in order to solve this, the organisation have to revive the corporate culture which was dominant once.

> e.g. "..all staff had that spirit..there was a sense of belonging..we all were working to improve our company..we do not have that spirit now.."

Along with the "sense of belonging", especially the participants from FM level, complained that they are not aware of the business strategy of the organisation.

> e.g. "..they do not ask for staff's contribution and do not inform us about the strategy.."

Ability to direct the organisation in sudden change and crisis

The participants all agreed that the organisation takes mission and vision statements as a guide and act aligned with its strategies even in unpredicted situations. It is emphasised that taking customer satisfaction as the top priority, the company may even lose money in this kind of situations. The participants highlighted that this is an important capability for the organisation in order to protect its image and prestige.

Ability to manage knowledge efficiently

Even though the participants claimed that the information management in the company is carried out according to the defined procedures, they pointed out the problems that are related with the efficiency of this process. Regarding the reasons of this inefficiency, various reasons were stated such as;

- problems with transforming data into information,

  > e.g. "..there may problems in headquarters, about transforming data into information..even if the planning department works hard for this, our efficiency in transforming data to information is about 50%-60%.."

- problems in data collection,

e.g. “even if they want information from headquarters, we sometimes cannot respond to it due to the heavy workload..”

- problems in sharing data and information,

  e.g. “..we collect the data efficiently but, problems may occur during sharing it..”

- problems with storing data,

  e.g. “..most of the times, data goes away with the users..the company has to track this..all information should be stored according to the defined procedures and the company should have a legacy archive..”

- inefficiency of the procedures that are defined for this process.

  e.g. “..the data is collected, organised, structured and distributed according to defined procedures..”, “..we are trying to do it however, the efficiency of the process is open to discussion..”

Ability to ensure successful decisions by sharing knowledge efficiently

Even though most of the participants agreed that organisation gives importance to keep its staff informed about the changes related with the work, some asserted that the distribution of information is not always quick and this causes some problems, especially with the ones that are strategically important. It was stated that these delays can be resulted from the behaviors individuals such as hiding information from others or heavy workload of the staff.

e.g. “..sometimes changes in the scope of work or related information or the changes in the expectations of the owner are not shared with related departments..you get this information through informal communication..”

e.g. “..sometimes the emergency of the operations get ahead of the sharing of information..”

Ability to make tough decisions quickly

All participants agreed that the decisions in the organisation are not given quickly. While upper levels (TM level) presented the need for detailed analysis to ensure preciseness, the lower levels (TM and FM) are not so optimistic about this habit of the organisation.

While most of the participants pointed out the high level of bureaucracy,

e.g. “..too much bureaucracy..even the approval of a very simple contract takes too much time and causes delays in the work..”, “..there is a long chain of approvals..as a result of this, decisions cannot be taken or implemented quickly..”

Some complained about the ambiguousness of roles and responsibilities and communication problems within the organisation.

> e.g. "..all staff should now their roles and responsibilities very well.."
>
> e.g. "..something that is important for you can be an ordinary task for another person.."

Authorise staff to make decisions in case of sudden changes

Findings showed that the organisation adopted a decision system in which the lower levels work on a decision and offer it to the upper levels for approval. In this regard, while MM and FM levels complain about the lack of authorisation, participants from TM level asserted that authorisation is given to the staff. Given these, the participants that described the delegation in the company as "problematic" claimed that the level of delegation depends on the leadership style of the managers. The managers who want to hold the power do not chose to delegate their responsibilities. Likewise, the ones that believe in the importance of teamwork and trust their team would chose to authorise staff.

> e.g. "..the delegation is problematic in the company..", "..there had been people from top management who gave cell phones to some workers they selected and wanted to be updated directly.."

Along with the leadership style of the managers, findings also showed that staff should be informed about their roles and responsibilities in detail, so that people cannot use this gap to evade their responsibilities or taking initiative.

> e.g. "..people like to avoid taking initiative and pass their responsibilities to others..", "..nobody wants to take the risk..when things get complicated the responsibilities are handed off to others.."

(c) Recovery from change

The findings of this capability analysed under six sub capabilities which were presented respectively;

Ability to assess recovery needs in sudden/unpredicted change

Participants claimed that the company possesses the ability to assess recovery needs, in sudden/unpredicted change. The findings pointed out that the company is capable of being aware of the needs however faces problems in the speed of responses.

Ability to assess recovery needs in planned change

The participants argued that the company conducts an assessment about the recovery needs that may occur, for planned changes. However, some findings presented counter results to this argument in which participants complained that; they had to undertake the responsibility for more than one role, based on cost issues. Participants from lower levels (FM) also complained that sometimes they do not even know what are they responsible for.

> e.g. "..lots of responsibilities and tasks are given to people without taking their opinions..I even do not know what I am officially responsible for.."

Ability to develop a recovery plan in sudden change

Unfortunately the findings showed that the organisation does not have a written recovery plan for sudden or unpredicted change, but based on their high level of experience, the management team supposed to have unofficial plans in their minds. Participants argued that the organisation acts with spontaneous decisions when faced with unpredicted change.

> e.g. "..we do not have such a plan..in this kind of situations things go spontaneously.."

If the situation is not something experienced before people do not act proactively and keep their silence, since they do not want to take any responsibility.

> e.g. "..if we face the situation for the first time, we do not act proactively..usually people do not want to take the responsibility.."

Ability to develop a recovery plan for planned change

Despite the views that such a recovery plan in planned change is being developed, some participants, especially from MM and FM levels, declared that such recovery plans do not consider the impact on people issues or the interlinks within the organisation.

> e.g. "..I do not think that they are concerned about the organisation (people issues).."

Ability to reorganise the resources quickly in sudden change

The findings demonstrated that the organisation is not quick in the reorganisation of resources in sudden change. While some participants highlighted the lack of procedures or plans for such a reorganisation,

e.g. "..there is not such a plan however due to the nature of the organisation, we quickly adapt ourselves to it.."

some participants pointed out the extra budget that will be needed for this reorganisation and presented as a factor that will surely reduce the speed of response. It was explained that the organisation identifies the unpredicted costs as "cost of poor quality" and they are problematic since they need the approval of the top management.

e.g. "..this needs a budget..an approval..company sees these kind of costs as cost of poor quality.."

In this regard it was asserted that the organisation would choose to defer this reorganisation till a problem arises.

Ability to implement the recovery plan

There was a general belief among the participants that if a plan is developed in the company, the planning department always follows and controls the implementation of such a plan, strictly. However, some of the participants emphasised that there is a gap this implementation based on the approaches of the managers.

e.g. "..we have problems regarding this..the implementation takes place if the arrangement need turns into a real problem.."

Table 6.6 summarises the important findings of the conducted interviews in terms of the responsiveness capability (R), based on experts' perceptions and understandings.

Table 6.6 : Barriers of the responsiveness capability in company A.

Sense, perceive and anticipate changes and risks in the environment
RA1 / Ability to be aware of emerging technologies, trends and changes in the industry
Taking technical specifications as the only guide for the IT need Corporate culture does not support this Lack of a specified unit/person to track these changes Lack of defined procedures for this
RA2 / Ability to be aware of level of organisation's resources
Lack of defined procedures for this
Seeing bid preparations enough for this assessment
RA3 / Ability to be aware of organisation's external connectivity
Focussing on projects too much and missing the big picture Corporate culture does not support this Having different priorities
RA4 / Ability to be aware of organisation's internal connectivity
Different perspectives of headquarters and the sites

Table 6.6 (continued) : Barriers of responsiveness capability in company A.

Disregarding the interaction between its units
Disregarding the motivation of staff
RA5 / Ability to analyse the potential risks of change on organisational resources
Unawareness of the interaction between People Process and Technology
Lack of defined procedures for this
RA6 / Ability to analyse the potential consequences of change on organisational resources
Unawareness of the interaction between People Process and Technology
Show immediate reaction to change and its demands
RC1 / Ability to define a clear strategic vision for organisation
Vertical communication problems
Lack of sense of belonging
RC3 / Ability to manage knowledge efficiently
Data collection problems
Data and information sharing problems
Problems with transforming data to information
Data storage problems
Inefficient procedures for information management
RC4 / Ability to ensure successful decisions by sharing knowledge efficiently
Hiding information (individual and departmental levels)
Heavy workload
RC5 / Ability to make tough decisions quickly
Organisational structure does not allow quick decisions
Ambiguousness of roles and responsibilities
Communication problems
RC6 / Authorise staff to make decisions in case of sudden changes
Ambiguousness of roles and responsibilities
Staff avoid taking initiative
Leadership style of the managers (delegation)
Recovery from change
RR2 / Ability to assess recovery needs in planned change
Disregarding the opinions of the staff that will be affected by the implementation
Lack of defined procedures for this
RR3 / Ability to develop a recovery plan in sudden change
Lack of such understanding
Seeing this as additional work and avoiding to take the responsibility
Lack of defined procedures for this
RR4 / Ability to develop a recovery plan for planned change
Being unaware of internal connectivity
RR5 / Ability to quickly reorganise the resources in sudden change
Lack of such a plan
Top management/managers see this as a source of cost
RR6 / Ability to implement the recovery plan
Being unaware of the benefits of such a plan

6.2.3.2 Flexibility

The interview findings that are related with the "flexibility" capability were analysed under three sub-capabilities, which are namely;

(a) Human resources flexibility

(a) IT flexibility

(b) Process flexibility

In this section, findings for each capability were presented in detail, based on the sub capabilities that constitute them.

(a) Human resources flexibility

The findings of this capability analysed under six sub capabilities which were presented respectively;

Staff's ability to work in different positions and responsibilities

Both the findings of the interviews and the observations that were conducted in the company showed that, people in the organisation are selected from candidates who are highly capabale and skiled, and participants agreed that people in the organisation are capable of working in different positions and under different responsibilities effective, if needed. The participants were all aware that the organisation expects the existence of this capability in all staff. However, the company does not have a rotation strategy as a part of their HR strategy.

> e.g. "..in construction production, except special tasks that need special professionalities, people can and should work in different positions, under different responsibilities.."

> e.g. "..you have to work in different positions and responsibilities..I really do not know what is my real responsibility or scope of work.."

The participants were all aware that the organisation expects the existence of this capability in all staff. However, they also remarked that in construction organisations, headquarters and sites have two different cultures and possible problems may emerge with the changes in positions and responsibilities of the staff, as a result of this cultural diversion.

> e.g. "..in construction production, headquarters and sites have different cultures..people who can work in both environments, efficiently, are very few in numbers.."

Staff's enthusiasm to develop skills and abilities

The findings demonstrated that the company gives importance to improving the skills and abilities of its staff. However, it was stated that there has not been any training requests recently which can be accepted as a sign that staff is not happy about attending training programs or the heavy workload prevents them to attend these programs.

> e.g. "..trainings are not so successful..probably because people are on attending them on their own will..training request has been nearly zero in the past few years.."

Even though this was stated as a matter that show changes from person to person, it was argued that, especially for the recent years, majority of the staff in the organisation have not been so eager to update their skills and abilities and wanted to continue working on a standard routine.

> e.g. "..we have both kinds of people..the ones that are keen to have trainings and the opposite..this is related with the personal characteristics of the staff..", "..people do not want to change their standard routine.."

Ability to learn new procedures quickly

The participants believed that the people in the organisation are capable about learning new procedures quickly. However, it was stated that new procedures may not be implemented by the staff based on various reasons;

they may not be interested in new procedures,

> e.g. "..the number of people who open the procedures and read them are very few..they are not interested..yet, they have the capacity.."

especially the experienced staff may not want to change the way that they do things. They can show passive resistance if they do not believe in the "new" and consciously avoid using the new procedures

> e.g. "..but I did not write that procedure..I should not be obliged to implement it..I would be persistent and try to find somebody who will do it as I want it to be done..most of the staff do not believe in them and do not follow them.."

Being eager to share information to learn from other

The responses from the participants showed that people working in the organisation are generally happy to share information and learn from each other. However,

participants also emphasised that there are some exceptions depending on the personality of people;

> e.g. "..there are people who are pleased to do this and there are some who would never do..actually the number of people who are enthusiastic about teaching others the things that they know is higher compared to the opposite group..however, I can say that this is related with the personality of the people.."

or power relations between departments, which undermines the teamwork in the organisation and the motivation of the staff.

> e.g. "..if we do not force them, this never happens..we have problems with team work..we could not have been successful yet..in my opinion this should be questioned in the assessments of HR departments recruitment process..", "..especially in headquarters, people do not want to share information quickly and wait for others to stumble and ask them.."

Ability to change work habits as a response to changes in the demands

The participants indicated that people in the organisation cannot change their habits easily; even it is for providing a successful response to change demands. In order to ensure this acceptance, the benefits of the new technology should be explained to the experienced staff who had been working for the company for a long time.

> e.g. "..they show passive resistance..","..if they believe in the benefits, they use it.."

However, convincing the experienced staff about these benefits takes time and top management's commitment to change is highly needed during this persuasion period.

> e.g. "..they show resistance..but they get used to it after a while", "..if top management insists on it, they have to do it..they do not have any other choice.."

The participants also emphasised that these people can be convinced to change their habits since they care about their company and try to do the best for its development. However there are also some staff who consider themselves as project based personnel, who neither care nor put effort to change their habits.

> e.g. "..real staff put their effort in this and change their habits..the ones that are project based..they do not care.."

Ability to act efficiently even under uncertain and ambiguous conditions

Participants believed that, even though a problem, which the staff do not have information about, emerges, most of the people in the organisation would certainly

act efficiently and move things forward. Participants also stressed that the level of this proactivity will surely show changes from person to person.

> e.g. "..we have both types of people..nobody is perfect..some people demoralise quickly.."

It was also noted that the characteristics of construction production do not allow any contrary situation and added that this is a result of corporate culture and the characteristics of the construction production which cannot stand time loss.

(b) IT Flexibility

The findings of this capability analysed under six sub capabilities which were presented respectively;

Scalability of IT infrastructure

Even though TM level confirmed that the organisation's IT infrastructure is capable of working efficiently, despite changes in the numbers of users, workloads or transactions, lower levels (MM and FM) did not totally agreed with this.

The participants complained about the actual level of IT infrastructure and accused the organisation (TM level) for not being aware of the benefits and importance of IT infrastructure, especially for sites.

> e.g. "..even sites do not work forever, they are branches of the company..they need to work properly..our IT infrastructure is very weak in some sites.. the IT investments for projects are planned at the beginning..and if you have delays in the project..your infrastructure, especially the hardware gets weaker.."

Participants complained about the organisation's perspective which does not invest site offices since they are seen as temporary bases. It is also stressed that the actual IT infrastructure clashes with the company's image. Participants explained that the IT infrastructure is accepted as a fixture in the organisation and the fixture purchases needs the approval of executive committee, which is very hard to get. As an example it is emphasised that the company sees the computer renewals as dead investments.

> e.g. "..for the company, IT infrastructure is a fixture..Fixture investments of the company needs the approval of executive committee..this means new investment..they see investment as wasted money..for this reason having this approval is extremely difficult..sometimes we wait three months for the purchase of a harddisk.."

However, it was also noted that this gap causes security gaps in the storage of information.

Modularity of IT infrastructure

Even though the TM level participants stated that they do not have problems when new software added to, modified or removed from the existing IT infrastructure, MM and FM level participants claimed that IT infrastructure would cause problems if changes take place such as; adding new software to the system, revising or removing an existing one. They also noted that it is not possible to make any additions, which the actual IT infrastructure does not allow. In this regard, especially the planning department works on developing solutions to improve the compatibility so the modularity of the existing IT infrastructure.

Facility of IT infrastructure

The findings showed that the company gives importance to develop its own software solutions. In addition to this, the ones that are not developed by company are well known products that are being used in the industry. In this regard it was pointed out that the interfaces of the systems used in different departments are similar enough to provide quick adaptation by the staff.

The participants also emphasised the need to improve the user-friendliness of the software program, which serves as the backbone of planning, in the company. Even though the experienced personnel seemed to get used to it somehow, it was identified as a serious barrier that hinders the efficiency.

e.g. "..they do not care about it much..we asked for some changes however had no results.."

Modernity of IT infrastructure

Even though the participants generally complain about the IT infrastructure, they claimed that that the hardware and software that are used in the organisation are based on well-known products.

Connectivity of IT infrastructure

During interviews, TM level claimed that all site offices are connected to the headquarters and the IT infrastructure allows staff to share information among different departments and sites, securely and easily. However, there were some opposing views based on the unawareness of the importance of IT infrastructure for the sites and the view that sites are seen as temporary bases that the investments should be kept at minimum.

e.g. "..we have weaknesses in this..have problems..actually it is better in the headquarters.."

Compatibility of IT infrastructure

The views of the participants showed that the organisation gives importance to the ability of systems to share and use each other's data without having any problems. It was also highlighted that the IT department is working to improve the efficiency of this interoperability.

(c) Process flexibility

The findings of this capability analysed under six sub capabilities which were presented respectively.

Along with the process flexibility capability, the important findings of the conducted interviews in terms of the all three main capabilities of the Flexibility capability (F), based on experts' perceptions and understandings, are summarised in Table 6.7.

Ability to develop a range of possible solutions in a sudden change

The participants agreed that the majority of the people working in the organisation are capable of creating a range of new process and paths to address the unpredicted changes and the demands caused by them. The opposing approaches were based on the fact that some people may not chose to adopt this approach, even if they are capable of doing it.

e.g. "..some can do this but some can't..people state different reasons for this..can just say that this is not defined in my procedures..actually they all possess the ability.."

Ability to develop range of possible solutions in planned change

The participants claimed that the organisation is capable of designing a range of different process paths after the decision of new technology adoption and emphasised that the planning department of the organisation is highly capable of developing any kind of plan.

Ability to provide solutions within optimum time and cost difference in sudden change

The participants asserted that the organisation is capable of developing alternative processes which complete in similar time and cost, when faced with a sudden change. However, it was remarked that since it is an unpredicted situation, the

priority of the organisation is achieving the desired results. In this regard, cost can be of secondary importance.

Table 6.7 : Barriers of the flexibility capability in company A.

Human resources flexibility
FH1 / Staff's ability to work in different positions and responsibilities
HR strategy does not have a rotation plan for staff
FH2 / Staff's enthusiasm to develop skills and abilities
Personality of the staff Heavy workload
FH3 / Ability to learn new procedures quickly
Staff's indifference towards new procedures Experienced staff do not want to change the way that they do things Passive resistance from the ones that are opposing change
FH4 / Being eager to share information to learn from each other
Personality of the staff Power balances
FH5 / Ability to change work habits as a response to changes in the demands
Lack of top management's commitment to change Being unaware of the benefits of new technology Staff does not have a sense of belonging
FH6 / Ability to act efficiently even under uncertain and ambiguous conditions.
Employees do not show a proactive approach (personality)
IT Flexibility
FI11 / Scalability of IT infrastructure
Being unaware of the importance and benefits of IT infrastructure Seeing sites as temporary bases and keeps investments at minimum Being unaware of the actual resource base
FI3 / Facility of IT infrastructure
Being unaware of the benefits of IT facility
FI5 / Connectivity of IT infrastructure
Being aware of the importance and benefits of IT infrastructure Seeing sites as temporary bases and keeps investments at minimum
Process flexibility
FP1 / Ability to develop a range of possible solutions in a sudden change
The leadership characteristics of the managers

Ability to provide solutions within optimum time and cost difference in planned change

The interviews findings showed that the organisation is capable of planning new process paths which will be completed within the same or similar time and cost values.

Ability to provide similar results in sudden change

The participants accepted that the organisation is capable of developing alternative process solutions with similar results, even faced with unpredicted change. However, it was also highlighted that if it is a situation that has not been witnessed before the response can be slow because of the long procedures of decision making.

Ability to provide similar results in planned change

The findings demonstrated that the organisation is capable of planning alternative process paths with similar results for successful adoption of new technology.

6.2.3.3 Competence

The interview findings that are related with the "competence" to manage diffusion process were analysed under three sub-capabilities, which are namely;

(a) Leadership

(b) Management of change process

(c) Strategy development

In this section, findings for each capability were presented in detail, based on the sub capabilities that constitute them.

(a) Leadership

The findings of this capability analysed under six sub capabilities which were presented respectively;

Empower staff to take their decisions

The interview findings showed that the organisation's approach towards decision making is built on the system, in which the lower levels makes a decision and gets the approval of the upper level(s) in order to implement it. In this regard TM level participants claimed that the organisation empower staff to take their decisions. However, the interpretation of lower levels do not match with the TM's approach. They claimed that, even if this looks like an empowerment, in practice, staff cannot take decisions and implement it on their own.

> e.g. "..all decisions need superior managers' approval..you can't just make a decision and implement it.."

As a result of this, the staff chose to leave decisions, completely, to upper levels and avoid taking initiative.

> e.g. "..it is right in theory..however, things usually do not go like this in practice..it is a people related issue..they do not want to take initiative.."

Provide incentives for efficient use of new technology

The findings of the interviews showed that especially the top management is not totally aware about the benefits of new technology.

> e.g. "..I have not witnessed something like this..actually some of the tools that we are using are twenty years old..when we use this tool it takes 30 times more time than normal..", "..actually company wants you to use new technologies but do not want to invest for them.."

In this regard, the participants claimed that the organisation supports its staff to use new technology however, this support does not transform into tangible incentives.

Development of an innovative culture

The interview results demonstrated that TM level participants believed in the existence of an innovative culture in the organisation and highlighted that the company has been a pioneer in the implementation of various technological innovations.

However, the majority of the participants did not agree with the TM level and claimed that even if the TM believe in the importance of innovativeness this does not reflect to the practice.

> e.g. "..actually they believe in the importance of an innovative approach but do not reflect it to practice.."

Even from the FM levels, some of the participants stated that the implementation of new technologies stem from top management's desire to have a more intensive control on them, rather than improving efficiency.

> e.g. "..we do not believe in the importance of every technological upgrade..these are tools that top management invests to have a better control on us.."

Development of a collaborative culture

Participants indicated that, once the decision to use new technology is introduced, people work collaboratively to achieve desired targets, even if some of them stated their objection about the subject. Participants believe that that collaboration is one of the valuable assets of their company.

Ability to develop trust to enable information sharing

The participants remarked that the information sharing is not at the optimum level in the company. The troubles that may rise in this process can either be the result of secrecy of some departments (due to the business needs) or the characteristics of department managers.

> e.g. "..some departments share information some do not..two departments that are working in the same process should be in touch with each other..some does this some does not.."

Even though the majority of the participants stressed that staff trust each other, findings showed that departments or units do not want to reveal their gaps and do not always want to share information, and this causes uneasiness among the staff. The reasons for this hesitation in sharing information can be a result of the will to protect power balances between different units.

> e.g. "..people do not want to share information with each other..they keep it at minimum..they..do not want to give advantage to each other..this causes uneasiness.."

Along with these, participants stated that the differences in the approaches of the sites and the headquarters also result with lack of information sharing.

> e.g. "..they do not think that this information is important for the other.."

Ability to develop trust to superiors

The participants stated that top management supports new technology implementation. However, it was also remarked that this support can easily fade away if a mistake that has a negative impact on financial statements, occurs. In this regard, the staff questions the sincerity of this support and do not feel comfortable about the implementation of new technology.

> e.g. "..you cannot make any mistakes..the ones that are responsible for the mistake can be found very quickly..", "..the ones that are responsible are called for account..nobody wants to be in this position and refrains from it.."

(b) Management of change process

The findings of this capability analysed under six sub capabilities which were presented respectively;

Ability to reengineer the processes

The organisation is known with its high level capability of process management which comes from the origins of its key management team. The participant's responses were aligned with this view and declared that the organisation reorganises the business processes to provide a seamless flow of implementation, when a new technology is introduced to the company.

Ability to clarify changes in roles and responsibilities

Participants confirmed that the organisation informs all related staff about the changes in roles and responsibilities caused by new technology related process changes.

Ability to provide service and technical support within the company

Even though extra costs were always stated as a problem for the company, participants agreed that the organisation provides required services and technical support to improve efficiency of new technology implementation.

Ability to provide technical support from outside of the company

Interview findings confirmed that the organisation employs external consultants to improve efficiency when needed.

Ability to develop a powerful internal communication

The findings showed that while some of the staff can easily exchange views and give feedback about the implementation process to their colleagues and peers, some remain silent. Along with the culture, personality of the staff is another important determinant for internal communication. Participants claimed that the corporate culture of the company supports this kind of internal communication.

> e.g. "..they usually remain silent..", "..you can easily discuss anything with your colleagues and your chiefs..we have this culture.."

Ability to develop a powerful external communication

Participants confirmed that the organisation has a smooth communication with the external parties. Along with the one on one efforts, company develops in-house software to improve the efficiency of this communication.

(c) Strategy Development

The findings of this capability analysed under six sub capabilities which were presented respectively;

Ability to align IT strategy with business strategy

The participants believed that the organisation's IT strategy is aligned with its business strategy and in this regard, the (new) technology that is being used provides advantage to the organisation in achieving its goals.

Ability to develop a diffusion program for new technology

Participants agreed that a diffusion program that embraces the implementation steps of new technology is developed and followed, when the organisation decides the use a new technology. It was also indicated that this program embraces step by step implementation phases, training programs and support services that are provided by either phone or internet.

Ability to employ IT and innovation ready staff

Generally participants declared that the capability of using new technology is a valuable asset for being employed and taking promotion in the organisation. On the other hand there are some different views, coming from the FM level, claiming that more than innovation or technology readiness, cost issues are the priorities of the organisation in the recruitment of employees.

Ability to encourage staff to use new technology

The findings revealed that there had been such plans in the past. However the company does not develop plans to encourage staff to use new technology, now.

> e.g. "..we do not have such plans..our perspective is more result-oriented..we need to reach our objectives..normally HR department should develop such plans but we have not witnessed any of them..",, "..no we do not have..only thing that we can name as encouragement is the trainings that are given.."

Ability to improve staffs' skill, knowledge and attitude towards new technology

The findings demonstrated that the organisation provides a detailed training program for staff about how to use new technology.

Ability to improve top management's knowledge about new technology

It was stated that the organisation provides managerial level trainings to line managers and top management to improve their knowledge and understanding about the benefits of new technology but also noted that top management cannot always find time to join to them.

> e.g. "..we have these kind of managerial trainings..however, top management cannot participate them frequently.."

Along with the heavy workload, top management's apathy to new technologies was stated another element that barriers the efficiency of managerial trainings, given in the company.

Table 6.8 summarises the important findings, in terms of the competence to manage diffusion process (C), based on experts' perceptions and understandings.

Table 6.8 : Barriers of the competence to manage diffusion process in company A.

Leadership
CL1 / Empower staff to take their decisions
Managers do not want to delegate their power of decision making Staff avoid taking initiative
CL2 / Provide incentives for efficient use of new technology
Top management's lack of awareness about the benefits of new technology
CL3 / Development of an innovative culture
Innovative approach of the top management
CL4 / Development of a collaborative culture
Personality of the staff
CL5 / Ability to develop trust to enable information sharing
Different perspectives of headquarters and the sites Power balances between departments Personal characteristics of the line managers
CL6 / Ability to develop trust to superiors
Sincerity of management in their support and actions
Management of change process
CM5 / Ability to develop a powerful internal communication
Personality of the staff
Strategy development
CS4 / Ability to develop plans to encourage staff to use new technology
Top Management's commitment to change
CS6 / Ability to improve top management's knowledge about new technology
Heavy workload of management

6.2.4 Case summary for company A

The analysis of the data that was collected from CA shows that; regarding the three main capabilities of agility, showing response to new technology is the weakest part, compared to the other two. Even though they all have similar values, "ability to show quick reaction to change and its requirements" has the lowest score among the three sub-capabilities of responsiveness. These quantitative findings overlap with the interview findings that underline the problems in decision making and delegation in the organisation. Even though the company present a profile which is familiar and interested with new technologies, the findings point out that CA does not approach all its resources (people, process and technology) with the same level of importance. Despite its well-known capabilities in planning and monitoring, the company does not seem familiar with planning change recovery needs beforehand and reorganising them quickly, due to the organisational requirements.

The employees of CA do not seem happy about "change" or eager to be ready to adapt it quickly. Especially when faced with an unknown or unplanned situation, it is problematic for the company to move forward. Even though the company seems to be aware of the importance of IT, cost issues can act as the biggest barrier for developing a more efficient and flexible infrastructure. CA's efficiency in process management also shows its positive impact, on the process flexibility capability of the company.

Even though the company presents a positive approach to the use of emerging technologies in business, employees have real doubts about the sincerity of top management and complain about lack of support in terms of technology. Despite its ability in providing communication and efficient management of the processes, top management fail to establish trust in the company in parallel with motivating the employees to use emerging technologies and developing an innovative and collaborative culture.

6.3 Company T

6.3.1 Background

Company T (CT) is a contracting company that is accepted as one of the biggest institutions in Turkey, in terms of value of its completed projects and the number of

construction machinery and equipment inventories. Its origin goes back to 1956 and CT is known as an international contractor with major accomplishments in Turkey, the Middle East, North Africa, Caucasia & Central Asia, East & Central Europe. Its wide span of activities range from heavy civil works to refineries and petrochemical plants; from satellite towns to major industrial processing plant; from pipelines and marine structures to power plants, electrical and communication works.

6.3.2 Quantitative data analysis

As it was stated in the Research Methodology Chapter (Chapter 5), both quantitative and qualitative data was collected in each case. The proportions of the respondents from CT are presented in Table 6.9, below.

Table 6.9 : Distribution of respondents in CT according to management level and year of experience.

Management Level	Year of Experience					TOTAL
	0 - 5	6 - 10	11 - 15	16 - 20	21 -	
Top Management	-	-	-	1	1	2
Middle Management	-	-	2	1	1	4
First Line Management	-	3	1	-	-	4
TOTAL	-	3	3	2	2	10

The respondents in CT were selected from three different management levels. While four professionals participated from FM and MM levels, two respondents from TM level made contribution to this research.

The distribution of the respondents' level of experience demonstrated that 50% of the respondents had experience level between 11-20 years in the field. Only three of the FM level participants' experience level was between 6-10 and this distribution shows that the respondents from CT possessed a high level of experience which is supposed to provide a positive impact on the accuracy of their perceptions and understandings.

The quantitative data that was collected from the case was analysed using REI approach (Chapter 5). Findings were ranked and importance levels were determined using the normalisation technique (N1), which was explained in the detail in Chapter 5. The values that were used in the normalisation technique to determine the

importance levels of the agile technology diffusion capabilities are presented on Table 6.10.

Table 6.10 : Values that are used in determining the importance level ranges of CT.

CT			
Mean			0.803
Stand.Dev.			0.069
IL		**Max.**	**Min.**
H	1	0.699	0.000
H-M	2	0.769	0.699
M	3	0.838	0.769
M-L	4	0.908	0.838
L	5	1.000	0.908

When the answers of CT employees were analysed (Table 6.11); the weakest area appears as the ability to make decisions quickly (1).

Table 6.11 : Importance levels of the Responsiveness capabilities based on REI.

CC	Capability	Mean	S.D.	REI	Rank	Imp. Level
RA1	Ability to be aware of emerging technologies, trends and changes in the industry	3.90	0.994	0.780	11	M
RA2	Ability to be aware of level of organisation's resources	3.70	0.949	0.740	7	H-M
RA3	Ability to be aware of organisation's external connectivity	3.80	1.033	0.760	9	H-M
RA4	Ability to be aware of organisation's internal connectivity	4.10	0.738	0.820	14	M
RA5	Ability to analyse the potential risks of change on organisational resources	3.70	0.823	0.740	5	H-M
RA6	Ability to analyse the potential consequences of change on organisational resources.	4.30	0.483	0.860	16	M-L
RC1	Ability to define a clear strategic vision for organisation	3.60	0.699	0.720	3	H-M
RC2	Ability to direct the organisation in sudden change and crisis.	4.20	0.919	0.840	15	M-L
RC3	Ability to manage knowledge efficiently	4.30	0.483	0.860	17	M-L
RC4	Ability to ensure successful decisions by sharing knowledge efficiently	3.80	0.919	0.760	8	H-M
RC5	Ability to make tough decisions quickly	2.90	0.876	0.580	1	H
RC6	Authorise staff to make decisions in case of sudden changes.	4.40	0.516	0.880	18	M-L
RR1	Ability to assess recovery needs in sudden/unpredicted change	3.60	0.966	0.720	4	H-M
RR2	Ability to assess recovery needs in planned change	4.00	0.471	0.800	12	M
RR3	Ability to develop a recovery plan in sudden change.	3.90	0.876	0.780	10	M
RR4	Ability to develop a recovery plan for planned change.	4.00	0.667	0.800	13	M
RR5	Ability to quickly reorganise the resources in sudden change	3.70	0.823	0.740	6	H-M
RR6	Ability to implement the recovery plan	3.40	0.516	0.680	2	H

The implementation of the recovery plan that is developed to soften the impact of change and the ability to assess the recovery needs in unpredicted change (4) take attention as the abilities that are needed to be improved, primarily. In addition to these, company's ability to define a clear strategic vision and to convey it to all levels of management (3) was reported as problematic, compared to other abilities.

The analysis of the data regarding the flexibility capability of CT (Table 6.12) showed that cost is neglected when the company needs to develop alternative processes to overcome the negative effects of an unpredicted change.

Table 6.12 : Importance levels of the Flexibility capabilities based on REI.

CC	Capability	Mean	S.D.	REI	Rank	Imp. Level
FH1	Staff's ability to work in different positions and responsibilities	4.30	0.823	0.860	14	M-L
FH2	Staff's enthusiasm to develop skills and abilities	3.90	0.738	0.780	6	M
FH3	Ability to learn new procedures quickly	4.10	0.738	0.820	10	M
FH4	Being eager to share information to learn from other	3.80	0.789	0.760	4	H-M
FH5	Ability to change work habits as a response to changes in the demands	3.70	0.823	0.740	3	H-M
FH6	Ability to act efficiently even under uncertain and ambiguous conditions.	4.00	0.667	0.800	7	M
FI1	Scalability of IT infrastructure	4.20	0.632	0.840	12	M-L
FI2	Modularity of IT infrastructure	3.90	0.568	0.780	5	M
FI3	Facility of IT infrastructure	3.50	0.972	0.700	2	H-M
FI4	Modernity of IT infrastructure	4.60	0.516	0.920	18	L
FI5	Connectivity of IT infrastructure	4.50	0.527	0.900	17	M-L
FI6	Compatibility of IT infrastructure	4.30	0.823	0.860	15	M-L
FP1	Ability to develop a range of possible solutions in a sudden change	4.10	0.568	0.820	9	M
FP2	Ability to develop range of possible solutions in planned change	4.40	0.516	0.880	16	M-L
FP3	Ability to provide solutions within optimum time and cost difference in sudden change.	3.40	0.699	0.680	1	H
FP4	Ability to provide solutions within optimum time and cost difference in planned change.	4.10	0.738	0.820	11	M
FP5	Ability to provide similar results in sudden change.	4.00	0.667	0.800	8	M
FP6	Ability to provide similar results in planned change	4.30	0.675	0.860	13	M-L

The analysis of the process flexibility ability demonstrates that CT has weakness in developing solutions for unpredicted change. Even though the company seems capable in providing IT flexibility, ability to provide facility (2) and modularity of IT infrastructure seems to be lacking, compared to other areas. The responses given for the assessment of HR flexibility point out the need in development of the abilities; to

change work habits as a response to change (3) and to be eager to share information and learn each other in order to adapt to change quickly (4).

The responses regarding CT's competence of managing diffusion process indicate that (Table 6.13) the company does not have a strategic plan to encourage its employees to use new technology efficiently (1). Top management was criticised for not being able to develop a culture, which is innovative as well as collaborative in approaching the implementation of novel technologies. While the company gives importance to improve staff's skill, knowledge and attitude towards new technology, development of a strategy to improve top management's knowledge (3) is primarily needed. Another area that the company needs to improve is to revise its HR strategy to recruit IT and innovation ready staff (4).

Table 6.13 : Importance levels of the Competence capabilities based on REI.

CC	Capability	Mean	S.D.	REI	Rank	Imp. Level
CL1	Empower staff to take their decisions	4.10	0.738	0.820	8	M
CL2	Provide incentives for efficient use of new tech.	4.20	0.789	0.840	11	M-L
CL3	Development of an innovative culture	4.00	0.943	0.800	5	M
CL4	Development of a collaborative culture	4.00	0.943	0.800	6	M
CL5	Ability to develop trust to enable information sharing	3.80	0.919	0.760	2	H-M
CL6	Ability to develop trust to superiors	4.50	0.527	0.900	17	M-L
CM1	Ability to reengineer the processes	4.20	0.632	0.840	10	M-L
CM2	Ability to clarify changes in roles and responsibilities	4.10	0.738	0.820	9	M
CM3	Ability to provide service and technical support within the company	4.30	0.483	0.860	13	M-L
CM4	Ability to provide technical support from outside of the company	4.40	0.699	0.880	16	M-L
CM5	Ability to develop a powerful internal communication.	4.60	0.516	0.920	18	L
CM6	Ability to develop a powerful external communication.	4.40	0.516	0.880	14	M-L
CS1	Ability to develop an IT strategy aligned with business strategy	4.10	0.568	0.820	7	M
CS2	Ability to develop a diffusion program for new technology.	4.20	0.789	0.840	12	M-L
CS3	Ability to employ IT and innovation ready staff	3.90	0.738	0.780	4	M
CS4	Ability to develop plans to encourage staff to use new technology	3.40	0.966	0.680	1	H
CS5	Ability to improve staffs' skill, knowledge and attitude towards new technology	4.40	0.516	0.880	15	M-L
CS6	Ability to improve top management's knowledge about new tech.	3.80	1.033	0.760	3	H-M

6.3.3 Agile diffusion in company T

6.3.3.1 Responsiveness

The interview findings that are related with the responsiveness capability were analysed under three sub-capabilities, which are namely;

(a) Sense, perceive and anticipate changes and risks in the environment

(b) Show immediate reaction to change and its demands

(c) Recovery from change

In this section, findings for each capability will be presented in detail, based on the sub capabilities that constitute them.

(a) Sense, perceive and anticipate changes and risks in the environment

The findings of this capability analysed under six sub capabilities which will be presented respectively;

Ability to be aware of emerging technologies, trends and changes in the industry

The responses of the participants showed that, the organisation is aware of the emerging technologies, trends and changes in the industry. However, these tracings are not done by special unit or staff that is responsible for conducting this process for the whole company. Actually it is not a process that defined by procedures either.

> e.g. "..we do not especially track them..we fulfil the requirements of the technical specifications in bid documents..","..it is done according to the requirements of the bid documents..not on periodic basis.."

The participants remarked that in every bid preparation the organisation conducts a detailed analysis especially for the technical specification requirements. It was also stated that the firms that develop innovations for construction industry, make presentation to the company in order to introduce their products.

Ability to be aware of level of organisation's resources

As it was stated for the external awareness, organisation's awareness of its own resource base is provided by the assessmets that are conducted in every bid preparation, before starting the projects. However, this assessment is not repeated on a periodical basis, after this level. Participants remarked that the company is project oriented and neglect these assessments while dealing with the operational problems;

it is not a part of corporate culture; the company does not have an innovative approach.

> e.g. "..it is done in every bid preparation..", "..it is not being assessed..the company is not aware of it..", "..such a culture has not been established..top management does not have an innovative approach.."

Ability to be aware of organisation's external connectivity

Even though there was a general positive view about organisation's awareness about how quickly it will be affected if it cannot keep in pace with the changes in the industry, it was also stated that the awareness of the organisation gets weaker by focussing fully on the projects and neglecting the changes in the bigger picture.

> e.g. "..not aware of the changes..why? because we are all project oriented..all the focus is on the projects.."

Participants also stated that the company is weak in long and middle term planning.

> e.g. "..we lack middle and long term planning..we operate fast, solve problems quickly..however the main focus is the project.."

Ability to be aware of organisation's internal connectivity

According to the interview findings, the organisation is aware of how a change in one department can an impact on the whole organisation. However, it was also emphasised that sometimes top management neglect the links and interdependencies between departments and make decisions supposing that whole organisation will adapt it sooner or later.

> e.g. "..top management sometimes makes an implementation and expects the organisation to harmonise with this change.."

Ability to analyse the potential risks of change on organisational resources

According to the interview findings, the organisation does not have a written risk analysis based on defined procedures, about the potential risks that may show up by the adoption or ignorance of the emerging technologies.

> e.g. "..there is not a written risk analysis..we discuss the potential risks..I think it is related with culture..", "..there is no standard.."

Ability to analyse the potential consequences of change on organisational resources

The participants stated that the organisation is fully aware of the impact of new technology on its actual resource base.

(b) Show immediate reaction to change and its demands

The findings of this capability analysed under six sub capabilities which were presented respectively;

Ability to define a clear strategic vision for organisation

Participants did not have a doubt about the existence of a strategic vision for the company. However, most of the employees do not have an idea about the company's aim and objectives. Participants think that this gap is related with; communication problems; the unawareness of the employees since they are working in small circles; the disinterest of the employees since their only focus is earning money.

> e.g. "..some of them do not care much..do not have ownership..", "..people are working in small loops..their focus is to earn money..most of them do not care.."
>
> e.g. "..there are problems with the communication..", "..maybe it is done but we do not know.."

Ability to direct the organisation in sudden change and crisis

Participants agreed that the mission and vision statements are taken as a guide no matter how big the impact of change is. They highlight that this is a part of the corporate culture.

Ability to manage knowledge efficiently

The findings of the interviews showed that the organisation can manage information efficiently by the help of their enterprise wide systems such as; ERP system, planning system and document control system.

Ability to ensure successful decisions by sharing knowledge efficiently

Participants generally state that the organisation gives importance to keeping people informed about the changes related to the work, in order to ensure quick and successful decisions. Besides, it is also mentioned that there may be some lags in distribution of information Participants claimed that these kind of lags usually can be seen on sites, as a result of heavy workload or leaving communication to people's initiative.

e.g. "..it is not quick..sometimes you may not be informed..", "..sometimes the information may not be shared quickly..the operation may be more important at that moment.."

Ability to make tough decisions quickly

The participants claimed that the speed of decision making, changes according to the nature and impact of the decision. While it is fast in operational units, managerial decisions take more time, especially according to their economic impact. Participants also emphasised that if it is an urgent situation the speed of decision making increases.

However the general view of the participants was pointing out the slowness of company in taking decisions. They defined the reasons for this as; high number of procedures and approvals, corporate culture, organisational structure, low level risk raking.

e.g. "..decision are slow..too much bureaucracy..", "..it is not so quick. permissions, approvals, analyses.."

e.g. "..culture is more important determinant..we cannot respond quickly..there are decisions mechanisms that are embedded in the corporate culture.."

Authorise staff to make decisions in case of sudden changes

Participants stressed that even if the organisation faces a sudden/unpredicted problem it is possible to find someone with the authority for decision making, to move things forward. It was also remarked that an opposing situation could be the choice of the manager.

e.g. "..it changes according to the manager or chief.."

(c) Recovery from change

The findings of this capability analysed under six sub capabilities which were presented respectively. Along with the capability to recover from change, the important findings of the conducted interviews, for all three main capabilities of the Responsiveness capability (R), are summarised in Table 6.14, based on experts' perceptions and understandings.

Ability to assess recovery needs in sudden/unpredicted change

Participants believed that the organisation can easily determine the recovery needs caused by an unpredicted change, based on its extensive experience.

However, it was also emphasised that this can differ from person to person.

Table 6.14 : Barriers of the responsiveness capability in company T.

Sense, perceive and anticipate changes and risks in the environment
RA1 / Ability to be aware of emerging technologies, trends and changes in the industry
Taking technical specifications as the only guide for the IT need
Lack of a specified unit/person to track these changes
Lack of defined procedures for this
RA2 / Ability to be aware of level of organisation's resources
Corporate culture does not support this (lack of innovative culture)
Lack of defined procedures for this
Seeing bid preparations enough for this assessment
RA3 / Ability to be aware of organisation's external connectivity
Focussing on projects too much and missing the big picture
Lack of mid and long term strategic planning
RA5 / Ability to analyse the potential risks of change on organisational resources
Overconfidence based on experience
Corporate culture does not support this
Lack of defined procedures for this
Show immediate reaction to change and its demands
RC1 / Ability to define a clear strategic vision for organisation
Vertical communication problems
Lack of sense of belonging
Corporate culture does not support this
RC4 / Ability to ensure successful decisions by sharing knowledge efficiently
Leaving communication to individuals' initiative
RC5 / Ability to make tough decisions quickly
Organisational structure does not allow quick decisions
Existence of old decision mechanisms based on culture
Staff's avoidance from taking initiative
RC6 / Authorise staff to make decisions in case of sudden changes.
Leadership style of the managers (delegation)
Recovery from change
RR1 / Ability to assess recovery needs in sudden/unpredicted change
Lack of such an understanding (Culture)
RR2 / Ability to assess recovery needs in planned change
Lack of such understanding
RR3 / Ability to develop a recovery plan in sudden change.
Lack of such understanding
RR5 / Ability to quickly reorganise the resources in sudden change
Lack of such a plan
Desire to protect the power balances
Top management/managers see this as a source of cost
RR6 / Ability to implement the recovery plan
Being unaware of the benefits of such a plan

Ability to assess recovery needs in planned change

It was declared that the organisation conducts an analysis about the areas that will need recovery, when the company decides to implement a change. Participants stressed that the high experience level of the employees is an advantage for the organisation in this process.

Ability to develop a recovery plan in sudden change

Even though some of the participants had doubts about the existence of such plans, TM level participants confirmed that these kind of plans exist and are known at the TM level.

Ability to develop a recovery plan for planned change.

Participants agreed that the organisation is aware of any transitional challenges that may show up during the implementation of a new technology, and capable of developing a recovery plan for a planned change.

Ability to quickly reorganise the resources in sudden change

The findings of the interviews showed that the organisation is not so quick in the reorganisation of the resources that are affected by a sudden change. While TM level point out the need for protecting power balance for this slowness, other participants claimed that the company does not have an action plan for such situations and the reaction is given spontaneously. They also emphasised that even if the organisation decides to do such a reorganisation, it would wait till a real problem occurs.

> e.g. "..this may take time..you can spoil everything if you rush for it..there can be unformal structures or different power groups within the organisation.."
>
> e.g."..we do not have such procedures but the reorganisation takes place according to the needs.."
>
> e.g. "..a reorganisation surely takes place but, they wait till the last minute.."

Ability to implement the recovery plan

The participants emphasised that these kind of reorganisations usually conducted spontaneously, without sticking to a plan. Even though such a plan is developed the implementation would not be efficient.

> e.g. "..plan is developed but I have not witnessed the implementation..", "..the implementation is problematic.."

6.3.3.2 Flexibility

The interview findings that are related with the "flexibility" capability were analysed under three sub-capabilities, which are namely;

(b) Human resources flexibility

(c) IT flexibility

(d) Process flexibility

In this section, findings for each capability will be presented in detail, based on the sub capabilities that constitute them.

(a) Human resources flexibility

The findings of this capability analysed under six sub capabilities which will be presented respectively;

Staff's ability to work in different positions and responsibilities

Participants stated that the employees are capable of working in different roles and responsibilities. On the other hand, it was stated that the company has conservative culture and usually does not change the type of work that an employee does. They mentioned that the company used to have a rotation strategy for the staff in order to improve their experience and understanding about different roles and responsibilities, yet these strategies are not valid now.

> e.g. "..people here in this company, work in the positions that they were recruited for..",
>
> e.g. "..the company has a conservative perspective about this issue..usually people work in the same position that they were requited for..the founders of the company once implemented rotation strategies, but we do not have that policy now.."

Staff's enthusiasm to develop skills and abilities

The interview findings showed that, the people in the organisation, generally, want to update their skills and abilities. However, the level of this eagerness changes according to the personality of the staff.

> e.g. "..it changes according to the individual..", "..some yes..but some are not so eager to do.."

Ability to learn new procedures quickly

The findings showed that the people in the organisation are capable of learning new procedures, quickly. But, people who have been working for the company for a long

time, may have problems to adapt to change and may want to continue working in the system that they are familiar with.

> e.g. "..may not be so quick..most of the staff have been working in the organisation for along time and this causes problems about changing the existing system..adapting to change is problematic in these terms.."

Being eager to share information to learn from other

Even though it was stated that people working in the organisation, generally share information and learn from each other, participants highlighted that opposing situations may be caused from; employee's personality, departmental secrecy or peoples wish to maintain or gain power.

> e.g. "..sometimes they share it, sometimes they do not…some chose to hide information..even though this is usually seen at levels below the FM level, sometimes engineers may also tend to do this.."

> e.g. "..we share information..if someone goes to a training he or she shares the things that was thought during that session..some may choose not to share based on their personality.."

> e.g. "..we share information..however, sometimes departmental secrecy comes into play.."

Ability to change work habits as a response to changes in the demands

The participants stated that 9 out of 10 people in the organisation have been working in the company more than 20 years. Even though this level of experience is a valuable asset for the company, it increases the chance of encountering resistance to change. Participants asserted that people in the organisation can change their habits to provide a successful response to change demands but they also note that this would not be an easy process. These people should be convinced about the benefits of new technology.

> e.g. "..even if they resist at the beginning, they can change their minds once they see the benefits.."

Participants also stressed that resistance to change resolves after a while, when the employees see top management's commitment to change.

> e.g. "..it is possible to see resistance..but it is resolved with the commitment of top management.."

Ability to act efficiently even under uncertain and ambiguous conditions

The participants claimed that the people in the organisation would certainly act efficiently and move things forward even though a problem that the staff do not have information about emerges suddenly. However, especially upper management levels expect a more proactive approach from the staff.

> e.g. "..We have problems about being proactive..we are trying to guide people to be so.."

(b) IT Flexibility

The findings of this capability analysed under six sub capabilities which were presented respectively;

Scalability of IT infrastructure

The interview findings show that company's capable to develop an IT infrastructure that is working efficiently, despite changes in the numbers of users, workloads or transactions. Participants also added that, even if there is a problem, the IT department is capable to solve it very quickly.

Modularity of IT infrastructure

It was stated that there can be problems when new software added to, modified or removed from the existing IT infrastructure. Yet, IT department of the company is capable enough to solve these problems quickly and efficiently.

Facility of IT infrastructure

The company had started to use an ERP system and it was emphasised that all software to be used in the company needs to be compatible with this system. While this provides similar interfaces for the users, the participants complained that the ERP system is not user-friendly. The responses show that the need for a user friendly system had been a topic of discussion in the organisation for a while. However the company was not aware of the benefits of the similarity of the interfaces of the software that are used in order to provide quick adaptation of the staff.

> e.g. "..I do not agree with this..you should use the software as it is..users should adapt to the software that is used.."

Modernity of IT infrastructure

Findings showed that the hardware and software that are used in the organisation are based on well-known products.

Connectivity of IT infrastructure

The company is capable to develop an IT infrastructure that allows staff to share information among different units, easily and securely.

Compatibility of IT infrastructure

The participants stated that the systems that are used in the organisation can share and use each other's data without having problems. It is also emphasised this is an important criteria for the selection of new software. The ERP system was shown as one of the facilitators of this capability. It was also emphasised that that IT department provides solutions to improve the level of interoperability whenever it is required.

(c) Process flexibility

The findings of this capability analysed under six sub capabilities which were presented respectively.

Along with the process flexibility capability, the important findings of the conducted interviews for all three main capabilities of the Flexibility capability (F), are summarised in Table 6.15, based on experts' perceptions and understandings.

Ability to develop a range of possible solutions in a sudden change

Accept some of the MM participants that asserted that the organisation is not flexible in sudden and unpredicted situations; majority of the participants claimed that the organisation is capable of creating a range of new process paths to address the unpredicted changes and the demands caused by them.

Ability to develop range of possible solutions in planned change

According to the participants' responses, the organisation is capable of designing a range of different process paths after the decision of new technology adoption.

Ability to provide solutions within optimum time and cost difference in sudden change

The findings of the interviews showed that the organisation is capable of developing alternative processes that complete in similar time and cost, even if it faces a sudden change. However, participants stressed that in sudden and unpredicted situations, cost can be of secondary importance in comparison to achieving the desired results which is the top priority of the organisation.

Table 6.15 : Barriers of the flexibility capability in company T.

Human resources flexibility
FH1 / Staff's ability to work in different positions and responsibilities
Corporate culture does not support this HR strategy does not have a rotation plan for staff
FH2 / Staff's enthusiasm to develop skills and abilities
Personality of the staff
FH3 / Ability to learn new procedures quickly
Staff's indifference towards new procedures Experienced staff do not want to change the way that they do things
FH4 / Being eager to share information to learn from each other
Personality of the staff Power balances Department related secrecy
FH5 / Ability to change work habits as a response to changes in the demands
Being unaware of the benefits of new technology
FH6 / Ability to act efficiently even under uncertain and ambiguous conditions.
Employees do not show a proactive approach (personality)
IT Flexibility
FI3 / Facility of IT infrastructure
Being unaware of the benefits of IT facility
Process flexibility
FP5/ Ability to provide similar results in sudden change.
Missing opportunities due to slow decisions

Ability to provide solutions within optimum time and cost difference in planned change

The participants agreed that the organisation is capable of planning new process paths which will be completed within the same or similar time and cost values. On the other hand, some participants also pointed out that the nature of the construction production may cause deviations.

Ability to provide similar results in sudden change

The participants stated that the organisation is capable of developing alternative process solutions with similar results even in unpredicted change. However they also underlined the importance of taking quick actions and note that otherwise it is possible to be unsuccessful.

> e.g. "..if you cannot take quick decisions and give quick responses, you cannot achieve similar results.."

Ability to provide similar results in planned change

The participants emphasised that the organisation is capable of planning alternative process paths with similar results for the successful adoption of new technology.

6.3.3.3 Competence

The interview findings that are related with the "competence" capability were analysed under three sub-capabilities, which are namely;

(a) Leadership

(b) Management of change process

(c) Strategy development

In this section, findings for each capability will be presented in detail, based on the sub capabilities that constitute them.

(a) Leadership

The findings of this capability analysed under six sub capabilities which will be presented respectively;

Empower staff to take their decisions

Even though majority of the participants confirmed the existence of empowerment of the staff to take their decisions, they also emphasised that the level of this empowerment changes according to the managers' characteristics.

> e.g. "..some managers encourage their staff and some don't.."

Provide incentives for efficient use of new technology

The participants claimed that the organisation sees the efficient use of new technology as staff's duty. Even though, efficient use is demanded from the staff, company do not provide incentives to improve the efficiency of the usage.

> e.g. "..staff should be able to use new technologies efficiently..this is not a plus but a necessity to fulfil their responsibilities.."

Development of an innovative culture

The findings demonstrated that company approaches technology as a necessity to be fulfilled in order to win the tender and take the job. Since most of the staff have been

working in the company for more than 20 years, a resistance shows up when a new technology is introduced.

> e.g. "..there is a resistance to new technologies..young staff is more familiar..the average age of the company is high.."

Development of a collaborative culture

The findings from the participant responses showed that the company possessed a collaborative culture. The participants stated that the organisation does not have an ideal homogenous nature and regarding the new technology implementation, there can be some resistances due to the characteristics of the individuals.

> e.g. "..we do not have a homogenous structure..some can resist..", "..it would be too idealistic to claim that all the staff would work collaboratively, even though some declared opposing views.."

Ability to develop trust to enable information sharing

Even though departments within the organisation actively share information with each other, participants stated that there can be contrasting examples in which people chose not to share information to protect or seize power. It was also emphasised that these kind of information gaps cause problems in the processes.

> e.g. "..there are problems about sharing information..there are coordination problems..they do not want to release the information..they do not want to lose their power.."

Ability to develop trust to superiors

Participants agreed that senior management support efforts and shows tolerance to mistakes, during new technology adoption. It was also highlighted that this support improves employees' sense of belonging to the company.

(b) Management of change process

The findings of this capability analysed under six sub capabilities which will be presented respectively;

Ability to reengineer the processes

The participants claimed that the company reorganises the business processes to provide a seamless flow of implementation, when a new technology is introduced to the company. However, the "age" of the organisation is high and the old/experienced staff would not want to change their old way of working and protect the existing process.

e.g. "..company reorganises the processes..but these staff do not want adapt to new way of working..they want to and try to protect the old implementations.."

Ability to clarify changes in roles and responsibilities

The participants stressed that the organisation informs all related staff about the changes in roles and responsibilities caused by the impact of new technology on processes. They also underlined that the organisation has been given more importance to this information sharing for the last 3-4 years.

Ability to provide service and technical support within the company

It was claimed that the organisation provides required services and technical support to improve efficiency of new technology implementation.

Ability to provide technical support from outside of the company

Findings showed that the organisation hires external consultants when needed in order to improve efficiency.

Ability to develop a powerful internal communication

It was emphasised that employees can easily exchange their views and give feedback about the implementation process with their colleagues or peers. Participants claimed that contrasting situations may occur due to the personality of the staff.

e.g. "..people can easily share their views..however there may be some who does not.."

Ability to develop a powerful external communication

The organisation was reported to has powerful external communication with external parties. On the other hand participants reminded that culture of the country also plays a significant role in the level of this communication.

(c) Strategy Development

The findings of this capability analysed under six sub capabilities which wwill be presented respectively;

Ability to align IT strategy with business strategy

The participants stated that the (new) technology that is being used, provides advantage to the organisation in achieving its goals. However, it was also claimed that the technologies that are to be implemented in the projects are determined according to the technical specifications of projects rather than IT strategy.

e.g. "..I don't think that they care about it..they just check the id documents and order the ones that are required.."

Ability to develop a diffusion program for new technology

The responses demonstrated that the organisation develops a diffusion program for new technology implementation, if it will be used by various departments of the company.

Ability to employ IT and innovation ready staff

The participants stated that the capability of using new technology is a valuable asset for being employed and taking promotion in the organisation, but not the priority. It was stressed that the priority is given to the references coming from TM and MM levels.

e.g. "..in the recruitment process, priority is on the; former employees and the applicants with references from the company..in this regard, IT and innovation readiness provides advantage but it is not determinative.."

Ability to encourage staff to use new technology

Unfortunately findings showed that top management approaches the use of new technology as something that should be done by the staff yet already. So they find this kind of encouragement unnecessary.

e.g. "..the company does not do this..we do not have a performance criteria like this..this is individuals own habit of working..", "..no..we do what is needed to finish the work..this is their primary duty.."

Ability to improve staffs' skill, knowledge and attitude towards new technology

The findings demonstrated that the organisation provides a detailed training program for staff in order to improve their skill and knowledge about how to use new technology.

Ability to improve top management's knowledge about new technology

Interview findings demonstrated that presentations about new technology that provides generic knowledge to TM level is given prior to the adoption decision, in order to convince them. Participants stated that trainings are also provided for department managers after the implementation decision, to improve their knowledge about how the system works.

e.g. "..they need to know..we have this..we are curious too..special trainings are also given to the department managers.."

e.g. "..they are given at minimum level..to provide an understanding to them.."

Table 6.16 summarises the important findings of the conducted interviews in terms of the competence to manage diffusion process (C), based on experts' perceptions and understandings.

Table 6.16 : Barriers of the competence to manage diffusion process in company T.

Leadership
CL2 / Provide incentives for efficient use of new tech.
Top management's lack of awareness about the benefits of such an implementation Top management's approach which sees using new technology efficiently as staff's duty
CL3 / Development of an innovative culture
Organisation's awareness about the benefits of new technology Innovative approach of the top management
CL4 / Development of a collaborative culture
Personality of the staff
CL5 / Ability to develop trust to enable information sharing
Power balances between departments
Management of change process
CM1 / Ability to reengineer the processes
Resistance to new processes
CM2 / Ability to clarify changes in roles and responsibilities
Leaving communication to individuals' initiative
CM5 / Ability to develop a powerful internal communication.
Personality of the staff
Strategy development
CS1 / Ability to develop an IT strategy aligned with business strategy
IT and/or IS strategy of the company is not clear Taking technical specifications as the only guide for the IT need
Lack of a detailed analysis
CS3 / Ability to employ IT and innovation ready staff
Bilateral relationships are efficient on recruitment
CS4 / Ability to develop plans to encourage staff to use new technology
Top Management's commitment to change
CS6 / Ability to improve top management's knowledge about new technology
Management's indifference towards new technology

6.3.4 Case summary for company T

The analysis of the case study findings point out that CT's ability to show response to changes, is weaker than the other core capabilities of agility. Even though the

participants emphasised the existence of delegation in the company, the speed of decision making seems as the weakest element among the other sub capabilities of responsiveness. Number of procedures and old decision mechanism based on corporate culture seems to have a significant impact on this speed. The high level of experience and skilled workforce have leaded the company to managerial blindness in which they develop an overconfidence and ignore the organisational effects of change. Even though the employees believe that CT has an efficient strategic vision, both the interview and the questionnaire results show that the company has problems in conveying the strategic vision and the objectives to all related levels and units. Findings declare that employees are not aware of the strategic intents of the company. Unfortunately employees who are not informed about the strategic visions and plans of CT have lost their motivation and feeling of ownership towards their company.

CT has a very qualified and experienced employee profile. However, this experience comes with age and employees who are used to do things in their own way, usually are not very open to "changes". People working for the company do not want to change their work habits easily, not really eager to improve their skills and abilities to adapt change and even do not want to share information if it is not really necessary. The company has a qualified and efficient IT department. Regarding the IT infrastructure, problems may occur time to time however, the IT department of the company is skilled enough to solve these problems immediately. Based on the lack of quick decision making ability, CT faces problems in providing process related solutions in unpredicted situations. As previously stated, old decision mechanisms based on culture, play a significant role on the speed of decision making, especially for the unpredicted situations.

The company, especially the top management, approaches technology as a tool that is needed to fulfil the bid requirements. In this regard, it is hard to say that IT/ IS strategies, HR strategy and Training strategies are being developed considering the requirements of technology diffusion. The reflection of this approach of top management, also can be seen in the leadership abilities of CT. The company accepts the efficient use of new technologies as staff's duty, so do not pay attention for encouraging or motivating staff in this way. Even though, the trust between superiors

and subordinates is developed, peers do not share information with each other due to the power balances, especially if they are from different units.

6.4 Company S

6.4.1 Background

Company S (CS) is the contractor firm of the Holding Group that provides services in construction, energy and construction equipment sectors. The origin of the firm goes back to 1938. It is known as one of the pioneers of the Turkish contractors that work in overseas projects and completed projects in 24 different countries. Focusing on Turkey, Middle East and North Africa (MENA) region, the Company has completed various types of projects including marine works, bridges, highways, tunnels, oilgas-power plants, power transmission lines, dams, residential-commercial-industrial buildings, water and sewage treatment plants, urban infrastructure, engineering and construction management services.

6.4.2 Quantitative data analyis

As it was stated in the Research Methodology Chapter (Chapter 5), both quantitative and qualitative data was collected in each case. The proportions of the respondents from CS are presented in Table 6.17, below.

Table 6.17 : Distribution of respondents in CS according to management level and year of experience.

Management Level	Year of Experience					TOTAL
	0 - 5	6 - 10	11 - 15	16 - 20	21 -	
Top Management	-	-	-	-	2	2
Middle Management	1*	-	2	1	-	4
First Line Management	(3+1*)	-	-	-	-	4
TOTAL	5	-	2	1	2	10

Notes: * have previous work experience in other industries

The respondents in CS were selected from three different management levels. While four professionals participated from First Line Management and Middle Management levels, two respondents from Top Management level made contribution to this research.

The distribution of the respondents' level of experience demonstrated that 50% of the respondents had an experience level that is less than 5 years. However, 40% of these people had previous work experience in other industries. While Top Management level participants all have more than 21 years of experience in the construction domain, 75% of the participants from Middle Management level has less than 16 years of experience. However, the experience levels of the participants present a balanced distribution of the different levels which is supposed to provide a positive impact on the accuracy of their perceptions and understandings.

The quantitative data that was collected from the case was analysed using REI approach (Chapter 5). Findings were ranked and importance levels were determined using the normalisation technique (N1), which was explained in the detail in Chapter 5. The values that were used in the normalisation technique to determine the importance levels of the agile technology diffusion capabilities are presented on Table 6.30.

Table 6.18 : Values that are used in determining the importance level ranges of CS.

CS			
Mean			0.797
Stand.Dev.			0.084
IL		**Max.**	**Min.**
H	1	0.672	0.000
H-M	2	0.755	0.672
M	3	0.839	0.755
M-L	4	0.923	0.839
L	5	1.000	0.923

The responses of the participants from CS show that (Table 6.19) the company has problems in implementing the recovery plan that is developed to overcome the negative impact of change on the organisation (1). The answers demonstrate that CS faces problems with recovery from change, especially if this change is not a planned one (4-5-8). Respondents emphasised that CS; has problems in managing information, cannot fully analyse the potential risks of change on organisational resources (3) and also not fully aware of the internal links and interdependencies of the organisation (6).

Table 6.19 : Importance levels of the Responsiveness capabilities based on REI.

CC	Capability	Mean	S.D.	REI	Rank	Imp. Level
RA1	Ability to be aware of emerging technologies, trends and changes in the industry	3.80	0.422	0.760	10	M
RA2	Ability to be aware of level of organisation's resources	4.00	0.943	0.800	15	M
RA3	Ability to be aware of organisation's external connectivity	4.10	0.994	0.820	17	M
RA4	Ability to be aware of organisation's internal connectivity	3.50	0.707	0.700	6	H-M
RA5	Ability to analyse the potential risks of change on organisational resources	3.20	0.789	0.640	3	H
RA6	Ability to analyse the potential consequences of change on organisational resources.	3.70	0.675	0.740	9	H-M
RC1	Ability to define a clear strategic vision for organisation	3.80	0.919	0.760	11	M
RC2	Ability to direct the organisation in sudden change and crisis.	4.50	0.527	0.900	18	M-L
RC3	Ability to manage knowledge efficiently	3.20	0.632	0.640	2	H
RC4	Ability to ensure successful decisions by sharing knowledge efficiently	3.80	1.033	0.760	12	M
RC5	Ability to make tough decisions quickly	3.60	0.516	0.720	7	H-M
RC6	Authorise staff to make decisions in case of sudden changes.	4.00	0.471	0.800	13	M
RR1	Ability to assess recovery needs in sudden/unpredicted change	4.00	0.667	0.800	14	M
RR2	Ability to assess recovery needs in planned change	3.60	0.843	0.720	8	H-M
RR3	Ability to develop a recovery plan in sudden change.	3.50	0.527	0.700	5	H-M
RR4	Ability to develop a recovery plan for planned change.	4.10	0.316	0.820	16	M
RR5	Ability to quickly reorganise the resources in sudden change	3.30	0.675	0.660	4	H
RR6	Ability to implement the recovery plan	2.90	0.738	0.580	1	H

The assessment of the respondents, regarding the flexibility capability of CS (Table 6.20), highlights the need for developing HR capability with respect to IT and process capabilities. When compared to others, the most problematic area seems as staff's ability to change their work habits as a response to changes in the demands (1).

The answers indicate that the employees have problems in sharing information and learning from each other (2) and cannot learn new procedures quickly (6) in order to harmonise with the change. The results of the analysis showed that CS is capable in providing a flexible IT infrastructure that carries out the capabilities of connectivity, compatibility scalability and modernity. The company is also capable of developing a range of possible solutions, in both planned and unplanned changes. However, in times of sudden changes, cost is neglected (3) in providing process solutions and similar results (4) cannot always be obtained.

Table 6.20 : Importance levels of the Flexibility capabilities based on REI.

CC	Capability	Mean	S.D.	REI	Rank	Imp. Level
FH1	Staff's ability to work in different positions and responsibilities	4.10	0.738	0.820	8	M
FH2	Staff's enthusiasm to develop skills and abilities	4.00	0.943	0.800	5	M
FH3	Ability to learn new procedures quickly	4.00	0.943	0.800	6	M
FH4	Being eager to share information to learn from other	3.50	0.850	0.700	2	H-M
FH5	Ability to change work habits as a response to changes in the demands	3.30	0.675	0.660	1	H
FH6	Ability to act efficiently even under uncertain and ambiguous conditions.	4.10	0.568	0.820	7	M
FI1	Scalability of IT infrastructure	4.40	0.699	0.880	17	M-L
FI2	Modularity of IT infrastructure	4.10	0.738	0.820	9	M
FI3	Facility of IT infrastructure	4.40	0.516	0.880	14	M-L
FI4	Modernity of IT infrastructure	4.60	0.516	0.920	18	M-L
FI5	Connectivity of IT infrastructure	4.30	0.675	0.860	13	M-L
FI6	Compatibility of IT infrastructure	4.20	0.789	0.840	11	M-L
FP1	Ability to develop a range of possible solutions in a sudden change	4.40	0.516	0.880	15	M-L
FP2	Ability to develop range of possible solutions in planned change	4.40	0.516	0.880	16	M-L
FP3	Ability to provide solutions within optimum time and cost difference in sudden change.	3.60	0.516	0.720	3	H-M
FP4	Ability to provide solutions within optimum time and cost difference in planned change.	4.30	0.483	0.860	12	M-L
FP5	Ability to provide similar results in sudden change.	3.90	0.568	0.780	4	M
FP6	Ability to provide similar results in planned change	4.20	0.632	0.840	10	M-L

Regarding the assessments of the capabilities needed to manage the diffusion process (Table 6.21); the lowest score was given to the top management's capability to develop trust between employees (1). Likewise, company's ability to develop a collaborative culture in terms of implementation of new technologies was reported as the second in the ranking of the weaknesses of CS.

Ability to develop an innovative culture is again one of the areas that need attention with its rank of 6th. The results of the analysis demonstrated that the ability to reengineer processes (3) and the clarification of changes in roles and responsibilities (4) caused by the implementation of new technologies are the areas that need attention. The company seems to neglect developing plans that will encourage employees to use new technology but pays attention to the IT and innovation readiness of the staff in the recruitment process.

Table 6.21 : Importance levels of the Competence capabilities based on REI.

CC	Capability	Mean	S.D.	REI	Rank	Imp. Level
CL1	Empower staff to take their decisions	4.10	0.738	0.820	8	M
CL2	Provide incentives for efficient use of new tech.	4.20	0.789	0.840	11	M-L
CL3	Development of an innovative culture	4.00	0.943	0.800	5	M
CL4	Development of a collaborative culture	4.00	0.943	0.800	6	M
CL5	Ability to develop trust to enable information sharing	3.80	0.919	0.760	2	H-M
CL6	Ability to develop trust to superiors	4.50	0.527	0.900	17	M-L
CM1	Ability to reengineer the processes	4.20	0.632	0.840	10	M-L
CM2	Ability to clarify changes in roles and responsibilities	4.10	0.738	0.820	9	M
CM3	Ability to provide service and technical support within the company	4.30	0.483	0.860	13	M-L
CM4	Ability to provide technical support from outside of the company	4.40	0.699	0.880	16	M-L
CM5	Ability to develop a powerful internal communication.	4.60	0.516	0.920	18	L
CM6	Ability to develop a powerful external communication.	4.40	0.516	0.880	14	M-L
CS1	Ability to develop an IT strategy aligned with business strategy	4.10	0.568	0.820	7	M
CS2	Ability to develop a diffusion program for new technology.	4.20	0.789	0.840	12	M-L
CS3	Ability to employ IT and innovation ready staff	3.90	0.738	0.780	4	M
CS4	Ability to develop plans to encourage staff to use new technology	3.40	0.966	0.680	1	H
CS5	Ability to improve staffs' skill, knowledge and attitude towards new technology	4.40	0.516	0.880	15	M-L
CS6	Ability to improve top management's knowledge about new tech.	3.80	1.033	0.760	3	H-M

6.4.3 Agile diffusion in company S

6.4.3.1 Responsiveness

The interview findings that are related with the responsiveness capability were analysed under three sub-capabilities, which are namely;

(a) Sense, perceive and anticipate changes and risks in the environment

(b) Show immediate reaction to change and its demands

(c) Recovery from change

In this section, findings for each capability will be presented in detail, based on the sub capabilities that constitute them.

(a) Sense, perceive and anticipate changes and risks in the environment

The findings of this capability analysed under six sub capabilities which will be presented respectively;

Ability to be aware of emerging technologies, trends and changes in the industry

The organisation does not have a department or an authorised staff to monitor emerging technologies or track trends and changes that take place in the industry. Departments conduct these processes on their own, according to their needs. The participants stated that the company becomes aware of these changes when the implementation of a new technology is required in bid documents. It was stated that the company had been known as the leader in the market in terms of construction innovation development. In this regard, this level of experience brings overconfidence.

> e.g. "..there is tracking when we can find time..it is not based on a systematic..departments pursue this tracking on their own.."
>
> e.g. "..tracking new technologies is not a part of corporate culture..it can't be done if someone does not take the leadership.."
>
> e.g. "..it is based on the technical requirements that are stated on the bid documents..it is not deemed necessary to search for a better one..tracings are individual based.."

Ability to be aware of level of organisation's resources

The participants stated that the organisation periodically assesses its resource base and is aware of the needs. They also added that these assessments are not being done according to defined procedures. Based on these findings it is possible to say that these assessments are conducted due to the needs of bid preparations. As it was also stated by some of the participants, they are not a part of corporate culture, yet.

> e.g. "..this is not a part of corporate culture..it has not become a habit of the organisation.."
>
> e.g. "..the company does not have a grasp of the quality of human resources..again regarding the technology, some departments are unaware.."

Ability to be aware of organisation's external connectivity

The interview findings showed that the company is confident about its experience in analysing the changes and links in the industry. However, some participants claimed that the company is overconfident and not totally aware of how quickly it will be affected if it cannot keep in pace with the changes in the industry.

> e.g. "..they are not aware of it..they assume that the risk can be managed..the company is confident..", "..even though there are efforts to develop a system about this ability, it is still not totally adopted by the staff.."

Ability to be aware of organisation's internal connectivity

Participants, especially from MM and FM levels, stressed that departments work disjointedly, which was mentioned by some of the participants as "vertical silo syndrome". It was claimed that company makes decisions, neglecting the links and interdependencies between departments, and acts according to the situations. Some argued that this can be resulted from communication problems between departments that are based on heavy workload.

> e.g. "..departments are evaluated as individual units..they do not pay attention to the interactions between them.."
>
> e.g. "..they do not pay attention to the interactions between units..they just implement something and wait to see what will happen.."
>
> e.g. "..there is a silo type management..they work independently and disconnectedly..company is trying to integrate them.."

Ability to analyse the potential risks of change on organisational resources

According to the participants' responses, the company does not conduct a detailed analysis about the potential risks that may show up by the adoption or ignorance of the emerging technologies. It was stated that an analysis that is focussed on how new technology will affect/will be affected by IT infrastructure and how much will it cost to the company. On the other hand, it was also indicated that this type of an analysis is conducted only for the ones that are to be used in macro scale, not only in one department. Participants argued the possible reasons for not conducting a detailed written risk analysis as; heavy workload, time constraints, communication problems, corporate culture, high level of assurance that company possess (based on its experience).

> e.g. "..it is not an assessment in this level.."
>
> e.g. "..it may be done for macro level softwares or technologies..not for the ones that are used department based..the possible impacts of new technology are questioned with the IT department.."
>
> e.g. "..it is based on experience..we do not have a written implementation..company does not have this culture..we have very experienced managers and we have high level of self-confidence.."
>
> e.g. "..it is not analysed thoroughly..there can be communication problems.."

e.g. " ..we do not have a risk analysis..do not have time for this..people are over-busy..it is neglected..we do not assess what can be a risk.."

Ability to analyse the potential consequences of change on organisational resources

The participants stated that the organisation is aware of the impact of new technology on its actual resource base. However, it was claimed that spoken assessments are carried out rather than written analyses about the potential consequences of change, which are not based on defined procedures. Participants also mentioned that there can be times in which the organisation just decides to do the implementation and act according to the reactions, rather than conducting and analysis.

e.g. "..it is not based on defined procedures.."

e.g. "..they usually implement the change and wait for its reflections.."

(b) Show immediate reaction to change and its demands

The findings of this capability analysed under six sub capabilities which will be presented respectively;

Ability to define a clear strategic vision for organisation

The participants stated that the company is capable of defining a clear strategic vision and top management gives importance to the assimilation of strategic approach by the whole company. However, responses showed that these efforts have a poor reflection on the lower levels due to the vertical communication problems.

e.g. "..no, there are problems in vertical communication..maybe they are not passed over to the lower levels of management..maybe they are not informed.."

e.g. ".top management puts real effort on this..they share this information with managers on meetings but there are problems with the vertical movement of information..these efforts do not reflect on the lower levels.."

Ability to direct the organisation in sudden change and crisis.

The participants argued that, even in sudden changes or a crisis, the company takes its mission and vision statements as a guide, no matter how big the impact of change is. It is emphasised that this is a part of the corporate culture.

Ability to manage knowledge efficiently

The interview findings highlighted that the organisation has a great data repository provided by the scale and the experience of the company but it was also declared that there are problems in transforming data to information and utilising it in the other projects of the company. Participants claimed that in order to provide a systemic and sustainable nature, the procedures about this process need to be reorganised according to the recent efforts.

e.g. "..a huge amount of data is being collected but, we have some deficiencies in transforming data to information.."

e.g. "..the amount of data is huge..it should be accessible..we need a legacy archive.."

e.g. "..there some communication problems between departments..information sharing procedures are problematic.."

Ability to ensure successful decisions by sharing knowledge efficiently

Participants stated that, in order to ensure quick and successful decisions, the organisation gives importance to keeping people informed about the changes related to the work. It was declared that there can be communication lags, time to time and emphasised that the act of sharing information should not be under the initiative of individuals but rather be carried out according to defined procedures.

e.g. "..there can be lags..even in organisational changes.."

e.g. "..knowledge sharing should not be left to individuals' initiative..processes are not defined.."

Ability to make tough decisions quickly

Participants underlined that the speed of decision making changes according to the nature and impact of the decision and declared that the organisation is slow in making decisions. They point out the need of; clarification in the roles and responsibilities, the rearrangement of the organisational structure, and improving communication between sites and headquarters, in order to support quick decision making.

e.g. "..this changes according to the decision..selection of the staff and the organisational structure are all important determinants.."

e.g. "..the speed of response should be high..in order to ensure this, competence is needed..the roles and responsibilities should be clearly identified.."

e.g. "..this changes according to the situation and people..some can take it quickly, some can't.."

Authorise staff to make decisions in case of sudden changes

Participants stated that even if the organisation faces a sudden/unpredicted problem it is possible to find someone with the authority of decision making, to move things forward. However, in order to improve the level of delegation in the company, the need for clarifying roles and responsibilities and the supporting staff to take initiative are indicated as the steps to be taken to achieve significant success.

e.g. "..we need to improve the level of delegation.."

e.g. "..roles and responsibilities should be clarified.."

e.g. "..the level of delegation may not be at the same level in all departments.."

(c) Recovery from change

The findings of this capability analysed under six sub capabilities which will be presented respectively;

Ability to assess recovery needs in sudden/unpredicted change

Participants stated that the organisation can easily determine the recovery needs caused by an unpredicted change as a result of its extensive experience. However it was also emphasised that the efficiency of this assessment can differ from person to person so establishment of homogeneity in the company is needed.

Ability to assess recovery needs in planned change

Participants stated that a detailed analysis to determine the recovery needs is being conducted, when the company decides a change. However, this analysis is carried out according to managers' experiences rather than a defined action plan.

e.g. "..we do not have a written analysis for this..", "..we do not have written assessments but these issues are solved by experience of the managers.."

Ability to develop a recovery plan in sudden change

The responses of the participants showed that the company does not have a recovery plan for sudden change. It deals with these kinds of issues with its experienced and qualified staff.

e.g. "..we do not have a written plan.."

e.g. "..such a plan does not exists..company move things forward by experience.."

e.g. "..the qualified staff is the advantage of the company..even if a problem occurs they can find a solution quickly.."

Ability to develop a recovery plan for planned change

Participants stated that company is aware of any transitional challenges that may show up during the implementation of a new technology. However, the heavy workload and the speed requirements can limit this awareness by not allowing to conduct a very detailed analysis.

e.g. "..this awareness is at generic level..not in detail..because of the heavy workload and the speed requirements.."

Ability to quickly reorganise the resources in sudden change

The responses from the participants showed that company is not so quick in terms of reorganisation of resources that are affected by sudden change. Participants stated that there would be no action till a problem occurs. It was stated that company does not have this approach.

e.g. "..if the company is prepared for this, if the previous experiences are recorded and analysed and then it is possible.."

Ability to implement the recovery plan

The responses of the participants showed that the company have problems regarding the implementation of recovery plan. While TM participants presented; the size of the company, number of international projects and existence of joint ventures as the reasons for this problem, other participants pointed out different determinants such as;

- Lack of qualified human resource
- The quick changes of needs due to the dynamism of the environment (market)
- Heavy workload and the different priorities accordingly
- Lack of enforcement in some cases

e.g. "..we are weak in the implementation phase..we extend it over a period of time..there are 7000 people working in 15 different projects that take place in 6-7 different countries..it takes time to implement these in all projects.."

e.g. "..needs change so quickly..we are in a very dynamic environment..following up and giving feedback are extremely important..there are problems in building this system..it is related with heavy workload and prioritisation..sometimes priorities are not declared clearly..accountability is a must and there should be sanctions..when these sanctions do not exist, you face with excuses rather than finished tasks.."

Table 6.22 summarises the important findings of the conducted interviews in terms of the responsiveness capability (R), based on experts' perceptions and understandings.

Table 6.22 : Barriers of the responsiveness capability in company S.

Sense, perceive and anticipate changes and risks in the environment
RA1 / Ability to be aware of emerging technologies, trends and changes in the industry
Overconfidence based on experience Taking technical specifications as the only guide for the IT need Corporate culture does not support this Lack of a specified unit/person to track these changes Lack of defined procedures for this
RA2 / Ability to be aware of level of organisation's resources
Corporate culture does not support this (lack of innovative culture) Lack of defined procedures for this
RA3 / Ability to be aware of organisation's external connectivity
Overconfidence based on experience
RA4 / Ability to be aware of organisation's internal connectivity
Communication problems between units (departments) Disregarding the interaction between its units
RA5 / Ability to analyse the potential risks of change on organisational resources
Unawareness of the interaction between People Process and Technology Overconfidence based on experience Corporate culture does not support this Lack of defined procedures for this
RA6 / Ability to analyse the potential consequences of change on organisational resources
Unawareness of the interaction between People Process and Technology Lack of defined procedures for this
Show immediate reaction to change and its demands
RC1 / Ability to define a clear strategic vision for organisation
Vertical communication problems
RC3 / Ability to manage knowledge efficiently
Problems with transforming data to information Data storage problems Inefficient procedures for information management
RC4 / Ability to ensure successful decisions by sharing knowledge efficiently
Leaving communication to individuals' initiative

Table 6.22 (continued) : Barriers of the responsiveness capability in company S.

Lack of defined procedures
RC5 / Ability to make tough decisions quickly
Organisational structure does not allow quick decisions Ambiguousness of roles and responsibilities Staff's avoidance from taking initiative
RC6 / Authorise staff to make decisions in case of sudden changes.
Staff's avoidance from taking initiative Ambiguousness of roles and responsibilities Leadership style of the managers (delegation)
Recovery from change
RR2 / Ability to assess recovery needs in planned change
Lack of such understanding Lack of defined procedures for this
RR3/ Ability to develop a recovery plan in sudden change
Lack of such understanding Lack of defined procedures for this
RR4 / Ability to develop a recovery plan for planned change
Lack of a detailed analysis as a result of heavy workload
RR5 / Ability to quickly reorganise the resources in sudden change
Lack of such a plan
RR6 / Ability to implement the recovery plan
Lack of sanctions for not implementing the developed plans Difficulties in the control of the implementation due to the size of the company

6.4.3.2 Flexibility

The interview findings that are related with the "flexibility" capability will be analysed under three sub-capabilities, which are namely;

(a) Human resources flexibility

(b) IT flexibility

(c) Process flexibility

In this section, findings for each capability will be presented in detail, based on the sub capabilities that constitute them.

(a) Human resources flexibility

The findings of this capability analysed under six sub capabilities which were presented respectively;

Staff's ability to work in different positions and responsibilities

The responses showed that the people working in the company are able to work in different positions and under different responsibilities. However, it was also indicated that it is not something that is preferred and the staff have the right to reject such an arrangement. On the other hand participants from middle and lower levels indicated that some of the departments implement internal rotations and give their staff multiple tasks. Yet this is not a part of the HR strategy of the company and the employees are not given tasks according to their actual level of capabilities. Along with this, it was also emphasised that the company has started to question these kind of capabilities during the recruitment process, a short while ago and this can be accepted as an indicator, which shows the advancements in company's HR strategy. Yet, the reflections of these changes have not been seen in practice.

> e.g. "..it is only done in times of crisis..it is not a part of our culture.."
>
> e.g. "..some units have internal rotations and multi tasking.."
>
> e.g. "..in my opinion the employees are not given tasks that will fit to their level of capabilities..the capabilities of the employees are not efficiently used.."
>
> e.g. "..the company is changing quickly..the recruitment strategies of HR department also changed..they have a more intense analysis which covers these issues.."

Staff's enthusiasm to develop skills and abilities

Participants claimed that people working in the organisation are eager to update their skills and abilities. Besides, it was also emphasised that the level of this eagerness is related with the employee's personality and can show difference from person to person. It was also stressed that sometimes staff cannot participate in trainings, even if they want to, because of the heavy workload.

> e.g. "..this changes from person to person..the company encourages its staff..sometimes they cannot participate because of the heavy workload..sometimes they are not willing to participate.."

Ability to learn new procedures quickly

Participants declared that staff are capable about learning new procedures quickly. However, there can be problems in the implementation phase. It was emphasised that it is hard for staff, especially the experienced ones, to change their way of doing

things. Another factor which can be accepted as effective is staff's indifference towards changes in the procedures.

e.g. "..they can understand but do not implement.."

e.g. "..they can learn however implementation is problematic..it is hard for them to change their habits.."

e.g. "..they can not..this is a problem..they are not interested.."

Being eager to share information to learn from other

Findings showed that people in the company are happy to share information and learn from each other, but it was also stated that sometimes there can be problems, caused by heavy workload. Participants emphasised that the company is not homogeneous and the level of this interaction changes according to individuals' personality.

e.g. "..it is not based on bad intention..it isrelated with time.."

e.g. "..the company is not homogenous..it is up to individuals.."

Ability to change work habits as a response to changes in the demands

Participants asserted that people in the organisation can change their habits to provide a successful response to change demands only if they believe in the benefits of change. Otherwise having resistance to change is quite possible. It was emphasised that the commitment of top management is very important for enabling this change.

e.g. "..experienced staff do not want to change the way that they used to do things..because they think that this is the right way..they should be convinced.."

e.g. "..this is not easy..top management's commitment to change is very important.."

Ability to act efficiently even under uncertain and ambiguous conditions

Participants stated that, people in the company would certainly act efficiently and move things forward, even though a problem that they do not have information about, emerges suddenly. This is a part of their culture and the employees are proactive and result oriented. However, it was also highlighted that this is also related with the department managers.

e.g. "..it is in our culture.."

e.g. "..they are proactive.."

e.g. "..it is related with the department chiefs.."

(b) IT Flexibility

The findings of this capability analysed under six sub capabilities which will be presented respectively;

Scalability of IT infrastructure

The findings showed that organisation's IT infrastructure is capable of working efficiently despite changes in the numbers of users, workloads or transactions.

Modularity of IT infrastructure

Participants stated that they do not have problems when new software added to, modified or removed from the existing IT infrastructure. It was noted that even if a problem occurs, IT department is capable to solve it quickly.

Facility of IT infrastructure

Participants declared that the company pays attention to the similarity of the interfaces of the software that are used, in order to provide quick adaptation of the staff. They pointed out the efforts to improve the designs and make them more user-friendly.

Modernity of IT infrastructure

The findings showed that the hardware and software that are used in the organisation are based on well-known products.

Connectivity of IT infrastructure

Most of the participants declared that IT infrastructure allows staff to share information among different units, easily and securely. However, it was also remarked that there may be problems in the IT infrastructure of site offices. Yet, it was also emphasised that IT department is highly capable of solving any problem that may occur, very quickly.

e.g. "..we do not have any problem at the headquarters but sites can have problems.."

Compatibility of IT infrastructure

It was stated that the systems that are used in the organisation can share and use each other's data without having problems. Participants also highlighted the advantage that the ERP system provides in this exchange.

(c) Process flexibility

The findings of this capability analysed under six sub capabilities which will be presented respectively;

Ability to develop a range of possible solutions in a sudden change

Participants confirmed that the organisation is capable of creating a range of new process paths to address the unpredicted changes and the demands caused by them.

Ability to develop range of possible solutions in planned change

Participants believed that the company is capable of designing a range different process paths after the decision of new technology adoption. However, it was claimed that the company does not have this foresight and does not have such a planning habit.

> e.g. "..the company does not have such a foresight..does not have such a planning habit.."

Ability to provide solutions within optimum time and cost difference in sudden change

During interviews it was stated that the organisation is capable of developing alternative processes, which complete in similar time and cost, even if it faces a sudden change. However, participants also stressed that in sudden and unpredicted situations, cost can be of secondary importance in comparison to achieving the desired results which is the top priority of the organisation.

> e.g. "..rather than acting with a cost perspective, the solutions would be result oriented..but time would still be an important determinant.."

Ability to provide solutions within optimum time and cost difference in planned change

Since it is a planning habit, participants who trust the planning capability of their company claimed that the company is capable of planning new process paths which will be completed within the same or similar time and cost values.

Ability to provide similar results in sudden change

It was indicated that the company is capable of developing alternative process solutions with similar results even in unpredicted change.

Ability to provide similar results in planned change

As it is in sudden change, participants confirmed that the company is capable of planning alternative process paths with similar results for the successful adoption of new technology.

Table 6.23 summarises the important findings of the conducted interviews in terms of the flexibility capability (F), based on experts' perceptions and understandings.

Table 6.23 : Barriers of the flexibility capability in company S.

Human resources flexibility
FH1 / Staff's ability to work in different positions and responsibilities
HR strategy does not have a rotation plan for staff Recruitment strategy does not question the existence of this capability
FH2 / Staff's enthusiasm to develop skills and abilities
Personality of the staff Heavy workload
FH3 / Ability to learn new procedures quickly
Staff's indifference towards new procedures Experienced staff do not want to change the way that they do things
FH4 / Being eager to share information to learn from other
Personality of the staff Heavy workload
FH5 / Ability to change work habits as a response to changes in the demands
Being unaware of the benefits of new technology Corporate culture does not support this
FH6 / Ability to act efficiently even under uncertain and ambiguous conditions.
Employees do not show a proactive approach (personality)
IT Flexibility
FI5 / Connectivity of IT infrastructure
The IT infrastructure of the area that the project will take place
Process flexibility
FP2 / Ability to develop range of possible solutions in planned change
The company does not have this approach
FP3 / Ability to provide solutions within optimum time and cost difference in sudden change.
The company does not have this approach

6.4.3.3 Competence

The interview findings that are related with the "competence" capability were analysed under three sub-capabilities, which are namely;

(a) Leadership

(b) Management of change process

(c) Strategy development

In this section, findings for each capability will be presented in detail, based on the sub capabilities that constitute them.

(a) Leadership

The findings of this capability analysed under six sub capabilities which will be presented respectively;

Empower staff to take their decisions

In the company it was stated that the employees are encouraged to take their own decisions and take initiative when needed. However it was also remarked that there is a vertical communication gap and claimed that top management's workload and the low level of delegation are the reasons behind it.

> e.g. "..even though there is an encouragement, the communication is weak..there are communication gaps between top management and other levels..it is related with the high number of site visits..in this regard delegation is problematic.."

Provide incentives for efficient use of new technology

Participants stated that in the use of new technology is encouraged and supported in their organisation. Top management's awareness of the benefits and the existence of little competitions to encourage this efficiency were highlighted.

Development of an innovative culture

Participants stated that the people working in the company, all believe in the importance of using new technologies. However, the level of this belief or level of awareness changes from person to person.

> e.g. "..it varies from person to person.."

Development of a collaborative culture

It was indicated that the company possesses a collaborative culture. However, participants claimed that the ones that are against the new technology during decision phase can show a passive (silent) resistance and if they see problems related with the processes, they can even sabotage them.

> e.g. "..they show passive resistance.."

e.g. "..they wait for it to see if it works or not..if they see a problem they can even sabotage the process.."

Ability to develop trust to enable information sharing

The participants stated that departments within the organisation actively share information with each other. However, they also noted that communication problems between departments can be seen. While some of the participants believed that these problems are results of heavy workload but not of malice prepense, some of them emphasised that some departments do not want to share information on purpose.

e.g. "..information sharing is not efficient..it is not of malice prepense but because of not having enough time.."

e.g. "..it changes according to the situation..some departments do not want to..while some actively share.."

Ability to develop trust to superiors

Senior management supports efforts and shows tolerance to mistakes, during new technology adoption.

(b) Management of change process

The findings of this capability analysed under six sub capabilities which will be presented respectively;

Ability to reengineer the processes

Even though there are some positive steps to develop a powerful process management system, participants emphasised that the process reengineering is not being done periodically and efficiently, the organisation is trying to adapt "process management" concept but it is still not a part of the corporate culture.

e.g. "..assimilation is problematic..we are dealing with passive resistance..but top management supports the efforts for change.."

e.g. "..company is trying to develop processes..it is problematic.."

Ability to clarify changes in roles and responsibilities

It was stated that organisation informs all related staff about the changes in roles and responsibilities caused by the impact of new technology on processes. However, the ambiguousness of the roles and responsibilities affects the efficiency of such information. It was also declared that procedures sharing such and information

should be defined clearly and the process should be managed according to these procedures, instead of leaving it to people's initiative.

> e.g. "..this information is problematic since the roles and responsibilities are not clearly defined.."

> e.g. "..as long as there is not problem about the work, such a notification may not take place.."

Ability to provide service and technical support within the company

Participants agreed that company provides required services and technical support to improve efficiency of new technology implementation.

Ability to provide technical support from outside of the company

Findings of the interviews showed that the company employs external consultants when needed, in order to improve efficiency. However, it was also pointed out that the organisation should be aware of its own human resources, when giving the decision to hire a consultant.

> e.g. "..in some professions we have very qualified staff..the company should be aware of its own resources before hiring a consultant from outside of the company..it should be kept in mind that someone from outside cannot know the nature of company better than its staff.."

Ability to develop a powerful internal communication

The organisation has a culture that is established by its founders in which the employees express their opinions and give feedback to their colleagues and chiefs. However, participants also mentioned that the level of this communication changes according to; the personality of the staff; the level of communication between superiors and subordinates; the culture or leadership style of the managers.

> e.g. "..related with culture..lower levels complain about not having sufficient feedback from their superiors..there are some gaps in the superior-subordinate communication.."

> e.g. "..they do not feel comfortable to share the views..we are trying to change this..trying to motivate people..this is related with or culture..in order to feel comfortable to share information establishment of mutual trust is essential.."

> e.g. "..this changes according to the chief or manager.."

Ability to develop a powerful external communication

Participants agreed on the view that that the organisation can easily share information with external parties. It was reminded that conditions of the country and its culture plays a significant role in the level of this communication.

(c) Strategy development

The findings of this capability analysed under six sub capabilities which will be presented respectively.

Along with the strategy development capability, the important findings of the conducted interviews for all three main capabilities of the Competence to manage diffusion process (C), are summarised in Table 6.24, based on experts' perceptions and understandings.

Ability to develop an IT strategy aligned with business strategy

The majority of the participants, especially from the upper levels, confirmed that the (new) technology that is being used provides advantage to the organisation in achieving its goals, which can be accepted as an indicator of the alignment of business and IT strategies. However, there were some opposing views, which were stated from lower levels, stating that this alignment is not relevant for all choices. They emphasised that the organisation sometimes can have quick purchases leaded by the will of moving forward quickly.

> e.g. "..we are trying to provide this..however sometimes things move on spontaneously.."

> e.g. "..we can not get the efficiency that we want..these kinds of new software or technologies may be purchased without having detailed information, with the desire to provide a quick solution.."

Ability to develop a diffusion program for new technology

The company develops and follows a diffusion program that embraces the implementation steps of new technology, right after the decision of adoption. However, this program is developed and followed for macro sized software and technologies, not for the ones that are department based.

> e.g. "..depends on the scope of the software..not developed for every software.."

> eg. "..do not have a specified roadmap for this..things move forward depending on the experience of some staff.."

Ability to employ IT and innovation ready staff

Participants stated that the capability of using and being familiar with new technology is a valuable asset for being employed and taking promotion in the organisation. With the implementation of ERP systems, ability and experience to use

these systems also started to be questioned. It was also underlined that these qualifications are required but not seen as a must for the positions at higher levels.

Table 6.24 : Barriers of the competence to manage diffusion process in company S.

Leadership
CL1 / Empower staff to take their decisions
Managers do not want to delegate their power of decision making
Vertical communication problems
CL3 / Development of an innovative culture
Organisation's awareness about the benefits of new technology
CL4 / Development of a collaborative culture
Old / experienced staff's resistance to change
CL5 / Ability to develop trust to enable information sharing
Personal characteristics of the line managers
Power balances between departments
Management of change process
CM1 / Ability to reengineer the processes
The organisation's incapability in process management
Resistance to new processes
CM2 / Ability to clarify changes in roles and responsibilities
Leaving communication to individuals' initiative
Ambiguous roles and responsibilities
CM4 / Ability to provide technical support from outside of the company
Being aware of how to benefit from external consultancy services
CM5 / Ability to develop a powerful internal communication.
Organisation's sincerity regarding the exchange of ideas
Problems in superior-subordinate communication
Personality of the staff
Corporate culture does not support this
Strategy development
CS1 / Ability to develop an IT strategy aligned with business strategy
IT and/or IS strategy of the company is not clear
Lack of a detailed analysis
CS2 / Ability to develop a diffusion program for new technology
Lack of such an approach
CS6 / Ability to improve top management's knowledge about new tech.
Heavy workload of top management

Ability to encourage staff to use new technology

The interview findings showed that the company develops plans and encourages people, to facilitate efficient use of new technology. Participants stated that performance criteria are reorganised in a way that embraces these measures.

Ability to improve staffs' skill, knowledge and attitude towards new technology

Participants agreed that the organisation provides a detailed training program for staff about how to use new technology.

Ability to improve top management's knowledge about new technology

It was asserted that the organisation provides managerial level trainings to line managers and top management to improve their knowledge and understanding about new technology and its benefits. However, it was noted that these trainings are provided for macro level technologies. It was also pointed out that the level of participation is not so high because of the heavy workload of managerial level.

> e.g. "..these kind of trainings are provided but the participation level is not so high due to the heavy workload

Table 6.42 summarises the important findings of the conducted interviews in terms of the capability to develop business strategy (CS), based on experts' perceptions and understandings.

6.4.4 Case summary for company S

The analysis of the quantitative data, which provides the chance to make a comparison between capabilities according to their level of existence in CS, showed that responsiveness capability is the weakest area among the three core capabilities of agility. The high level of experience of its staff gives CS the chance to overcome various problems and move things forward. However, this experience also brings overconfidence, which acts as the main barrier for the development of responsiveness capability. Along with the risk assessments, this overconfidence also has a negative impact on the development of a culture, which assesses the emerging recovery needs of the company, as a result of the implementation of new technology. Another gap that CS has regarding the responsiveness capability is the lack of efficient information management protocols to guide the company in transforming the collected data into useful information.

Regarding the flexibility of resources, HR flexibility is the most problematic one, compared to IT and process flexibility. Experienced staff, who have done their jobs successfully so far, do not want to change their work habits and not so open to demands of change. If any problem occurs about IT infrastructure's compliance with

new technology, IT department of CS is capable to solve it quickly. Even though the process flexibility can be provided by the highly experienced and skilled staff, sudden/unpredicted changes can cause problems since the focus is on finishing the job ASAP.

The company is in a transition process to become more innovation ready. However, strategic plans of the company, embracing IT /IS, HR and Training strategies, are not developed to support efficient technology diffusion. The HR department does not give importance to develop plans to encourage staff for efficient use of new technology or being innovation ready have not been questioned in the recruitment process of the employees. Top management have been trying to develop an innovative culture in the company but they have not been successful yet. Despite their importance and benefits for the company, old and experienced staff play a negative role in the establishment of this culture. Even though employees trust their managers, different units of CS do not freely share information with each other, in order to keep the "power" for themselves. The company provides a comprehensive training program for the employees from different levels. However, as the level of management gets higher, the efficiency of these programs decreases. Upper level managers claim that they do not have time to attend these programs due to their heavy workload.

6.5 Summary of the chapter

This chapter focussed on the analysis of the evidence that are collected from cases. Even though a literal replication approach was adopted for case selection, both quantitative and qualitative analyses of the cases presented separately as case reports. Triangulation of the quantitative and qualitative data provided and in depth information about each case. Results of the analyses showed that, although there are little differences in particular points, all cases present a very similar profile and similar reactions when faced with a technology related change.

Next chapter presents a cross-case analysis of the findings, based on the analyses results that were provided in this chapter.

7. CROSS CASE SYNTHESIS

7.1 Introduction

Following the within case analyses that were presented in the previous chapter, this chapter presents the cross-case synthesis of the three case studies. Consisting of three main sections, the chapter will present; the details and findings of the synthesis of the quantitative findings from the three cases; the synthesis of the qualitative findings; and a description about the affects of the organisational dynamics on the Agile Technology Diffusion capabilities.

7.2 The Priority Areas to be Focussed to Enable Agility

As it was explained in detail in the research methodology and within case analysis chapters; the priorities to be focussed, based on the existence levels, were analysed using REI approach. However these index values were calculated separately, based on the responses that were collected from each case. In order to provide a synthesis from the analysis result of these three cases and determine the importance level for the different levels of capabilities (Figure 7.1), a normalisation method, which was introduced in research methodology chapter of the thesis, was used. The importance levels were determined according to the values of each level.

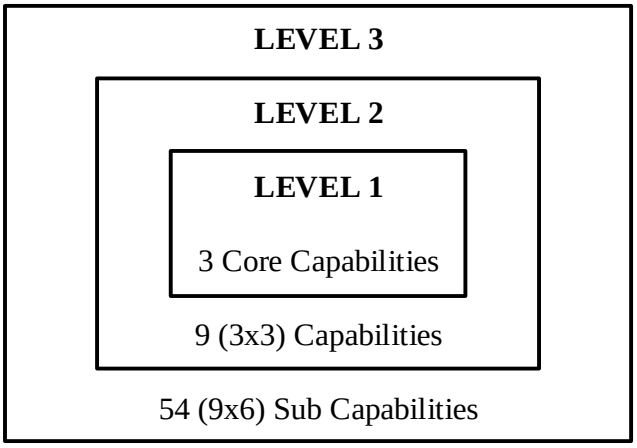


Figure 7.1 : Levels of agile technology diffusion capabilities.

In this calculation the importance level (IL) values of each case were accepted as the case responses for that factor. Based on the case responses, the total REI values (REI_T) were calculated using equation 5.2. Subsequent to the calculation of REI_T values, they were transformed into importance levels using the normalisation method (N1), which was explained in the research methodology chapter, in detail (Figure 5.6).

The REI_T values calculated for the each level were shown in Table 7.1 including the level number to the notation (REI_{T3} for Level 3, REI_{T2} for Level 2, etc.). The results of the calculations were presented in Table 7.2 as the results of the data synthesis process of the three cases.

Table 7.1 : Values that are used in determining the importance level ranges.

Level 3				**Level 2**			
Mean			0.605	Mean			0.605
Stand. Dev.			0.164	Stand. Dev.			0.109
IL_3		Max.	Min.	IL_2		Max.	Min.
H	1	0.359	0.000	H	1	0.442	0.000
H-M	2	0.523	0.359	H-M	2	0.551	0.442
M	3	0.687	0.523	M	3	0.659	0.551
M-L	4	0.851	0.687	M-L	4	0.768	0.659
L	5	1.000	0.851	L	5	1.000	0.768

The results showed that, in terms of priority, responsiveness capability is the most neglected one and has the highest priority to be focussed. Even though all three capabilities of responsiveness have the same level of priority (H-M), REI values show that recovery from change is the most neglected part among the three. Regarding the sub capabilities; implementation of a recovery plan, in sudden or planned change, seems as the most problematic area of the recovery from change. Ability to analyse the potential risks of change on organisational resources and making quick decisions are the other two sub capabilities, which have the lowest importance levels within their groups.

Flexibility of the organisational resources, takes the second place in the overall ranking of core capabilities. The REI values show that, in comparison to other two Human Resources flexibility seems as the most neglected one. Ability to change work habits as a response to change in the demands has the lowest score within the sub capabilities of HR Flexibility. The scores show that the staff do not feel so

enthusiastic to learn new skills and not so eager to share information and learn from each other.

Table 7.2 : Importance levels of the capabilities based on REI values.

CC	Capability	REI_{T3}	IL_3	REI_{T2}	IL_2	REI_{T1}	IL_1
R	**RESPONSIVENESS**						
RA	**Sense, perceive and anticipate changes and risks in the environment**					0.507	1
RA1	Ability to be aware of emerging technologies, trends and changes in the industry	0.600	3	0.511	2		
RA2	Ability to be aware of level of organisation's resources	0.533	3				
RA3	Ability to be aware of organisation's external connectivity	0.467	2				
RA4	Ability to be aware of organisation's internal connectivity	0.533	3				
RA5	Ability to analyse the potential risks of change on organisational resources	0.333	1				
RA6	Ability to analyse the potential consequences of change on organisational resources.	0.600	3				
RC	**Show immediate reaction to change and its demands**						
RC1	Ability to define a clear strategic vision for organisation	0.600	3	0.544	2		
RC2	Ability to direct the organisation in sudden change and crisis.	0.800	4				
RC3	Ability to manage knowledge efficiently	0.533	3				
RC4	Ability to ensure successful decisions by sharing knowledge efficiently	0.533	3				
RC5	Ability to make tough decisions quickly	0.267	1				
RC6	Authorise staff to make decisions in case of sudden changes.	0.533	3				
RR	**Recovery from change**						
RR1	Ability to assess recovery needs in sudden/unpredicted change	0.600	3	0.467	2		
RR2	Ability to assess recovery needs in planned change	0.533	3				
RR3	Ability to develop a recovery plan in sudden change.	0.467	2				
RR4	Ability to develop a recovery plan for planned change.	0.600	3				
RR5	Ability to quickly reorganise the resources in sudden change	0.333	1				
RR6	Ability to implement the recovery plan	0.267	1				
F	**FLEXIBILITY**						
FH	**Human Resources Flexibility**					0.641	2
FH1	Staff's ability to work in different positions and responsibilities	0.667	3	0.511	2		
FH2	Staff's enthusiasm to develop skills and abilities	0.467	2				
FH3	Ability to learn new procedures quickly	0.533	3				
FH4	Being eager to share information to learn from other	0.467	2				
FH5	Ability to change work habits as a response to changes in the demands	0.333	1				

Table 7.2 (continued) : Importance levels of the capabilities based on REI values.

CC	Capability	REI_{T3}	IL_3	REI_{T2}	IL_2	REI_{T1}	IL_1
FH6	Ability to act efficiently even under uncertain and ambiguous conditions.	0.600	3				
FI	**IT Flexibility**						
FI1	Scalability of IT infrastructure	0.667	3				
FI2	Modularity of IT infrastructure	0.600	3				
FI3	Facility of IT infrastructure	0.667	3	0.733	4		
FI4	Modernity of IT infrastructure	0.867	5				
FI5	Connectivity of IT infrastructure	0.800	4				
FI6	Compatibility of IT infrastructure	0.800	4				
FP	**Process Flexibility**						
FP1	Ability to develop a range of possible solutions in a sudden change	0.667	3				
FP2	Ability to develop range of possible solutions in planned change	0.800	4				
FP3	Ability to provide solutions within optimum time and cost difference in sudden change.	0.400	2	0.678	4		
FP4	Ability to provide solutions within optimum time and cost difference in planned change.	0.733	4				
FP5	Ability to provide similar results in sudden change.	0.600	3				
FP6	Ability to provide similar results in planned change	0.867	5				
C	**COMPETENCE**						
CL	**Leadership**						
CL1	Empower staff to take their decisions	0.667	3				
CL2	Provide incentives for efficient use of new tech.	0.667	3				
CL3	Development of an innovative culture	0.533	3	0.578	3		
CL4	Development of a collaborative culture	0.533	3				
CL5	Ability to develop trust to enable information sharing	0.400	2				
CL6	Ability to develop trust to superiors	0.667	3				
CM	**Management of change process**						
CM1	Ability to reengineer the processes	0.667	3				
CM2	Ability to clarify changes in roles and responsibilities	0.667	3				
CM3	Ability to provide service and technical support within the company	0.800	4	0.778	5	0.667	3
CM4	Ability to provide technical support from outside of the company	0.800	4				
CM5	Ability to develop a powerful internal communication.	0.867	5				
CM6	Ability to develop a powerful external communication.	0.867	5				
CS	**Strategy development**						
CS1	Ability to align IT strategy with business strategy	0.667	3				
CS2	Ability to develop a diffusion program for new technology.	0.667	3				
CS3	Ability to employ IT and innovation ready staff	0.733	4	0.644	3		
CS4	Ability to encourage staff to use new technology	0.333	1				
CS5	Ability to develop plans to improve staffs' skill, knowledge and attitude towards new technology	0.933	5				

Table 7.2 (continued) : Importance levels of the capabilities based on REI values.

CC	Capability	REI_{T3}	IL_3	REI_{T2}	IL_2	REI_{T1}	IL_1
CS6	Ability to improve top management's knowledge about new tech.	0.533	3				

Regarding the other elements of Flexibility; the skilled IT departments seem to improve their IT Flexibility scores, where as the experienced staff who are highly capable, improve the Process Flexibility scores.

Despite the high score that Competence had within the core capabilities category, it possesses some sub capabilities which have very low scores compared to overall rankings. Within the three capabilities of Competence, Leadership capabilities had the lowest score, especially the development of trust between peers. Even though the ability to develop a business strategy that will provide efficiency in IT diffusion has score which puts it in the middle of three capabilities of Competence, the ability to develop plans to encourage staff to use new technology, has one of the lowest in overall rankings.

The importance values for each level were used to provide the priorities to be focussed for the achievement of Agile Technology Diffusion.

7.3 Comparison of the Factors Affecting Agile Technology Diffusion

The results of the within case analysis uncovered various barriers causing the lack of efficiency for the sub capabilities of the companies. The aim of this section will be to understand the factors behind these barriers and their links to organisational dynamics. In this regard, the nine main capabilities will be analysed in the light of the evidence gathered from three cases.

7.3.1 Sense, perceive and anticipate changes and risks in the environment

All three organisations agree on the fact that technical specifications of the bids, determine the technology need of the company. Tracking and monitoring changes in the industry has not been seen important enough to assign any staff or to design any process. While CA and CT emphasised that this is a cultural issue, CS pointed out the fact that the company's high level of experience provides an overconfidence, which leads it to a state of nonchalance. As for the external awareness, CA and CT see the bid preparations of the projects sufficient for the assessment of internal

resources of the company. The internal audit of the organisational resources is not seen as a separate need for the companies because of the project oriented culture and none of the companies posses any arrangement for this assessment in their procedures list.

According to CS, the overconfidence based on the high level of experience appears as the only barrier regarding the unawareness of the impacts of changes on the market actors and dynamics. However, the findings from three cases show that the main problem appears as the project based focus of the companies, which causes them to miss the bigger picture. While CS is the only company that pointed out the impact of culture, both CS and CT emphasise the importance of the strategic perspective, which affects the lens that these companies see the market through.

Even though they have so little in common, companies underlined different concepts, which have impact on the companies' awareness of internal connectivity. Disregarding the interaction between units, which was declared by CA and CS seems as the most common factor. Even though, both CS and CA pointed out the importance of communication, they underlined different elements of it. While CS drew attention to the importance of an efficient communication between organisational units, CA emphasised the problems that are caused by the different perspectives of the headquarters and sites regarding the same problem. CA also indicated that, disregarding the motivation of the staff in the decisions that are taken, hampers the awareness of internal connectivity in organisations.

Even though all companies stated that they are aware of the benefits of risk management, none of them have defined procedures for analysing the potential risks of change on organisational resources. While CT and CS pointed out the lack of culture supporting this analysis, all companies agreed that awareness is needed to provide this ability. CT and CS highlighted the impact of overconfidence as a result of high level of experience. On the other hand, CA and CS underlined the need of awareness of the interaction between people, process and technology for being able to analyse, not only the potential risks but also the potential consequences of change on the organisational resources. CS also added that the lack of defined procedures for the analysis of the potential consequences of change, increases the choice of ignorance regarding this implementation.

Table 7.3 summarises the cross case synthesis results of three cases for RA capability.

Table 7.3 : The analysis results of all cases regarding RA capability.

META CODES	FC CODES	CA	CT	CS
RA1 / Ability to be aware of emerging technologies, trends and changes in the industry				
Awareness	*Overconfidence based on experience*			+
Awareness	*Taking technical specifications as the only guide for the IT need*	+	+	+
Culture	*Corporate culture does not support this*	+		+
Process Management	*Lack of a specified unit/person to track these changes*	+	+	+
Process Management	*Lack of defined procedures for this*	+	+	+
RA2 / Ability to be aware of level of organisation's resources				
Culture	*Corporate culture does not support this (lack of innovative culture)*		+	+
Process Management	*Lack of defined procedures for this*	+	+	+
Awareness	*Seeing bid preparations enough for this assessment*	+	+	
RA3 / Ability to be aware of organisation's external connectivity				
Awareness	*Overconfidence based on experience*			+
Awareness	*Focussing on projects too much and missing the big picture*	+	+	
Strategic Management	*Lack of mid and long term strategic planning*		+	
Culture	*Corporate culture does not support this*	+		
Strategic Management	*Having different priorities*	+		
RA4 / Ability to be aware of organisation's internal connectivity				
Communication	*Communication problems between units (departments)*			+
Communication	*Different perspectives of headquarters and the sites*	+		
Awareness	*Disregarding the interaction between its units*	+		+
Awareness	*Disregarding the motivation of staff*	+		
RA5/ Ability to analyse the potential risks of change on organisational resources				
Awareness	*Unawareness of the interaction between People Process and Technology*	+		+
Awareness	*Overconfidence based on experience*		+	+
Culture	*Corporate culture does not support this*		+	+
Process Management	*Lack of defined procedures for this*	+	+	+
RA6 / Ability to analyse the potential consequences of change on organisational resources.				
Awareness	*Unawareness of the interaction between People Process and Technology*	+		+
Process Management	*Lack of defined procedures for this*			+

7.3.2 Show quick reaction to change and its demands

Even though, top management level of all three companies stated the importance of strategic management and highlighted the importance that is given to define a clear strategic vision, vertical communication problems was introduced as the source of gaps in conveying these messages to lower levels. CA and CT stressed the importance of sense of belonging which leads the participants to be interested in and question the strategic changes. In addition to the given factors, CT also stated the importance of a corporate culture in which the strategic vision and plans are openly shared with all levels in the organisation. Despite of the communication problems in conveying the changes of strategic plans, the findings showed that all of the companies take mission and vision statements that reflect the values of the company as a guide when engaging in the response to sudden change.

Regarding the ability to manage knowledge efficiently, CA and CS complained about the inefficiency of the information management procedures. Along with the data collection and sharing problems companies highlight the gaps in making use of the data that is collected. ERP implementations seem as a solution for this gap but the efficiency in ERP use is again another problem that is faced. Since the knowledge management processes are not efficient, CT and CS indicated that the efficiency of communication is being determined by the individuals' initiative, which causes delays and so the gaps in ensuring successful decisions that are powered by efficient and quick information sharing. CS also emphasised that process management practices should include defined procedures to ensure the speed of information sharing. Along with the stated factors, CA declared that this speed can be hampered by heavy workload of staff or people may chose not to share the information since they think that it will be used against them.

Even if the information can reach units or actors quickly, the decision speed can still be low. All companies agreed on the negative impact of organisational structure, on the speed of decisions. Along with this, CA and CS also underlined the need for clarification of the roles and responsibilities, which can prevent staff to leave decision making to someone else in order to be free of its responsibility by using this gap. Unfortunately staff that do not trust the support of its managers, avoid taking initiative, which is another barrier pointed out by CT and CS, regarding the speed of decisions. In addition to these factors that are stated by more than one company, CA

indicated the impact of communication problems while CT argued the negative effect of the culture based old decision mechanisms that the experienced staff have been using and resist to stop following. The barriers that prevent organisations from improving the level of delegations are based on three main dynamics; leadership characteristics of the managers, which means that they may not choose to authorise their staff (stated by CA, CT and CS); the inefficient process management abilities that will clarify the roles and responsibilities (stated by CA and CS) and the lack of trust that prevent the staff to take initiatives (stated by CA and CS).

Table 7.4 summarises the cross case synthesis results of three cases for RC capability.

Table 7.4 : The analysis results of all cases regarding RC capability.

META CODES	FC CODES	CA	CT	CS
RC1/ Ability to define a clear strategic vision for organisation				
Communication	*Vertical communication problems*	+	+	+
Trust	*Lack of sense of belonging*	+	+	
Culture	*Corporate culture does not support this*		+	
RC2 / Ability to direct the organisation in sudden change and crisis.				
RC3/ Ability to manage knowledge efficiently				
Communication	*Data collection problems*	+		
Communication	*Data and information sharing problems*	+		
Communication	*Problems with transforming data to information*	+		+
Communication	*Data storage problems*	+		+
Process Management	*Inefficient procedures for information management*	+		+
RC4/ Ability to ensure successful decisions by sharing knowledge efficiently				
Process Management	*Leaving communication to individuals' initiative*		+	+
Trust	*Hiding information (individual and departmental levels)*	+		
Planning & Control	*Heavy workload*	+		
Process Management	*Lack of defined procedures*			+
RC5/ Ability to make tough decisions quickly				
Leadership	*Organisational structure does not allow quick decisions*	+	+	+
Culture	*Existence of old decision mechanisms based on culture*		+	
Process Management	*Ambiguousness of roles and responsibilities*	+		+
Communication	*Communication problems*	+		
Trust	*Staff's avoidance from taking initiative*		+	+
RC6/ Authorise staff to make decisions in case of sudden changes.				
Process Management	*Ambiguousness of roles and responsibilities*	+		+
Leadership	*Leadership style of the managers (delegation)*	+	+	+
Trust	*Staff avoid taking initiative*	+		+

7.3.3 Recovery from change

The findings of the interviews generally showed that the concept of recovery from change is usually disregarded in the construction organisations that are subject to this research. Table 7.5 summarises the cross case synthesis results of three cases for RR capability.

Table 7.5 : The analysis results of all cases regarding RR capability.

META CODES	FC CODES	CA	CT	CS
RR1 / Ability to assess recovery needs in sudden/unpredicted change				
Culture	*Lack of such an understanding (Culture)*		+	
RR2 / Ability to assess recovery needs in planned change				
Awareness	*Disregarding the opinions of the staff that will be affected by the implementation*	+		
Culture	*Lack of such understanding*		+	+
Process Management	*Lack of defined procedures for this*	+		+
RR3/ Ability to develop a recovery plan in sudden change.				
Culture	*Lack of such understanding*	+	+	+
Awareness	*Seeing this as additional work and avoiding taking responsibility*	+		
Process Management	*Lack of defined procedures for this*	+		+
RR4 / Ability to develop a recovery plan for planned change				
Awareness	*Being unaware of internal connectivity*	+		
Planning & Control	*Lack of a detailed analysis as a result of heavy workload*			+
RR5 / Ability to quickly reorganise the resources in sudden change				
Culture	*Lack of such a plan*	+	+	+
Power	*Desire to protect the power balances*		+	
Awareness	*Top management/managers see this as a source of cost*	+	+	
RR6 / Ability to implement the recovery plan				
Awareness	*Being unaware of the benefits of such an implementation*	+	+	
Leadership	*Lack of sanctions for not implementing the developed plans*			+
Planning & Control	*Difficulties in the control of the implementation due to the size of the company*			+

Within the three companies, CT declared that they do not have an approach in which the recovery needs are assessed quickly in a sudden or unpredicted change. Actually CS also agreed with CT that this kind of an implementation is also not relevant in planned changes. While CA and CS showed the lack of defined procedures as a reason for not being able to assess the recovery needs for a planned change, CA pointed out the need for taking opinions from different units that will be affected from change to improve the efficiency of such an assessment.

All companies agreed that, development of a recovery plan in a sudden change is not a part of their culture. While it was argued that this plan can be discussed verbally or developed in the mind of managers, CA and CS underlined the lack of defined procedures for such an implementation. CA also stated that even if they become aware of such a need, most of the staff would avoid taking the responsibility since they see it as an additional work. As the factors that barrier the development of such a recovery plan for a planned change, CA emphasised the unawareness of internal connectivity while CS argued that; even if such a plan could be developed it would not be a detailed and efficient one because of the heavy workloads of the staff.

All organisations agreed that, the lack of a culture that supports the development of a recovery plan in sudden change is an important barrier for the quick reorganisation of the organisational resources. CA and CT stated, that such a quick reorganisation does not take place since the managers see it as a source of extra cost. CT also indicated that managers may avoid changing the power balances within the company and not act so quickly regarding this reorganisation. In planned changes, the lack of awareness about the benefits was pointed out by CA and CT, as the factor that barriers the implementation of recovery plans. CS emphasised the hardships of controlling such implementations due to the size of the company and highlighted the importance of sanctions, especially for the concepts that the older staff are not very familiar with.

7.3.4 Human resources flexibility

All companies agreed that a rotation plan for staff should be developed as a part of the HR strategy to enable the ability of the staff to work in different positions and responsibilities efficiently. Table 7.6 summarises the cross case synthesis results of three cases for FH capability.

While CT pointed out the importance of a culture that supports such an approach, CS highlighted that it would be more advantageous to questions this skill during the recruitment process. In order to have the flexibility to switch different positions and responsibilities, staff should also be eager to develop their skills and abilities. All organisations agreed that the personality of the staff has a direct impact on this ability. In addition to this, CA and CS emphasised that, even if the people working in

the company are eager to develop their skills and abilities at the beginning, the heavy workload hampers this will, as time passes.

Table 7.6 : The analysis results of all cases regarding FH capability.

META CODES	FC CODES	CA	CT	CS
FH1 / Staff's ability to work in different positions and responsibilities				
Culture	*Corporate culture does not support this*		+	
Strategic Management	*HR strategy does not have a rotation plan for staff*	+	+	+
Strategic Management	*Recruitment strategy does not question the existence of this capability*			+
FH2 / Staff's enthusiasm to develop skills and abilities				
Characteristics	*Personality of the staff*	+	+	+
Planning & Control	*Heavy workload*	+		+
FH3 / Ability to learn new procedures quickly				
Resistance To Change	*Staff's indifference towards new procedures*	+	+	+
Resistance To Change	*Experienced staff do not want to change the way that they do things*	+	+	+
Resistance To Change	*Passive resistance from the ones that are opposing change*	+		
FH4/ Being eager to share information to learn from other				
Characteristics	*Personality of the staff*	+	+	+
Planning & Control	*Heavy workload*			+
Power	*Power balances*	+	+	
Trust	*Department related secrecy*		+	
FH5 / Ability to change work habits as a response to changes in the demands				
Leadership	*Lack of top management's commitment to change*	+		
Awareness	*Being unaware of the benefits of new technology*	+	+	+
Culture	*Corporate culture does not support this*			+
Trust	*Staff does not have a sense of belonging*	+		
FH6 / Ability to act efficiently even under uncertain and ambiguous conditions.				
Trust	*Employees do not show a proactive approach (personality)*	+	+	+

One of the similar characteristics of the three companies was the high number of experienced staff that they had. Unfortunately in all companies, the will of experienced staff to continue their job as the way they are used to do and their indifference to new procedures since they are happy with the way they have been working this far, presented as the barriers of the ability to learn and implement new procedures quickly. CA also pointed out the fact that, even if they may not declare their thoughts about being against the new implementations, staff can show passive resistance to change. Even if it is for improving the speed of adapting the needs of new technology, the personality of some people may not be suitable to share information and learn from each other. CA and CT declared that power balances both

within and between departments may also hamper this collaboration. CT mentioned that some departments may choose not to share information with others asserting the departmental secrecy. CS also stated that even if they may be open for it, heavy workload may not allow them to do so.

In such companies, which possess a high level of experienced staff, changing work habits as a response to change is not an easy task. All companies agreed that employees should be aware and believe in the benefits of new technology that will cause change. CA asserts the importance of top management's commitment to change and the need for sense of belonging of the staff to change something that they already have been doing and believed in. CS emphasises the need of corporate culture that supports such changes for the sake of company. Avoiding the uncertain or ambiguous situations is one of the reasons of the staff for not being eager to change the work habits. All companies agreed that their staff do not show a proactive approach when faced with an unexpected situation.

7.3.5 IT flexibility

Regarding the ability of developing an IT infrastructure that can work efficiently despite the changes in the number of users, workload and transactions, Table 7.7 summarises the cross case synthesis results of three cases.

Emphasising the importance of awareness, CA highlighted that the company should be aware of; the importance and benefits of IT infrastructure for the business; the actual resource base; and the importance of site offices as the units which construction production is being managed. Companies declared that even if problems occur when software modules added, modified or removed from the existing IT infrastructure, it can quickly be solved by the IT department.

Even though all of the companies had experienced the implementation process of an ERP software, both CA and CT complained about the unawareness regarding the benefits of having similar interfaces that are easy to use. All of the companies stated that the IT infrastructure they use are well known products in the industry.

CA stated that the problems they faced regarding the development of an IT structure that enable information sharing between different units easily and securely, is generally about awareness.

Table 7.7 : The analysis results of all cases regarding FI capability.

META CODES	FC CODES	CA	CT	CS
FI1 / Scalability of IT infrastructure				
Awareness	*Being unaware of the importance and benefits of IT infrastructure*	+		
Awareness	*Seeing sites as temporary bases and keeps investments at minimum*	+		
Awareness	*Being unaware of the actual resource base*	+		
FI2 / Modularity of IT infrastructure				
FI3 / Facility of IT infrastructure				
Awareness	*Being unaware of the benefits of IT facility*	+	+	
FI4/ Modernity of IT infrastructure				
FI5/ Connectivity of IT infrastructure				
Planning & Control	*The IT infrastructure of the area that the project will take place*			+
Awareness	*Being aware of the importance and benefits of IT infrastructure*	+		
Awareness	*Seeing sites as temporary bases and keeps investments at minimum*	+		
FI6/ Compatibility of IT infrastructure				

These problems of CA, were stated as; the lack of awareness of the importance and benefits of IT infrastructure, and approaching site offices as temporary bases. In addition to these CS also pointed out the importance of the IT infrastructure of the area that the project will take place. All the organisations declared that they do not have significant problems about interoperability issues and they all highlighted the existence of the efforts for improving this capability.

7.3.6 Process flexibility

The ability of the organisation to provide flexibility was questioned under three main capabilities. They were; ability to develop a range of different processes as response to change; ability to provide different processes (solutions) with optimum time and cost difference, and ability to reach similar results with the alternative processes (solutions). Process flexibility was examined as another important but ignored factor, which generally have been provided in the Turkish construction companies with the help of high level of experience and skills of the staff. Table 7.8 summarises the cross case synthesis results of three cases for FP capability.

CA claims that the ability to develop a range of possible solutions in a sudden change depends on the leadership capabilities of the managers. However, CS stressed that

companies do not have the culture of developing these kind of possible solutions in planned changes, beforehand.

Table 7.8 : The analysis results of all cases regarding FP capability.

META CODES	FC CODES	CA	CT	CS
FP1 / Ability to develop a range of possible solutions in a sudden change				
Leadership	*The leadership characteristics of the managers*	+		
FP2 / Ability to develop range of possible solutions in planned change				
Culture	*The company does not have this approach*			+
FP3 / Ability to provide solutions within optimum time and cost difference in sudden change.				
Culture	*The company does not have this approach*			+
FP4/ Ability to provide solutions within optimum time and cost difference in planned change.				
FP5/ Ability to provide similar results in sudden change.				
Leadership	*Missing opportunities due to slow decisions*		+	
FP6/ Ability to provide similar results in planned change				

According to CS, even though time and cost issues are always taken into consideration, in sudden changes companies focus on moving things forward and work quickly rather than paying attention to cost. However, if it is a planned change, time and cost values of the alternative solutions are all taken into account.

Regarding the ability to provide solutions with similar results in sudden change; CT points out the importance of taking quick decisions stating that opportunities can be missed due to slow decisions. Yet, in planned change all organisations believe that they are capable of providing solutions with desired results.

7.3.7 Leadership

Regarding the organisation's ability to motivate staff to implement new technology by; giving support, empowerment and incentives; companies indicated the impact of leadership, communication and trust related issues. Table 7.9 summarises the cross case synthesis results of three cases for CL capability.

CA and CS indicated that managers' choice of leadership style which prevents them to delegate their power to take decisions, hinders the efforts to motivate to staff for using new technologies. Along with this, CS points out the negative role of vertical communication problems, while CA emphasises the staff's avoidance in taking initiative since they do not trust the support of upper levels. Regarding the use of incentives to motivate staff; CA and CT underlined the top management's lack of

awareness about the benefits of such an approach prevents such an implementation. The approach which sees using new technology efficiently as staff's duty is also another barrier, which was stated by CT.

In order to develop an innovative culture that support new technology implementation, CT and CS highlighted the need for organisational awareness about the benefits of the technology that is being planned to be implemented. In addition to this CA and CT pointed out the need of the top management's innovative approach in order to provide sustainability of the process. Regarding the development of a collaborative culture which supports the implementation of change as long as it is useful for the company, personality of the staff was indicated as an important parameter by CA and CT. In addition to this, CS pointed out the negative impact of the resistance that may potentially come from the experienced staff.

Table 7.9 : The analysis results of all cases regarding CL capability.

META CODES	FC CODES	CA	CT	CS
CL1 / Empower staff to take their decisions				
Leadership	*Managers do not want to delegate their power of decision making*	+		+
Communication	*Vertical communication problems*			+
Trust	*Staff avoid taking initiative*	+		
CL2 / Provide incentives for efficient use of new tech.				
Awareness	*Top management's lack of awareness about the benefits of such an implementation*	+	+	
Leadership	*Top management's approach which sees using new technology efficiently as staff's duty*		+	
CL3 / Development of an innovative culture that supports the use of new tech.				
Awareness	*Organisation's lack of awareness about the benefits of new technology*		+	+
Culture	*Lack of innovative approach of the top management*	+	+	
CL4 / Development of a collaborative culture				
Characteristics	*Personality of the staff*	+	+	
Resistance To Change	*Old / experienced staff's resistance to change*			+
CL5 / Ability to develop trust to enable information sharing				
Communication	*Different perspectives of headquarters and the sites*	+		
Power	*Power balances between departments*	+	+	+
Leadership	*Personal characteristics of the line managers*	+		+
CL6 / Ability to develop trust to superiors				
Trust	*Sincerity of management in their support and actions*	+		

Development of trust, both between peers and between superiors and subordinates, was stated to be affected by the issues of communication, power relations, leadership

and trust. The power balances between departments was stated as a barrier for the development of trust between peers, by all of the companies. The personal characteristics of the line managers who chose not to share information with other departments were underlined as a factor that hinders the development of trust, by CA and CS. Another barrier that was reported by CA was the different perspectives of headquarters and the sites on particular problems. This difference in perspectives leads them to have different assessments for the same problem and assign different priorities. So they chose not to be open in sharing information with each other with the fear of losing their advantage or putting themselves in a difficult position. CA also indicated that top management should be sincere in their support and actions in order develop trust between different levels.

7.3.8 Management of change process

The ability to manage change process was questonaed under three sub capalities which are; the ability to reengineer processes due to the requirements of new technology, organisations ability to provide technical support and services to the staff during the implementation of new technology, and ability to development powerful communication both internal and external. Table 7.10 summarises the cross case synthesis results of three cases for CM capability.

CT and CS declared the success of the organisations ability to reengineer processes is negatively affected by the resistance to new processes. CS also highlighted the importance of being capable in process management. The reengineering of processes also means changes in the roles and responsibilities. These changes should be clarified and conveyed to all related staff. CT and CS emphasised that communication should not be left to individuals' initiative. The procedures of communication for such phases should be identified clearly. CS also highlighted the need to know the previous roles and responsibilities of the staff in order to clarify and present the difference that change brings.

All companies stated that they are happy with the services and technical supports that provided during the implementation of new technologies, within the company. CS also pointed out the awareness need about how to benefit from external consultancy services more efficiently.

Table 7.10 : The analysis results of all cases regarding CM capability.

META CODES	FC CODES	CA	CT	CS
CM1 / Ability to reengineer the processes				
Process Management	*The organisation's incapability in process management*			+
Resistance To Change	*Resistance to new processes*		+	+
CM2 / Ability to clarify changes in roles and responsibilities				
Process Management	*Leaving communication to individuals' initiative*		+	+
Process Management	*Ambiguous roles and responsibilities*			+
CM3 / Ability to provide service and technical support within the company				
CM4 / Ability to provide technical support from outside of the company				
Awareness	*Being aware of how to benefit from external consultancy services*			+
CM5 / Ability to develop a powerful internal communication.				
Trust	*Organisation's sincerity regarding the exchange of ideas*			+
Trust	*Problems in superior-subordinate communication*			+
Characteristics	*Personality of the staff*	+	+	+
Culture	*Corporate culture does not support this*			+
CM6 / Ability to develop a powerful external communication.				

There was an agreement of all three companies about the impact of personality of the staff, regarding the development of a powerful internal communication. However, CS also took attention to; organisation's sincerity regarding the exchange of ideas, problems in superior-subordinate communication that stems from the lack of trust, and the development of culture that supports seamless and powerful communication in the organisation. Organisations stated that they do not have problems with their communication with external parties

7.3.9 Strategy development

Organisations' ability to develop strategies that are supposed to support the new technology diffusion process was examined under; development of IT/IS strategy that is covering diffusion plan of new technology aligned with Business Strategy; development of HR strategy that is focussed in both, employing IT and innovation ready staff and developing strategies to improve the performance of staff in new technology implementation; and development of training strategy that is focussed on not only improving staff's skill, knowledge and attitude towards new technology, but also increasing top management's knowledge about the new technology and its

possible impacts on business. Table 7.11 summarises the cross case synthesis results of three cases for CS capability.

Table 7.11 : The analysis results of all cases regarding CS capability.

META CODES	FC CODES	CA	CT	CS
CS1 / Ability to develop and IT strategy aligned with business strategy				
Strategic Man.	*IT and/or IS strategy of the company is not clear*		+	+
Awareness	*Taking technical specifications as the only guide for the IT need*		+	
Planning & Control	*Lack of a detailed analysis*		+	+
CS2 / Ability to develop diffusion program for new technology.				
Culture	*Lack of such an approach*			+
CS3 / Ability to employ IT and innovation ready staff				
Culture	*Bilateral relationships are efficient on recruitment*		+	
CS4 / Ability to develop plans to encourage staff to use new technology				
Leadership	*Top Management's commitment to change*	+	+	
CS5 / Ability to improve staffs' skill, knowledge and attitude towards new tech.				
CS6 / Ability to improve top management's knowledge about new tech.				
Planning & Control	*Heavy workload of top management*	+		+
Awareness	*Management's indifference towards new technology*		+	

In order to develop an IT strategy that is aligned with business strategy, CT and CS pointed out the need for developing a clear IT strategy with sufficient level of analysis that will fit the needs of the company regarding the Business strategy. CT also emphasised the importance of being aware of the benefits and importance of developing an IT strategy and leading the IT needs based on this strategy instead of technical specifications of project bid documents. Regarding the development of a diffusion program for the new technology, CS took attention to the existence of such an approach in the corporate culture.

Regarding the recruitment process CT pointed out the impact of bilateral relationships instead of other qualities or skills. CT and CA also emphasised the importance of top management's commitment to change in the development of plans by HR department to encourage staff to use new technology.

Even though the organisations possess reasonable ability to improve staffs' skill, knowledge and attitude towards new technology, the efficiency of the ability to improve top management's knowledge about new technology is hindered by the lack of attendance of top management because of the heavy workload (reported by CA

and CS). CT also highlighted the indifference of top management towards new technology.

The cross case synthesis of the analyses that are retrieved from three cases provided us the organisational dynamics as meta codes under each capability. Next section provides an in depth understanding about the organisational dynamics that are effective on the sub capabilities of ATD.

7.4 Organisational Dynamics that Affect Agile Technology Diffusion

The analysis of the evidence that were collected from the three cases, provided the factors that have negative impact on the existence of given capabilities, which can also be named as the barriers. Subsequently the cross case synthesis of the evidence of three cases delivered a deeper understanding for the development of the meta codes, which can be named as the Organisational Barriers. This section aims to provide an in-depth analysis for the impact of organisational dynamics (Figure 7.2) on the capabilities that constitute Agile Technology Diffusion.

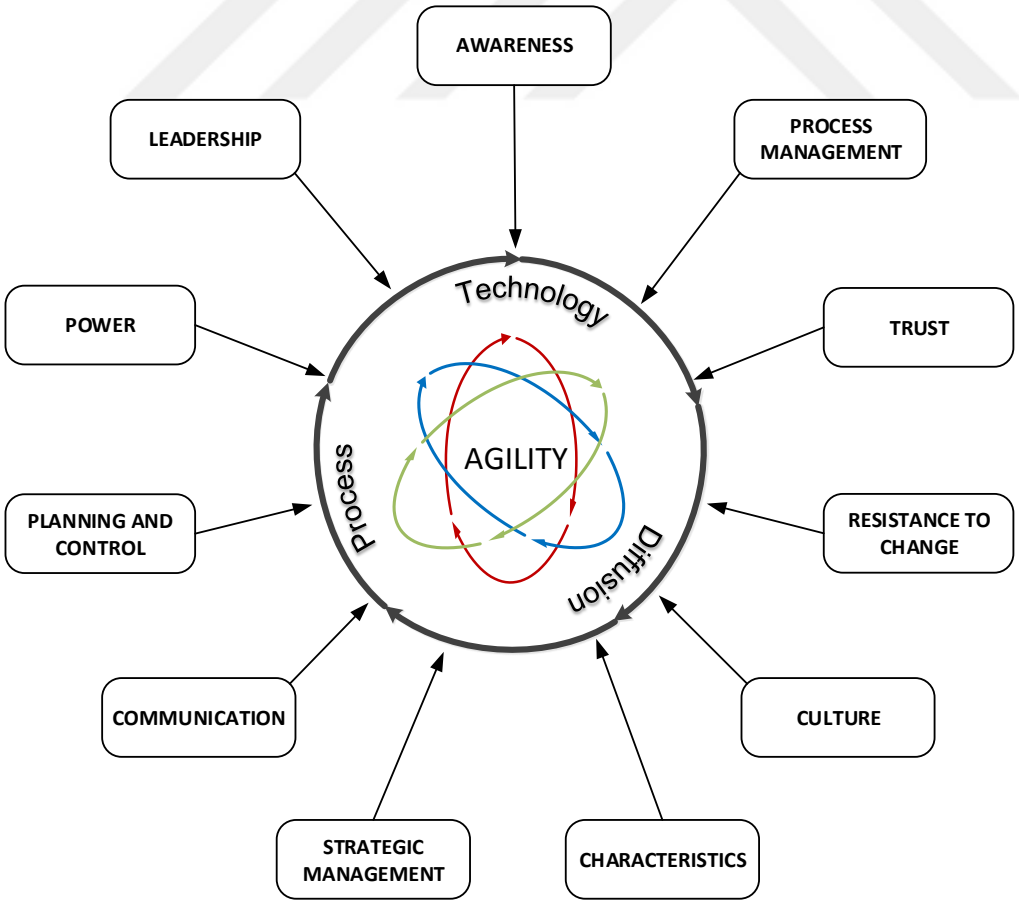


Figure 7.2 : Organisational Dynamics that affect Agile Technology Diffusion.

7.4.1 Awareness

The Oxford dictionary defines awareness as “knowledge or perception of a situation or fact”. The analysis of the case study evidence show that the barriers that stem from the awareness can be the result of attributes such as “not being aware”, ”disregarding” and/or having different “perspectives”. The company or a unit of the organisation may “not be aware” of the; links and interdependencies, importance and/or benefits of the factors that are closely related with organisational capabilities. Different than “not being aware” “disregarding” contains an ignorance with the thought of being capable, concerning the factors such as; motivation of the staff, interaction between different elements, etc. Approaching a problem from different “perspectives” can cause lack of awareness of the problem from other angles. The difference of perspectives can result with different assessments or acts regarding the same problem.

Regarding the results of the analyses, the strongest impact of awareness is on the responsiveness capability. It affects all the sub-capabilities (RA1 to RA6) of the “sense, perceive and anticipate changes and risks in the environment” (RA) in terms of;

- *not being aware* of the interaction between people process and technology, and the units of the organisation;
- *disregarding* the changes based on overconfidence or focusing only on projects; the motivation of the staff, the interaction between units,
- having a different *perspective* in determining the IT needs.

Recovery from change (RR) is the second in the row, in terms of feeling the impact of awareness. It affects the sub-capabilities of RR (RR2 to RR6) in terms of;

- *not being unaware* of the internal connectivity of the organisation, and the benefits of the implementation of recovery plan,
- *disregarding* the opinions of the staff,
- having a different *perspective* that sees recovery plan as additional work (staff) and seeing reorganisation of resources as a source of cost (top management).

The impact of awareness on flexibility (F) is mainly on the IT Flexibility (FI). The main focus is on;

- *not being aware* of the importance and benefits of IT infrastructure (FI1, FI5), new technologies (FH6) and the actual resource base (FI1);
- and as a different *perspective* of TM level, seeing site offices as temporary bases (FI1, FI5).

The competence (C) of managing the technology diffusion process requires;

- *being aware* of benefits of new technology (CL3), providing incentives for motivation (CL2), external consultancy services (CM4);
- *disregarding* the benefits of new technology (CS6);
- having different *perspectives* in determining the IT need (CS1).

7.4.2 Characteristics

Characteristics can be described as "a feature or quality belonging typically to a person, place, or thing and serving to identify them" (Oxford Dictionnaires 2015) . It is an important determinant of inter and intra personal relations in organisations (Luthans, 2010). As a barrier of agile technology diffusion capabilities, characteristics have impact on capabilities that are related with the personality of the staff, such as; the enthusiasm to develop skills and abilities, being eager to share information and learn from each other, development of collaborative culture, and development of internal communication.

7.4.3 Communication

The effect of communication mainly affects the responsiveness capability. The problems related with communication appear as; vertical communication problems in conveying the strategic vision and empowerment of the staff to take their decisions, different assessments based on the different perspectives of headquarters and the site offices, and problems regarding the management of information. Along with information management capability in the organisations, communication problems affect organisation's ability to make tough decisions quickly, ability to be aware of the internal links and interdependencies and ability to foster trust within the organisation.

7.4.4 Culture

Tylor (1871) explained culture as the "complex whole which includes knowledge, belief, art, morals, law, custom and any other capabilities and habits acquired by man as a member of society." Aligned to this approach the organisational culture can be explained as "a pattern of basic assumptions that a group has invented, discovered or developed in learning to cope with its problems of external adaptation and internal integration, and that have worked well enough to be considered valid, and therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems" (Schein, 2010).

The results show that the organisational culture related barriers, mainly affect the responsiveness and its sub-capabilities. Companies construct their IT strategies in addressing the technical demands in the bid documents of the projects. In this regard monitoring the changes (internal and external), being aware of the links and interdependencies in the market, analysing potential risk of change are not a part of their corporate culture. The organisations are not familiar with the concept of recovery from change. This unfamiliarity also appeared as a barrier on the related actions or implementations such as; being aware of recovery needs, development of a recovery plan and its implementation, which are not a part of the corporate culture.

Even though the companies give importance to the development of strategic vision the corporate culture can cause some problems in conveying it to the lower levels. Again, the old decisions mechanisms based on culture can hinder the speed of decision making.

The old mechanisms or believes that are nested in the culture also show their effects on the sub capabilities of HR flexibility. Staff shows resistance to their work habits which has become a part of their culture. The process flexibility is also one the concepts that does not have a place in the corporate culture since the companies are not familiar with it.

The cultural impacts on the sub capabilities of competence to manage diffusion process mainly stem from the lack of top management's innovative approach. This gap affects the development of innovative culture, establishmet of a powerful communication and also not being aware of the need of recruiting innovation ready

staff to enable the development and improve the speed of innovative culture in the organisation.

7.4.5 Leadership

The impact of leadership on the Agile Technology Diffusion capabilities can be examined under two main categories. The impact can either be a result of the lack of leadership ability of the managers, or the leadership style that they adopt.

The leadership style of the managers, show its impact mainly by the choices and approaches such as; not delegating the decision power (CL1, RC6), not using sanctions as well as incentives to motivate and give direction to the staff (FH3, CL2, RR6) and not providing enough support to show their commitment to change (CS4, FH3).

Even though the managers that are working in the companies were all experienced and skilled people, the level of complexity or the scale of the work was evenly at high level. Even though they were less in number compared to the leadership style related factors, some of the barriers were related with the lack of leadership ability of the managers. The leadership ability shows its impact on enabling the speed of decisions. Missing opportunities due to slow decisions of the managers (FP5), and not being able to develop an organisational structure that will enable quick decisions (RC5) are the barriers that stem from the lack of leadership abilities of the managers.

7.4.6 Planning and control

Managing means looking ahead and for successful management, and plans of action should be developed aligned with this forecast. However planning should also be supported by control, which is conducted to see if everything occurs in conformity with policy and practice (McNamara, 2011; Wren & Bedeian, 2009).

The negative impact of planning and control on the agile technology diffusion capabilities mainly revealed as the complaints about heavy workload (RC4, FH2, FH4, CS6), lack of detailed analysis (CS1, RR4, FI2, FI5) and difficulties in the control of plans due to size and scope of work (RR6).

7.4.7 Power

Power can be defined as “control or influence over the behaviour of other people with or without their consent” (Mullins, 2005). Bradshaw and Boonstra (2004) argued that the concept of “power” can be examined within the framework of two polarities, which are; individual power vs collective power and manifest power vs latent power. Individual power is required to make changes happen in the organisations and it can be described as the capability of an actor to achieve his or her will, even at the expense of others who might resist (Giddens, 1979). From a collective perspective, power is seen as a property of a social group, shaped by the observable structures and culture of the group (Bradshaw & Boonstra, 2004).

The negative impact of Power on agile technology diffusion capabilities can be seen as the desire to protect the power balances between units and individuals. This appears as a barrier on; the quick reorganisation of the resources in sudden change (RR5), being eager to share information and learn from each other (FH4) and the development of trust to enable information sharing (CL5).

7.4.8 Process management

The negative impact of process management on the agile technology diffusion capabilities can be examined under two main categories. This impact can either be the result of undefined, or inefficient procedures. Undefined procedures generally exists in the responsiveness capabilities. Ability to monitor and reporting changes (RA1, RA2), analysing risks and consequences of change (RA5, RA6), managing information efficiently (RC3, RC4), assessment of recovery needs (RR1) and development of a recovery plan (RR3) can be presented as the sub capabilities that are affected by the undefined procedures.

Problems that arise from the inefficient procedures, affect the ability to manage knowledge and information (RC3, RC4) by leaving communication to individual’s initiative; the ability to provide devolved and responsive decision making (RC5,RC6) and also the assessment of recovery needs in planned change (RR2) by the ambiguousness of roles and responsibilities; the ability to reengineer the processes (CM1, CM2) by the organisation’s incapability of in process management; and the empowerment of staff to take decisions (CL1) again by unclear roles and responsibilities .

7.4.9 Resistance to change

Employees resistance to change mainly affects the ability to learn and adapt new procedures quickly (FH3) under HR flexibility by the affect of experienced staff who do not want to change their work habits and uninterested in the new processes. Actually similar resistances affect the development of a collaborative culture that supports new technology diffusion (CL4) and the ability to reengineer processes (CM1).

7.4.10 Strategic management

The impacts related with strategic management mainly affects the organisation's awareness about external connectivity (RA3) by not having a mid and long term strategic plan, staff's ability to work in different positions and responsibilities (FH1) by the lack of rotation plan in HR strategy and not questioning this capability during recruitment process; and ability to develop an IT strategy aligned with business strategy (CS1) by not being able to clarify the IT or IS strategy.

7.4.11 Trust

The Oxford Dictionary defines trust as the "firm belief in the reliability, truth, or ability of someone or something". The affects of trust was examined in two different categories, which are; trust to peers and trust to upper levels.

The negative impact that is caused by the lack of trust to upper levels shows itself; in the ability to act efficiently under uncertain and ambiguous conditions (FH6) as not showing a proactive approach to problems; in the ability to define a clear strategic vision (RC1), ability to change work habits as a response to change (RC4) and ability to make quick decisions (FH4) as not having a sense of belonging; and in the ability to develop powerful internal communication (CM5) as not believing in the sincerity of top management.

Lack of trust to peers, negatively affect the ability to share information quickly to ensure successful decisions (RC4) as hiding information. It also has a negative effect on being eager to share information and learn from other (FH4) under the excuse of department related secrecy.

7.5 Summary of the Chapter

This chapter presented the cross-case synthesis of the case study findings in order to provide a common solution from all three cases.

Initially the syntheses of the quantitative findings were described and the priorities were presented, based on the calculated importance level values. Subsequently the case study findings, coming from within cases analyses, were synthesised and the organisational dynamics (meta codes) that are effective on the establishment of each barrier were determined. For the last step, the effects of organisational dynamics on agile technology capabilities were discussed.

The findings of the chapter will be used in the next phase of the research, using the Delphi process, elucidated later in Chapter 8.

8. DEVELOPMENT OF THE CONCEPTUAL FRAMEWORK OF AGILE DIFFUSION

8.1 Introduction

This chapter presents the conceptual framework development process in organisations. It is specifically structured to accomplish the objective 7 which is; “To test and validate the developed conceptual framework with domain experts; and draw comments for future research”. The chapter initially provides detailed information on the Delphi method used, which helped to determine the priorities derived from the qualitative analysis. This discussion presents the elements needed to be taken into consideration for each agile diffusion capability. The conceptual framework is then formally presented. The validation process then explained in order to evaluate the reliability and generalisability of the conceptual framework. This engaged domain experts from both Industry and Academia.

8.2 The Delphi Method

Cognisant of the need to engage multiple viewpoints and positioning, the Delphi technique was used as an iterative process of developing the conceptual framework. The aim was to determine the prioritisation of the problematic areas that hamper the agile technology diffusion for each capability, by the consensus of industry professionals. As it was discussed in Chapter 5, the Delphi process usually begins with a questionnaire (round one), which aims to clarify the critical issues that will be addressed in later rounds. However, in this research, these critical issues were provided as the results of case study analyses. In this regard, the initial round of classic Delphi study was accepted to be accomplished and the research moved to the panel rounds.

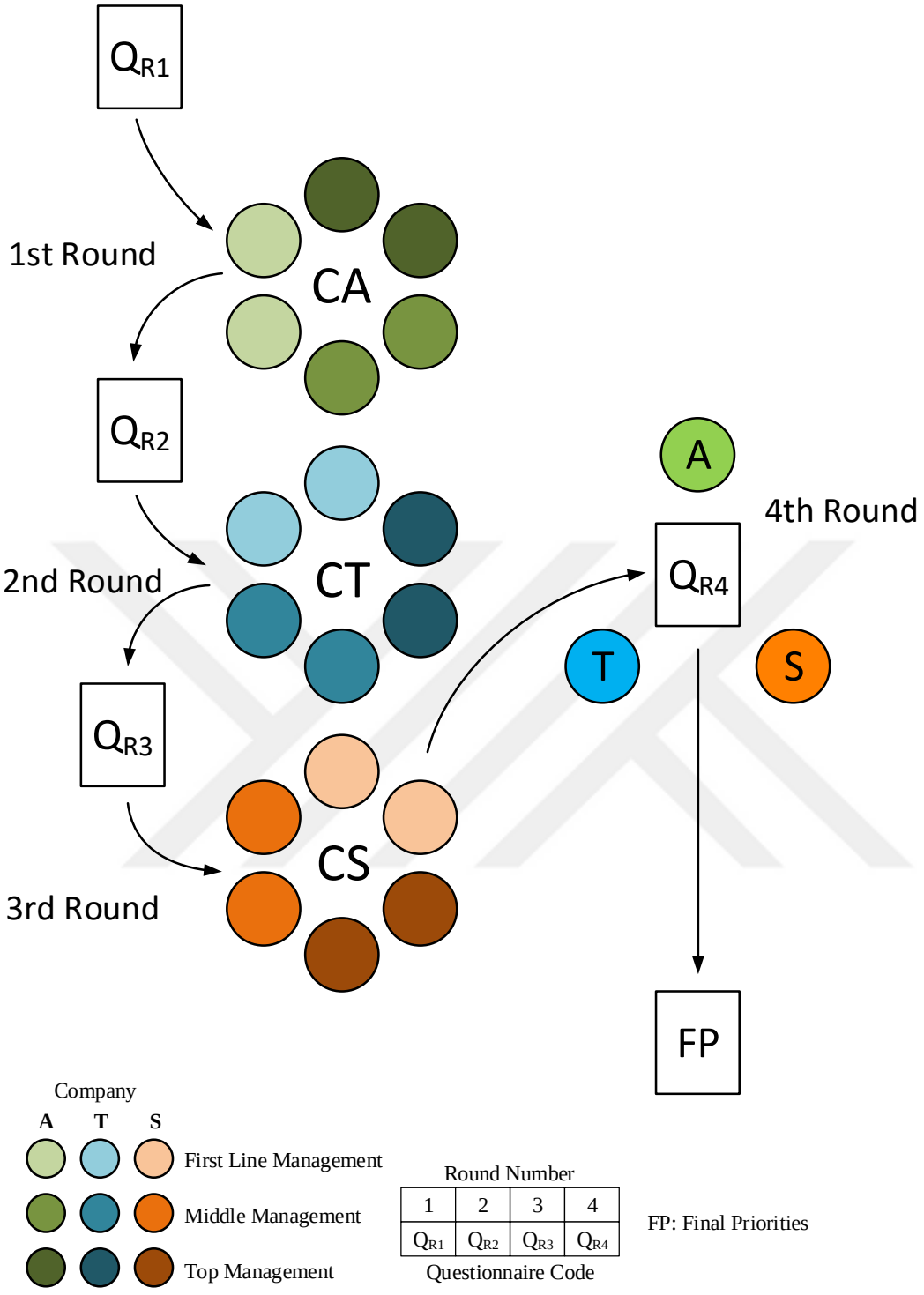


Figure 8.1 : Delphi Process.

As the next step of the process, panel members were selected. Instead of random sampling, Delphi uses expert opinion. Therefore the selection of these panel members is a critical component of the method (Keeney *et al.*, 2001). Rather than choosing up people who state that they have knowledge in the area and willing to engage in the discussion, the panel members of this research were selected from the

sample of experts who participated the research and experienced the process. This also amplified the representativeness of the Delphi panel, which can be provided by the quality rather than numbers (Powell, 2003). In this regard, 6 people from each case of the research were selected as panel members, which made a total number of 18. These panel members were selected from different levels of management (Top Management, Middle Management, and First Line Management) in order to have a balanced approach.

As the initial step of the process, the questionnaire (Q_{R1}) based on the case study results were given to the panel members of CA. During the panel meeting (1st Round), factors that are determined for each capability were ranked by the panel members and the panel reached a consensus for each ranking (Q_{R2}). With the rankings and feedback from CA, the panel members of CT discussed the rankings (2nd Round). At the end of this discussion the panel members reached a consensus and a new ranking (Q_{R3}) is established. For the next round (3th Round) the panel members CS, discussed the rankings of Q_{R3} taking the feedback from previous rounds into consideration. As a result of the consensus that is provided by CS, a revised ranking (Q_{R4}) was established. At the end of these three panel rounds, which were conducted in a separate but iterative nature, a ranking was established. However, a last round was needed to have the consensus of three parties. Since it was not likely to have these 18 panellists together in a meeting, who had tight time limitations and also were from rival companies, the last round (4th Round) was conducted with a panel that constitutes one participant from each of the companies. Since all companies had reached their own consensus at the end of long discussions, the participants were selected as representatives who had the grasp of the views of their own companies. The consensus of the last panel provided the final rankings (FP) that were used in the framework of the research.

In order to provide the credibility and efficiency of the Delphi Analysis the criteria that were defined by Rowe and Wright (2011) were met as given bellow;

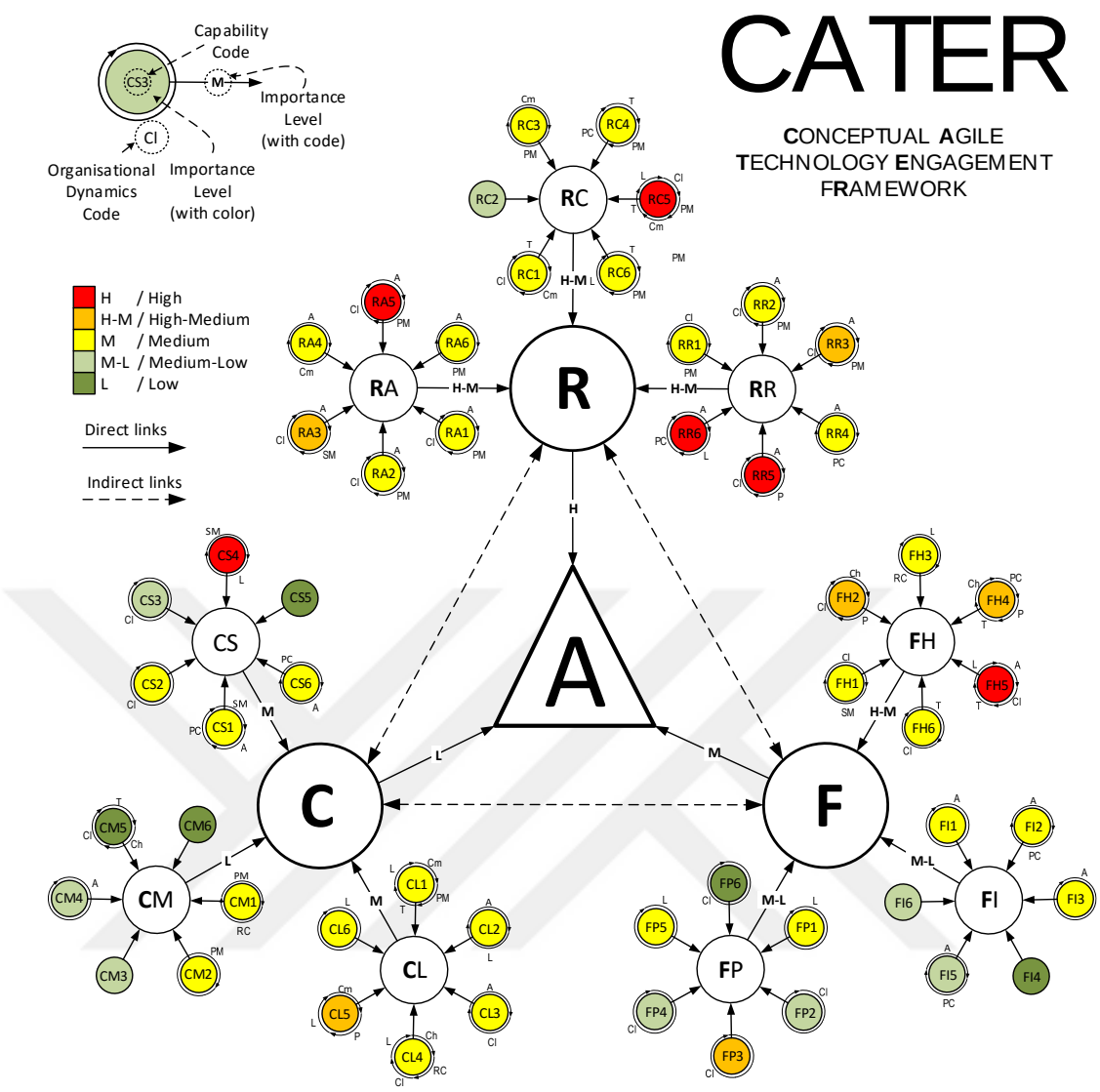
- *Improving the recruitment and retention of the panellist over Delphi rounds;* The panel members were selected from the list of people who had attended the questionnaires and interviews, and experienced the processes that are the topic of the research,

- *Creating useful heterogeneity in panel membership;* In each company, the same number of people from each three level, attended the panel meetings, in order to provide the heterogeneity,
- *Enhancing information exchange between panellists*; The panel meetings conducted with the attendance of all panel members in each company. Feedback from previous meetings was provided, and a consensus was established as a result of information exchange between panellists,
- *Improving question formulation to provide easy and understandable questions;* the critical factors that were ranked in the panels were determined by the same participants during the case study phase.
- *Combining Delphi with other techniques and* ; The critical factors to be ranked, which formed the structure of the initial questionnaire, were provided from case study findings,

8.3 Agile Diffusion Framework

This section provides a detailed description about the Conceptual Agile Technology Engagement Framework (CATER), which is based on the Agile Technology Diffusion Capabilities given in Table 5.4. CATER aims to map the dynamics that affect the agility of new technology diffusion process (Figure 8.2).

As it was discussed in the research methodology chapter, development process of CATER had four main steps. The first step was the development of the main structure, which can be named as the "skeleton" of CATER. This main structure provided the capabilities of Agile Technology Diffusion. The subsequent steps (2, 3 and 4) were used to "dress" this skeleton, with the relevant findings. The second step was the determination of the priorities to be focussed in order to improve the agility capabilities. At the third step, the barriers and the related organisational dynamics were determined and the fourth step provided the importance rankings of the barriers for each Agile Technology Diffusion capability.



CODES OF ORGANISATIONAL DYNAMICS AFFECTING AGILITY (META LEVEL)

A	Awareness	L	Leadership	RC	Resistance to Change
Ch	Characteristics	PC	Planing & Control	SM	Strategic Management
Cm	Communication	P	Power	T	Trust
Cl	Culture	PM	Process Management		

Figure 8.2 : The proposed Conceptual Agile Technology Engagement Framework.

8.3.1 Responsiveness in diffusion process

Responsiveness in diffusion process is related with showing quick reaction to the market demands in accordance with company's strategic goals. Based on the three main capabilities of responsiveness, the factors that affect construction companies' responsiveness are as follows;

8.3.1.1 Sense, perceive and anticipate changes and risks in the environment

The ability to sense, perceive and anticipate changes and risks in the environment (RA) consists of six sub capabilities, which will be described respectively, below. The representation of dynamics affecting this capability is provided in Figure 8.3 with its place on CATER.

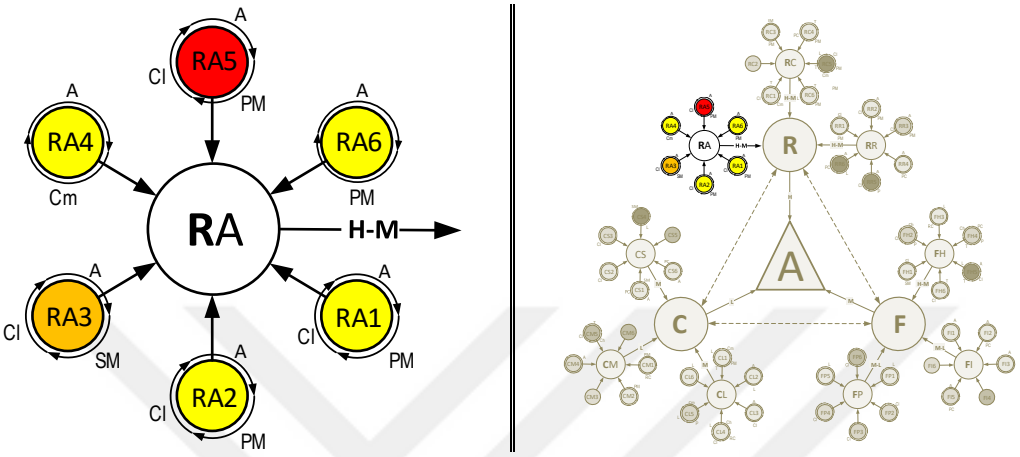


Figure 8.3 : Dynamics affecting RA capability.

RA1- Ability to be aware of emerging technologies, trends and changes in the industry

A construction company that is aiming to be competitive in the international market should be aware of the changes, emerging trends and technologies that are taking place in the industry (Table 8.1).

Table 8.1 : Rankings of the barriers of RA1 capability based on Delphi findings.

Ranking	Barrier	OD	ODC
1	Overconfidence based on experience	Awareness	A
2	Taking technical specifications as the only guide for the IT need	Awareness	A
3	Corporate culture does not support this	Culture	Cl
4	Lack of a specified unit/person to track these changes	Process Management	PM
5	Lack of defined procedures for this	Process Management	PM

Notes: OD-Organisational Dynamics; ODC- Organisational Dynamics Code

Even though having an innovative culture is an important asset for this capability, the company should avoid being overconfident about its actual assets and having an approach that takes technical specifications as the only guide for the IT need. Instead,

the focus should be searching for alternatives that will be strategic fit. In a company that is aiming sustainability in terms of this external awareness, the steps to be followed and the responsibilities for this tracking process should be determined clearly.

RA2-Ability to be aware of level of organisation's resources

Along with the external awareness, a construction company should also be aware of its own resources and internal dynamics. People that are working in the company should believe in the importance of internal awareness, which is one of the main prerequisites of an innovative approach. In order to provide this awareness, assessments should be conducted on a periodically basis, based on defined procedures. During this process, the assessors should avoid focussing on some parts more than the others, which may lead them to miss some of the key areas. The resource management should be carried out seriously and the company should not be contented only with the bid preparations (Table 8.2).

Table 8.2 : Rankings of the barriers of RA2 capability based on Delphi findings.

Ranking	Barrier	OD	ODC
1	Corporate culture does not support this	Culture	Cl
2	Lack of defined procedures for this	Process Management	PM
3	Seeing bid preparations enough for this assessment	Awareness	A

Notes: OD-Organisational Dynamics; ODC- Organisational Dynamics Code

RA3-Ability to be aware of organisation's external connectivity

In order to develop a successful business strategy, the company that is tracking and monitoring the changes in the industry, should also be able to interpret the consequences that will be result of them. In other words, the company should be aware of the connectivity between the actors and dynamics of the environment that it operates in. Companies that are competent in the international market, usually are very experienced in the field and unfortunately, the overconfidence that is based on this experience can hamper the external connectivity awareness of the company. Even though the sites are the bases of construction production, focussing on the projects too much, may lead companies to miss the big picture and misguide them in the analysis of the dynamics of the market. In order to make efficient interpretations of the changes, the company should have a developed strategy and strategic plans

aligned to it. The people working in the company should believe in the importance and benefits of connectivity awareness, and keep these benefits in mind while determining the company's strategic priorities (Table 8.3).

Table 8.3 : Rankings of the barriers of RA3 capability based on Delphi findings.

Ranking	Barrier	OD	ODC
1	Overconfidence based on experience	Awareness	A
2	Focussing on projects too much and missing the big picture	Awareness	A
3	Lack of mid and long term strategic planning	Strategic Man.	SM
4	Corporate culture does not support this	Culture	Cl
5	Having different priorities	Strategic Man.	SM

Notes: OD-Organisational Dynamics; ODC- Organisational Dynamics Code

RA4- Ability to be aware of organisation's internal connectivity

Any element that is new to the organisation will surely have an impact on the organisation's actual operations and resources. The organisation that is aiming to show a response to change, should be aware of the impact that this change will bring on its units. In order to have a healthy understanding about this impact, the links and interdependencies in the organisation should also be clarified and known by the management. In construction companies, this requires a healthy communication between departments (Table 8.4).

Table 8.4 : Rankings of the barriers of RA4 capability based on Delphi findings.

Ranking	Barrier	OD	ODC
1	Communication problems between units (departments)	Communication	Cm
2	Different perspectives of headquarters and the sites	Communication	Cm
3	Disregarding the interaction between its units	Awareness	A
4	Disregarding the motivation of staff	Awareness	A

Notes: OD-Organisational Dynamics; ODC- Organisational Dynamics Code

Along with the communication, the construction companies face a big dilemma that is caused by the diverse cultures of headquarters and sites. Top management should be aware of the different approaches of these units and resolve them as soon as possible. The people in the organisation, especially the top management, should be aware of the importance of these interactions comprehensively.

RA5- Ability to analyse the potential risks of change on organisational resources

If the organisation is planning to use a new technology, an analysis of the potential risks of change on the organisational resources should be conducted, subsequent to the organisation's awareness of internal and external dynamics. At this point, the awareness of the interaction between people, process and technology is crucial and should be examined in detail. The importance and benefits of risk analysis should be understood by all staff and the high level of experience should not hamper this analysis. In this regard, the steps to be taken and the content of this analysis should be clearly identified (Table 8.5).

Table 8.5 : Rankings of the barriers of RA5 capability based on Delphi findings.

Ranking	Barrier	OD	ODC
1	Unawareness of the interaction between People Process and Technology	Awareness	A
2	Overconfidence based on experience	Awareness	A
3	Corporate culture does not support this	Culture	Cl
4	Lack of defined procedures for this	Process Management	PM

Notes: OD-Organisational Dynamics; ODC- Organisational Dynamics Code

RA6- Ability to analyse the potential consequences of change on organisational resources

If the organisation is faced with a sudden change, in which a risk analysis could not be conducted, the company should be able to analyse the level of impact of this unpredicted change, on its resources (Table 8.6).

Table 8.6 : Rankings of the barriers of RA6 capability based on Delphi findings.

Ranking	Barrier	OD	ODC
1	Unawareness of the interaction between People Process and Technology	Awareness	A
2	Lack of defined procedures for this	Process Management	PM

Notes: OD-Organisational Dynamics; ODC- Organisational Dynamics Code

In order to succeed in this analysis, being aware of the interaction of people process and technology is the first thing that is needed. Along with this awareness, the people that are responsible for this process and the procedures to be carried on, should be clearly identified.

8.3.1.2 Show quick reaction to change and its demands

The ability to show quick reaction to change and its demands (RC) consists of six sub capabilities, which will be described respectively, below. The representation of dynamics affecting this capability is provided in Figure 8.4 with its place on CATER.

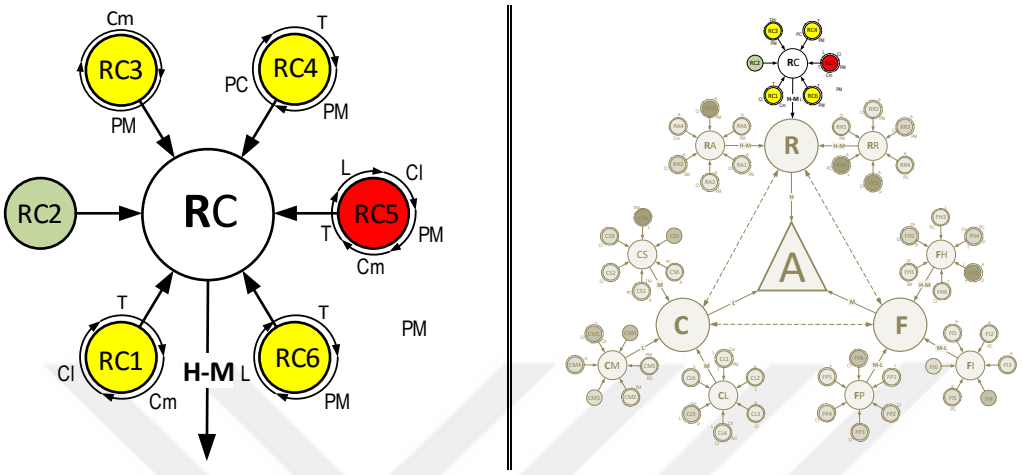


Figure 8.4 : Dynamics affecting RC capability.

RC1- Ability to define a clear strategic vision for organisation

When a company faces a change, the response should be aligned with the company's overall strategy. This necessitates the existence of a clearly defined strategic vision of the company and its transmission to all employees (Table 8.7).

Table 8.7 : Rankings of the barriers of RC1 capability based on Delphi findings.

Ranking	Barrier	OD	ODC
1	Vertical communication problems	Communication	Cm
2	Lack of sense of belonging	Trust	T
3	Corporate culture does not support this	Culture	Cl

Notes: OD-Organisational Dynamics; ODC- Organisational Dynamics Code

Even though companies at this level are aware of the importance of strategic management, the strategic objectives and trajectories are usually known only by top management. The problems about the transmission of the strategic vision to employees are due to the problems that are seen in vertical communication and the incuriousness of the staff who does not have a sense of belonging for the company.

RC2- Ability to direct the organisation in sudden change and crisis

In times of sudden change and crisis, the organisation should be able to direct the company in line with the strategic vision. The construction companies in Turkey that

are competent in the international arena, possess not only a high level of experience in engineering and construction but also the ability to thrive in the environments that are open to crisis. In this regard, this is an ability that the Turkish Contractors have mastered because of the constantly changing internal market conditions of the country.

RC3- Ability to manage knowledge efficiently

The efficient management of information is important for all response process. In this regard, the company should be able to master the phases of information management, such as data collection, storage, transforming it to information. These phases should be clearly defined with procedures and the procedures should be up to date (Table 8.8).

Table 8.8 : Rankings of the barriers of RC3 capability based on Delphi findings.

Ranking	Barrier	OD	ODC
1	Data collection problems	Communication	Cm
2	Data and information sharing problems	Communication	Cm
3	Problems with transforming data to information	Communication	Cm
4	Data storage problems	Communication	Cm
5	Inefficient procedures for information management	Process Management	PM
6	Lack of defined procedures for information management	Process Management	PM

Notes: OD-Organisational Dynamics; ODC- Organisational Dynamics Code

RC4- Ability to ensure successful decisions by sharing knowledge efficiently

Along with the efficiency of data collection and transformation to information efficiently, the organisation should share this information with the related staff quickly, in order to improve the speed of response (Table 8.9).

At this point, construction companies need to identify the procedures of information sharing clearly. Unfortunately, some staff or departments choose to slow down this process by hiding information intentionally or cause this slowness unitentionally because of the heavy workload.

Table 8.9 : Rankings of the barriers of RC4 capability based on Delphi findings.

Ranking	Barrier	OD	ODC
1	Leaving communication to individuals' initiative	Process Management	PM
2	Hiding information (individual and departmental levels)	Trust	T
3	Heavy workload	Planning & Control	PC
4	Lack of defined procedures	Process Management	PM

Notes: OD-Organisational Dynamics; ODC- Organisational Dynamics Code

RC5- Ability to make tough decisions quickly

As the organisations get bigger, they lose their agility in taking decisions. The speed of taking decisions, is the most complained element in construction organisations (Table 8.10).

Table 8.10 : Rankings of the barriers of RC5 capability based on Delphi findings.

Ranking	Barrier	OD	ODC
1	Organisational structure does not allow quick decisions	Leadership	L
2	Existence of old decision mechanisms based on culture	Culture	Cl
3	Ambiguousness of roles and responsibilities	Process Management	PM
4	Communication problems	Communication	Cm
5	Staff's avoidance from taking initiative	Trust	T

Notes: OD-Organisational Dynamics; ODC- Organisational Dynamics Code

The organisational structure of the company is an important factor that is affecting the speed of taking decisions and should be organised accordingly. Most of the construction companies possess old decision mechanisms that are coming from their culture. The employees, especially the experienced ones, usually chose to follow the old procedures, even though the organisation declares the revised ones. Another important factor in decision making is the ambiguousness of the roles and responsibilities in the organisation. People that are avoiding risks and taking initiative, usually use this gap on their behalf. Along with these elements a powerful communication, both internal and external is also crucial for improving the speed of decisions.

RC-6 Authorise staff to make decisions in case of sudden changes

Due to its type and scale, construction production can be very costly. The lags in the operation can cause big problems to the construction companies, which are always fighting with time to complete projects on time. In this regard, giving staff the authorisation to take decisions in case of sudden changes or unpredicted situations is a way to avoid these lags and improve the overall speed of the process. In order to provide this; the roles and responsibilities should be clarified and announced to all employees; and the managers should agree to delegate some of their responsibilities and empower their staff (Table 8.11).

Table 8.11 : Rankings of the barriers of RC6 capability based on Delphi findings.

Ranking	Barrier	OD	ODC
1	Ambiguousness of roles and responsibilities	Process Management	PM
2	Leadership style of the managers (delegation)	Leadership	L
3	Staff avoid taking initiative	Trust	T

Notes: OD-Organisational Dynamics; ODC- Organisational Dynamics Code

8.3.1.3 Recovery from change

The ability to recover from change (RR) consists of six sub capabilities, which will be described respectively, below. The representation of dynamics affecting this capability is provided in Figure 8.5 with its place on CATER.

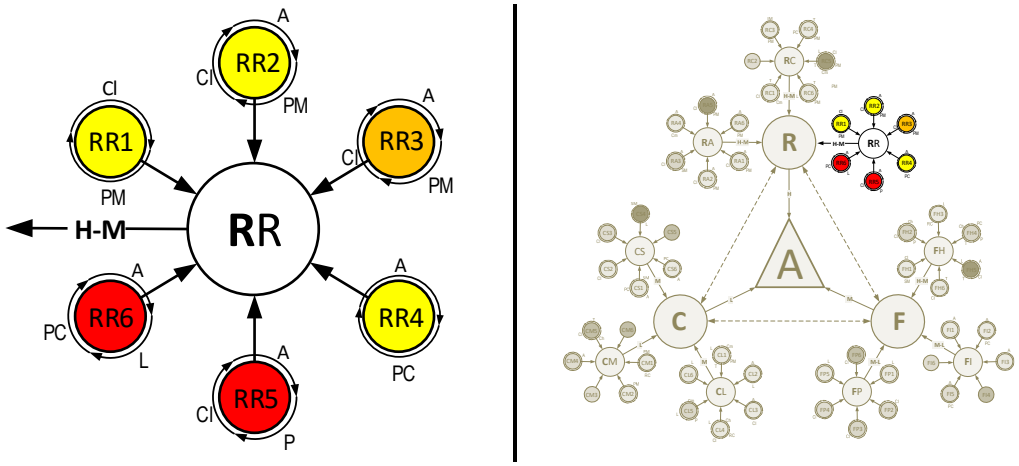


Figure 8.5 : Dynamics affecting RR capability.

RR1-Ability to assess recovery needs in sudden/unpredicted change

When faced with a sudden change the organisation should be able to assess the recovery needs that will arise depending on the impact of this change. Even though the construction companies are capable in managing the crisis, most of them do not have an understanding about the assessment of recovery needs in unpredicted situations. Since the change is sudden, the emphasis would be on resolving the problems quickly. An understanding about the importance and benefits of recovery from change should be developed and the steps to be followed in such unpredicted situations should be identified (Table 8.12).

Table 8.12 : Rankings of the barriers of RR1 capability based on Delphi findings.

Ranking	Barrier	OD	ODC
1	Lack of such an understanding (Culture)	Culture	Cl
2	Lack of defined procedures for this	Process Management	PM

Notes: OD-Organisational Dynamics; ODC- Organisational Dynamics Code

RR2- Ability to assess recovery needs in planned change

In order to conduct a healthy assessment of the possible recovery needs that will arise in a planned change, the organisation should take the opinions of all parties that will be affected by the new implementation. The benefits of change recovery process should be explained to the staff in order to make them believe in its importance. The roles and responsibilities of the staff should be clearly identified to ensure the efficiency of the recovery needs assessment (Table 8.13).

Table 8.13 : Rankings of the barriers of RR2 capability based on Delphi findings.

Ranking	Barrier	OD	ODC
1	Disregarding the opinions of the staff that will be affected by the implementation	Awareness	A
2	Lack of such understanding	Culture	Cl
3	Lack of defined procedures for this	Process Management	PM

Notes: OD-Organisational Dynamics; ODC- Organisational Dynamics Code

RR3- Ability to develop a recovery plan in sudden change

Once the needs are assessed, steps to be taken should be planned for the recovery. The most important factor that hampers this ability is the lack of such an approach in the organisation. The construction organisations, usually chose to react to changes when they face them. Employees see this kind of planning as an additional work and do not want to take its responsibility. In this regard, the understanding about the importance and the benefits of an efficient recovery from change should be developed in the organisation. This will surely increase the value that is given to the planning of this stage. Yet, the clarification of the steps to be taken is crucial for such a plan (Table 8.14).

Table 8.14 : Rankings of the barriers of RR3 capability based on Delphi findings.

Ranking	Barrier	OD	ODC
1	Lack of such understanding	Culture	Cl
2	Seeing this as additional work and avoiding taking responsibility	Awareness	A
3	Lack of defined procedures for this	Process Management	PM

Notes: OD-Organisational Dynamics; ODC- Organisational Dynamics Code

RR4- Ability to develop a recovery plan for planned change

Planned changes, provide a better chance of analysis for a recovery plan. However, companies do not give importance to develop a plan for recovery from change. A company that is aiming to develop this ability, should have a culture that is aware of the importance and benefit of change recovery. Along with this, the awareness of internal connectivity is also needed (Table 8.15).

Table 8.15 : Rankings of the barriers of RR4 capability based on Delphi findings.

Ranking	Barrier	OD	ODC
1	Being unaware of the benefits of such a plan	Awareness	A
2	Being unaware of internal connectivity	Awareness	A
3	Lack of a detailed analysis as a result of heavy workload	Planning & Control	PC

Notes: OD-Organisational Dynamics; ODC- Organisational Dynamics Code

Even though companies show their heavy workload as a reason for ignoring the development of this plan, once the organisations become more aware of the benefits of this concept, more time would surely be reserved to conduct a detailed analysis.

RR5- Ability to reorganise the resources quickly in sudden change

Subsequent to the development of the plan, the resources that are affected by the change should be recovered quickly. Yet, the construction companies generally do not have a plan for the reorganisation of resources that are affected by sudden change. Managers' concern for protecting the power balances is one of the barriers for quick reorganisation. Since it is seen as a source of extra cost by the managers, this action is usually deferred until it becomes a must (Table 8.16).

Table 8.16 : Rankings of the barriers of RR5 capability based on Delphi findings.

Ranking	Barrier	OD	ODC
1	Lack of such a plan	Culture	Cl
2	Desire to protect the power balances	Power	P
3	Top management/managers see this as a source of cost	Awareness	A

Notes: OD-Organisational Dynamics; ODC- Organisational Dynamics Code

RR6- Ability to implement the recovery plan

Even if the organisation develops such a plan, the line managers may not be aware of its benefits and do not give importance to its implementation (Table 8.17).

Table 8.17 : Rankings of the barriers of RR6 capability based on Delphi findings.

Ranking	Barrier	OD	ODC
1	Being unaware of the benefits of such an implementation	Awareness	A
2	Lack of sanctions for not implementing the developed plans	Leadership	L
3	Difficulties in the control of the implementation due to the size of the company	Planning & Control	PC

Notes: OD-Organisational Dynamics; ODC- Organisational Dynamics Code

Since the importance of change recovery is not adapted by the staff, top management also do not use power, such as sanctions, to provide the implementation. The construction companies in this calibre, have projects all over the world and this (size of the company) is another factor that has a negative impact on the implementation of such a plan.

8.3.2 Flexibility in diffusion process

Flexibility in diffusion process is related with ability to adjust the organisational resources due to change demands of the new technology that is to be implemented. Based on its three main capabilities, the factors that affect construction companies' flexibility are as follows;

8.3.2.1 Human resources flexibility

The ability to provide human resources flexibility (FH) consists of six sub capabilities, which will be described respectively, below. The representation of dynamics affecting this capability is provided in Figure 8.6 with its place on CATER.

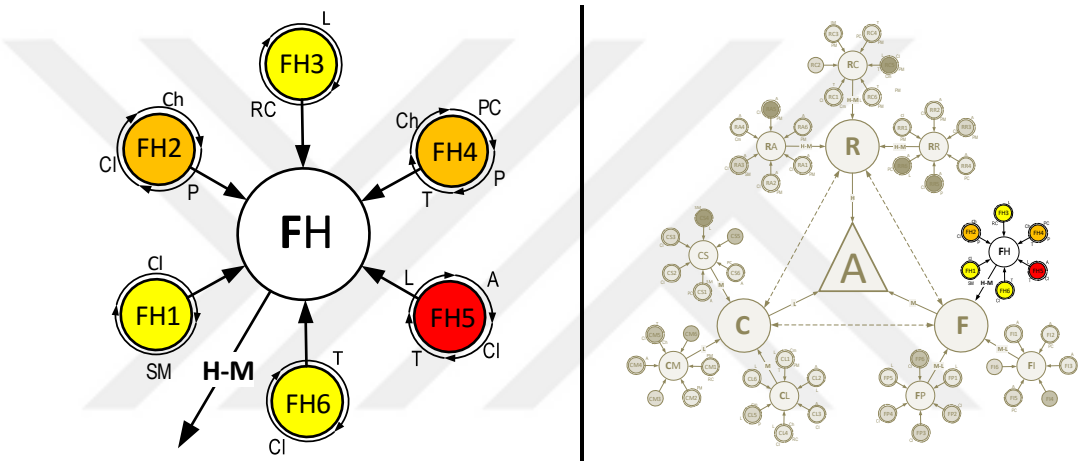


Figure 8.6 : Dynamics affecting FH capability.

FH1- Ability to switch different positions and responsibilities

The people that are working for construction companies, which are internationally competitive are qualified people. In this sense, as long as it is not a very specific subject, they have the capability to work in different positions and responsibilities. However, the companies at this level, usually hire employees for specific positions and usually do not want to change their role unless something very extraordinary happens. In this sense, development of staff's ability to work in different positions and responsibilities, depends on the HR strategy of the company.

Company can choose either to hire people that possess this capability or improve staff's ability with periodic rotations in order to give them to chance to see the different parts and phases of the work. Yet, these kinds of arrangements are all depend on the existence of a supportive culture (Table 8.18).

Table 8.18 : Rankings of the barriers of FH1 capability based on Delphi findings.

Ranking	Barrier	OD	ODC
1	Corporate culture does not support this	Culture	Cl
2	HR strategy does not have a rotation plan for staff	Strategic Man.	SM
3	Recruitment strategy does not question the existence of this capability	Strategic Man.	SM

Notes: OD-Organisational Dynamics; ODC- Organisational Dynamics Code

FH2- Staff's enthusiasm to develop skills and abilities

As the skills of the staff enhances so does the competence of a construction company. Yet, all the employees may not share the same enthusiasm to develop their skills and abilities. In this regard this should be a point to be considered during the recruitment process. Heavy workload is another factor that takes away that will of self-development. The training strategy should be carefully developed and planned to facilitate both the skill development of the employees and the smooth working of the processes. In this sense, the eagerness for self-development should be a part of company's culture (Table 8.19).

Table 8.19 : Rankings of the barriers of FH2 capability based on Delphi findings.

Ranking	Barrier	OD	ODC
1	Personality of the staff	Characteristics	Ch
2	Heavy workload	Planning & Control	PC
3	Corporate culture does not support this	Culture	Cl
4	Age of the company	Characteristics	Ch

Notes: OD-Organisational Dynamics; ODC- Organisational Dynamics Code

FH3- Ability to learn new procedures quickly

Even though the staff are qualified enough to learn new procedures quickly, companies can face problems in this process. The first step to improve this ability is convince the employees about the importance of new procedures. This effort should focus on especially the experienced staff, who want to pursue the processes in the way that they are used to and show resistance to the new. Along with the efforts of informing staff about the benefits, the organisation should also design a plan of sanctions and implement them to resolve the resistance. It should kept in mind that

the success of all these efforts depend on top management's level of commitment to change (Table 8.20).

Table 8.20 : Rankings of the barriers of FH3 capability based on Delphi findings.

Ranking	Barrier	OD	ODC
1	Staff's indifference towards new procedures	Resistance to Change	RC
2	Experienced staff do not want to change the way that they do things	Resistance to Change	RC
3	Lack of sanctions	Leadership	L
4	Passive resistance from the ones that are opposing change	Resistance to Change	RC
5	Lack of top management's commitment to change	Leadership	L

Notes: OD-Organisational Dynamics; ODC- Organisational Dynamics Code

FH4- Being eager to share information to learn from each other

The eagerness of employees to share information and learn from each other depends on the self improvement will of the employee. Even if they have that will, the heavy workload does not always allow them to come together and even cause this will to fade away. Along with these, staff may not choose to teach others and share their information due to protect the power balance in the organisation or the secrecy of the work that they are responsible for (Table 8.21).

Table 8.21 : Rankings of the barriers of FH4 capability based on Delphi findings.

Ranking	Barrier	OD	ODC
1	Personality of the staff	Characteristics	Ch
2	Heavy workload	Planning & Control	PC
3	Power balances	Power	P
4	Department related secrecy	Trust	T

Notes: OD-Organisational Dynamics; ODC- Organisational Dynamics Code

FH5- Ability to change work habits as a response to changes in the demands

In construction companies, especially the experienced staff do not want to change their work habits and this blocks the flow of change. In order to resolve this blockage, Top Management commitment is highly needed. Even though these people who do not want to change their habits are regarded as "problems", they take this stance because they do not believe that the change will be beneficial for their

organisation. These people need to believe in the benefits of change for the company, and to do this, they need to be aware of the benefits of new technology. This belief should be a part of the corporate culture and every person working in the company should adapt this approach. This adaption necessitates the sense of belonging from the staff (Table 8.22).

Table 8.22 : Rankings of the barriers of FH5 capability based on Delphi findings.

Ranking	Barrier	OD	ODC
1	Lack of top management's commitment to change	Leadership	L
2	Being unaware of the benefits of new technology	Awareness	A
3	Corporate culture does not support this	Culture	Cl
4	Staff does not have a sense of belonging	Trust	T

Notes: OD-Organisational Dynamics; ODC- Organisational Dynamics Code

FH6- Ability to act efficiently even under uncertain and ambiguous conditions

Even though all employees agree that the construction production cannot stop and should always be running, because of their personal characteristics some of the employees may not work efficiently under uncertain and ambiguous conditions. Besides the personality, sometimes the culture in the work environment also leads staff towards such an attitude (Table 8.23).

Table 8.23 : Rankings of the barriers of FH6 capability based on Delphi findings.

Ranking	Barrier	OD	ODC
1	Employees do not show a proactive approach (personality)	Trust	T
2	Corporate culture does not support this	Culture	Cl

Notes: OD-Organisational Dynamics; ODC- Organisational Dynamics Code

8.3.2.2 IT flexibility

The ability to provide IT flexibility (FI) consists of six sub capabilities, which will be described respectively, below. The representation of dynamics affecting this capability is provided in Figure 8.7 with its place on CATER.

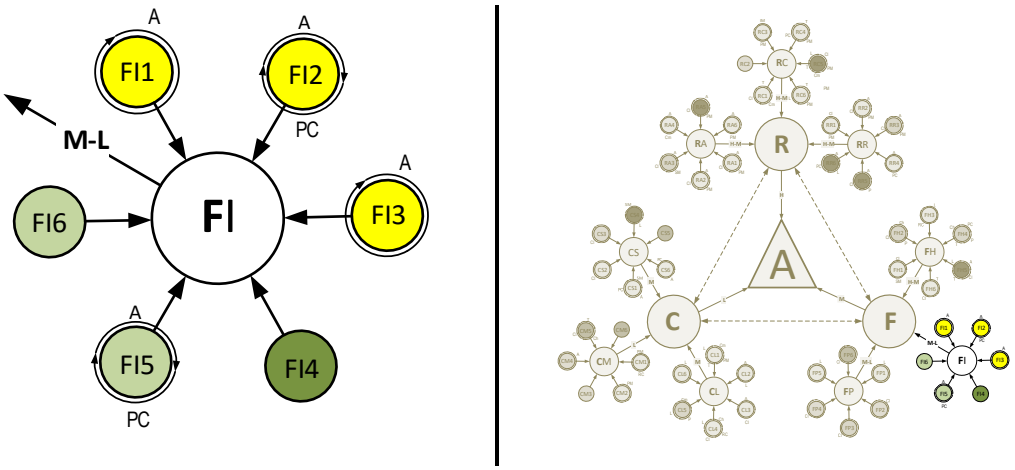


Figure 8.7 : Dynamics affecting FI capability.

FI1- Ability to provide scalability of IT infrastructure

The size of the construction companies can quickly change, based on the number and size of the project that they are working in. At this point the organisation approach towards IT infrastructure is very important in order to meet the demands of such a change in the scale. Approaching IT infrastructure as a dead investment is one of the most important reasons for not being able to satisfy this demand. Even though they are the bases that the construction production takes place, most of the construction companies see the site offices as temporary structures and choose not to invest in their IT infrastructure so much. Another gap that is preventing the scalability of IT infrastructure can be identified as the unawareness of the company regarding the actual level of its resource base (Table 8.24).

Table 8.24 : Rankings of the barriers of FI1 capability based on Delphi findings.

Ranking	Barrier	OD	ODC
1	Being unaware of the importance and benefits of IT infrastructure	Awareness	A
2	Seeing sites as temporary bases and keeps investments at minimum	Awareness	A
3	Being unaware of the actual resource base	Awareness	A

Notes: OD-Organisational Dynamics; ODC- Organisational Dynamics Code

FI2- Ability to provide modularity of IT infrastructure

The problems regarding the providing or improving the modularity of IT infrastructure arise from the incompatibility of the systems that are provided without

making a detailed analysis and not taking this feature into consideration during the development of an IT strategy (Table 8.25).

Table 8.25 : Rankings of the barriers of FI2 capability based on Delphi findings.

Ranking	Barrier	OD	ODC
1	Neglected during the development of IT strategy	Awareness	A
2	Lack of detailed analysis about the compatibility of products	Planning & Control	PC

Notes: OD-Organisational Dynamics; ODC- Organisational Dynamics Code

FI3- Ability to provide facility of IT infrastructure

In every new implementation the IT departments publish manuals that are describing the steps and important areas that are needed for a proper usage and the IT departments work on the improvements of the user-friendliness of the systems that are used. However, the intensity of these efforts is correlated with the awareness of managers regarding this concept (Table 8.26).

Table 8.26 : Rankings of the barriers of FI3 capability based on Delphi findings.

Ranking	Barrier	OD	ODC
1	Being unaware of the benefits of IT facility	Awareness	A

Notes: OD-Organisational Dynamics; ODC- Organisational Dynamics Code

FI4- Ability to provide modernity of IT infrastructure

Construction companies at this level usually improve their standards according to the other parties that they are working with and the technical specifications of the projects. In this regard they believe in the importance of using well known and modern products in the market.

FI5- Ability to provide connectivity of IT infrastructure

The IT departments of the construction companies, work on developing an IT infrastructure that enables easy and secure communication between different units. However, the IT infrastructure of the area that the project is planned to be built on, has a significant impact on the efficiency of this communication. If the infrastructure is not sufficient to support the required services, the company needs to make a considerable amount of investment to establish the communication. Companies usually have problems in these kinds of situations due to the unwillingness of the top management to invest on infrastructure. Sites are usually evaluated as temporary

bases and for that reason the focus of the company is usually on the headquarters (Table 8.27).

Table 8.27 : Rankings of the barriers of FI5 capability based on Delphi findings.

Ranking	Barrier	OD	ODC
1	The IT infrastructure of the area that the project will take place	Planning & Control	PC
2	Being aware of the importance and benefits of IT infrastructure	Awareness	A
3	Seeing sites as temporary bases and keeps investments at minimum	Awareness	A

Notes: OD-Organisational Dynamics; ODC- Organisational Dynamics Code

FI6- Ability to provide compatibility of IT infrastructure

Construction organisations choose to adapt ERP systems, not only for managing information more efficiently, but also to improve the compatibility of their systems. Along with the ones that are trying to adapt the well known systems, some of them choose in house developed ones. The IT department is also responsible for ensuring the interoperability among applications and operating systems.

8.3.2.3 Process flexibility

The representation of dynamics affecting Process flexibility (FP) is provided in Figure 8.8 with its place on CATER.

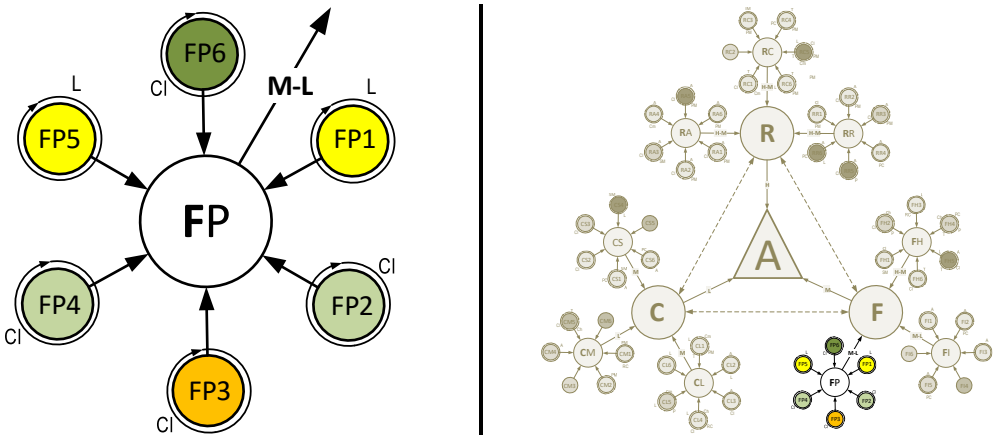


Figure 8.8 : Dynamics affecting FP capability.

This capability consists of six sub capabilities, which will be described respectively, below.

FP1- Ability to develop a range of possible solutions in a sudden change

Turkish construction companies, especially the ones at this level are qualified and experienced in the business. So, most of their staff are capable of developing a range of possible solutions in sudden change. Yet, the problems that can be raised are due to the leadership characteristics of the managers (Table 8.28).

Table 8.28 : Rankings of the barriers of FP1 capability based on Delphi findings.

Ranking	Barrier	OD	ODC
1	The leadership characteristics of the managers	Leadership	L

Notes: OD-Organisational Dynamics; ODC- Organisational Dynamics Code

FP2- Ability to develop range of possible solutions in planned change

Based on their experience Turkish construction companies are capable of; developing a range of possible solutions, in planned change. However, as it is the same in risk analysis, companies usually do not have the habit of planning these alternatives before they face them (Table 8.29).

Table 8.29 : Rankings of the barriers of FP2 capability based on Delphi findings.

Ranking	Barrier	OD	ODC
1	The company does not have this approach	Culture	Cl

Notes: OD-Organisational Dynamics; ODC- Organisational Dynamics Code

FP3- Ability to provide solutions within optimum time and cost difference in sudden change

In sudden changes the emphasis is on completing the work within the required quality and time, yet the cost sometimes can drop behind of these two (Table 8.30).

Table 8.30 : Rankings of the barriers of FP3 capability based on Delphi findings.

Ranking	Barrier	OD	ODC
1	The company does not have this approach	Culture	Cl

Notes: OD-Organisational Dynamics; ODC- Organisational Dynamics Code

FP4- Ability to provide solutions within optimum time and cost difference in planned change

Based on their experience, Turkish construction companies are capable of; providing solutions within the optimum time and cost difference in planned change. However,

as it is the same in risk analysis, companies usually do not have the habit of planning these alternatives before they face them (Table 8.31).

Table 8.31 : Rankings of the barriers of FP4 capability based on Delphi findings.

Ranking	Barrier	OD	ODC
1	The company does not have this approach	Culture	Cl

Notes: OD-Organisational Dynamics; ODC- Organisational Dynamics Code

FP5- Ability to provide similar results in sudden change

Either it is planned or unpredicted, in every condition the aim of the company is to reach the desired results. However, slow decision making may cause the company to miss opportunity to provide the same or similar results (Table 8.32).

Table 8.32 : Rankings of the barriers of FP5 capability based on Delphi findings.

Ranking	Barrier	OD	ODC
1	Missing opportunities due to slow decisions	Leadership	L

Notes: OD-Organisational Dynamics; ODC- Organisational Dynamics Code

FP6- Ability to provide similar results in planned change

Based on their experience Turkish construction companies are capable of; developing alternative solutions that will provide the same or similar results, in planned change. However, as it is the same in risk analysis, companies usually do not have the habit of planning these alternatives before they face them (Table 8.33).

Table 8.33 : Rankings of the barriers of FP6 capability based on Delphi findings.

Ranking	Barrier	OD	ODC
1	The company does not have this approach	Culture	Cl

Notes: OD-Organisational Dynamics; ODC- Organisational Dynamics Code

8.3.3 Competence in diffusion process

Competence in diffusion process is related with possessing the abilities that will facilitate the efficiency and success of the technology diffusion process. Based on its three main capabilities, the factors that affects construction companies' flexibility are as follows;

8.3.3.1 Leadership

The Leadership ability (CL) consists of six sub capabilities, which will be described respectively, below. The representation of dynamics affecting this capability is provided in Figure 8.9 with its place on CATER.

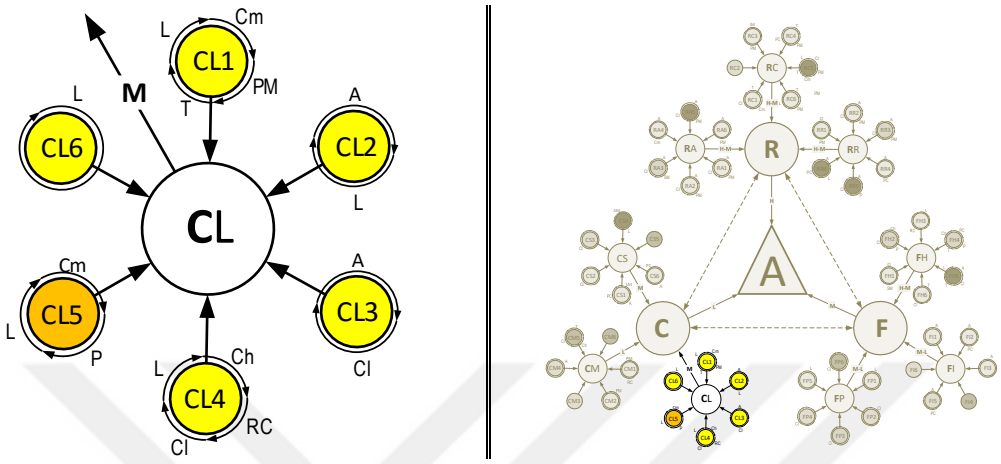


Figure 8.9 : Dynamics affecting CL capability.

CL1- Empower staff to take their decisions

The empowerment of staff to take their decisions mainly depends on the manager's choice of delegating responsibilities to other staff. Yet, in order improve the efficiency of this delegation, roles and responsibilities should be clarified (Table 8.34).

Table 8.34 : Rankings of the barriers of CL1 capability based on Delphi findings.

Ranking	Barrier	OD	ODC
1	Managers do not want to delegate their power of decision making	Leadership	L
2	Roles and responsibilities are not clear	Process Management	PM
3	Vertical communication problems	Communication	Cm
4	Staff avoid taking initiative	Trust	T

Notes: OD-Organisational Dynamics; ODC- Organisational Dynamics Code

The problems in vertical communication barriers staff's involvement in decisions and thus make them feel isolated and lead them to avoid taking initiative. Construction organisations should remember that empowerment is also a type of communication between managers and the staff, so the improvements in vertical communication will surely have a positive impact on this process as well. However, staff should also improve their skills of leadership and be eager to take initiative.

CL2- Provide incentives for efficient use of new technology

Generally, top management's level of awareness about the actual and possible benefits of new technology is low. Thus, they approach technology as a technical requirement to be met in order to take the project bid. Based on this view, top management also think that the organisation does not need to motivate staff to use new technology efficiently with incentives since it is their duty to do so. In addition to this, rather than motivating staff with incentives, top management's approach of; "do not change the one that is working", acts as a demotivator for the staff, which also affects their sense of belonging, negatively (Table 8.35).

Table 8.35 : Rankings of the barriers of CL2 capability based on Delphi findings.

Ranking	Barrier	OD	ODC
1	Top management's lack of awareness about the benefits of such an implementation	Awareness	A
2	Top management's approach which sees using new technology efficiently as staff's duty	Leadership	L

Notes: OD-Organisational Dynamics; ODC- Organisational Dynamics Code

CL3- Development of an innovative culture

In order to develop an innovative culture in the company, the awareness of the employees about the benefits of new technology should be developed (Table 8.36).

Table 8.36 : Rankings of the barriers of CL3 capability based on Delphi findings.

Ranking	Barrier	OD	ODC
1	Organisation's awareness about the benefits of new technology	Awareness	A
2	Innovative approach of the top management	Culture	Cl

Notes: OD-Organisational Dynamics; ODC- Organisational Dynamics Code

Top management's approach to innovations and novel technologies plays an important role in this process.

CL-4 Development of a collaborative culture

Employees' collaboration regarding the implementation of new technology is strongly correlated with the commitment of top management. Another factor that is affective in the level of collaboration is the personality of the staff. At this point, usually the experienced staff do not want to change the way that they do their job so

they show resistance to the “new” and do not participate in the collaboration efforts. The corporate culture also plays an important role in this collaboration. Regardless of the age of employees, an organisation with an innovative culture is more advantageous in ensuring the collaboration for the implementation of new technology (Table 8.37).

Table 8.37 : Rankings of the barriers of CL4 capability based on Delphi findings.

Ranking	Barrier	OD	ODC
1	Top Management's commitment to change	Leadership	L
2	Personality of the staff	Characteristics	Ch
3	Old / experienced staff’s resistance to change	Resistance To Change	RC
4	Lack of innovative culture in the company	Culture	Cl

Notes: OD-Organisational Dynamics; ODC- Organisational Dynamics Code

CL5- Ability to develop trust to enable information sharing

The different cultures in sites and headquarters, is one of the major problems in construction companies. This difference in the perspectives of two sides, also act as an important barrier for sharing information (Table 8.38).

Table 8.38 : Rankings of the barriers of CL5 capability based on Delphi findings.

Ranking	Barrier	OD	ODC
1	Different perspectives of headquarters and the sites	Communication	Cm
2	Power balances between departments	Power	P
3	Personal characteristics of the line managers	Leadership	L

Notes: OD-Organisational Dynamics; ODC- Organisational Dynamics Code

The sites do not share information freely with headquarters, thinking that this can reveal their gaps as well. However, the headquarters is responsible for controlling the work and take due precautions for the possible risks. Power relationships between departments also have a negative impact on the establishment of trust. Departments want to have and maintain the control of information, which also gives them the competitive advantage.

CL6- Ability to develop trust to superiors

The health of trust between the staff and management, depends on the sincerity of their actions. Once the employees lost their belief in the sincerity of their seniors' support, they will not choose to share information or give feedback (Table 8.39).

Table 8.39 : Rankings of the barriers of CL6 capability based on Delphi findings.

Ranking	Barrier	OD	ODC
1	Sincerity of management in their support and actions	Trust	T

Notes: OD-Organisational Dynamics; ODC- Organisational Dynamics Code

8.3.3.2 Management of change process

The ability to manage change process (CM) consists of six sub capabilities, which will be described respectively, below. The representation of dynamics affecting this capability is provided in Figure 8.10 with its place on CATER.

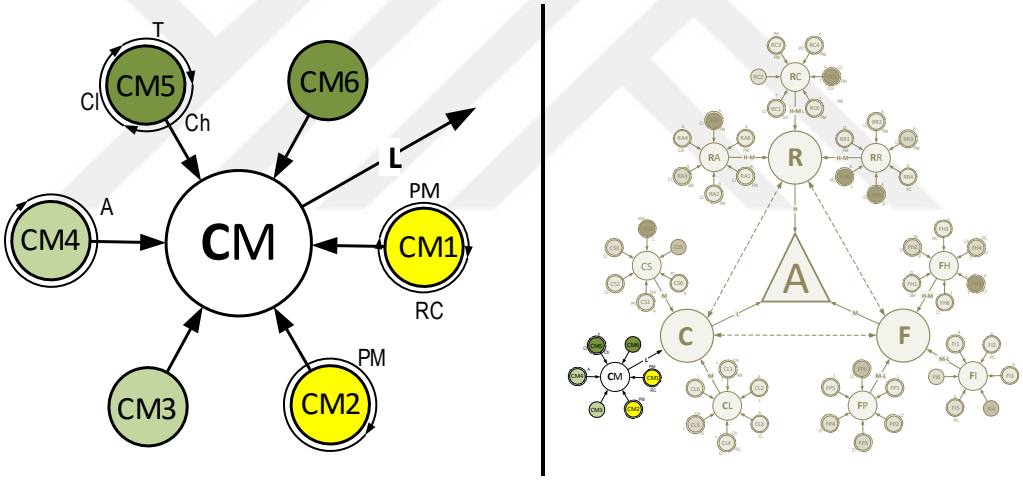


Figure 8.10 : Dynamics affecting CM capability.

CM1- Ability to reengineer the processes

Regarding this ability, the main problem of the construction companies at this level is the lack of experience in process reengineering. Line managers usually solve the problems with the help of their experience, but as the companies get bigger the tracking and reengineering the processes needs a considerable amount of expertise. Even if the organisation possesses this expertise for the design of revised or new processes, the resistance to change always waits as a barrier for the implementation of reengineering (Table 8.40).

Table 8.40 : Rankings of the barriers of CM1 capability based on Delphi findings.

Ranking	Barrier	OD	ODC
1	The organisation's incapability in process management	Process Management	PM
2	Resistance to new processes	Resistance To Change	RC

Notes: OD-Organisational Dynamics; ODC- Organisational Dynamics Code

CM2- Ability to clarify changes in roles and responsibilities

Subsequent to the revisions in processes, the changes in the roles and responsibilities should be announced to the staff. At this point the steps to be followed in the distribution of this information should have been defined. However, along with the procedures of information sharing, the roles and responsibilities should also have been clarified before, in order to see and announce the changes that arise after the revisions (Table 8.41).

Table 8.41 : Rankings of the barriers of CM2 capability based on Delphi findings.

Ranking	Barrier	OD	ODC
1	Leaving communication to individuals' initiative	Process Management	PM
2	Ambiguous roles and responsibilities	Process Management	PM

Notes: OD-Organisational Dynamics; ODC- Organisational Dynamics Code

CM3- Ability to provide service and technical support within the company

During the implementation of new technology the organisations should provide service and technical support to the staff, in order to facilitate their use and adaptation to new technology.

CM4- Ability to provide technical support from outside of the company

Along with the service and support that is given by the organisation’s own resources, external technical support might be needed. Consultants can be hired either to have guidance and leadership for the implementation of new technology or for technical solutions when the expertise of the organisation is not enough to solve problems. At this point the organisation should learn how to use the consultants more efficiently (Table 8.42).

Table 8.42 : Rankings of the barriers of CM4 capability based on Delphi findings.

Ranking	Barrier	OD	ODC
1	Being aware of how to benefit from external consultancy services	Awareness	A

Notes: OD-Organisational Dynamics; ODC- Organisational Dynamics Code

CM5- Ability to develop a powerful internal communication

The management of change process needs open internal communication. People working in the company should be able to share their views and ideas with each other easily, in order to provide a successful transition process. During this process the organisation should be sincere about the value that is given for exchanging ideas. The staff could be able to share their views with their seniors without hesitation or fear. Even though the level of this communication is also related with the personality of the employees, development of a culture that is supporting the internal communication would be a valuable asset for any company (Table 8.43).

Table 8.43 : Rankings of the barriers of CM5 capability based on Delphi findings.

Ranking	Barrier	OD	ODC
1	Organisation's sincerity regarding the exchange of ideas	Trust	T
2	Problems in superior-subordinate communication	Trust	T
3	Personality of the staff	Characteristics	Ch
4	Corporate culture does not support this	Culture	Cl

Notes: OD-Organisational Dynamics; ODC- Organisational Dynamics Code

CM6- Ability to develop a powerful external communication

Construction companies can have projects in different countries and geographical conditions. In order to carry out a healthy construction process, companies should establish strong ties and advanced communication skills with the third parties. At this point culture of the country that the project is based should be examined in detail.

8.3.3.3 Strategy development

The ability to develop a strategy that will enable Agile Technology Diffusion (CS) consists of six sub capabilities, which will be described respectively, below. The representation of dynamics affecting this capability is provided in Figure 8.11 with its place on CATER.

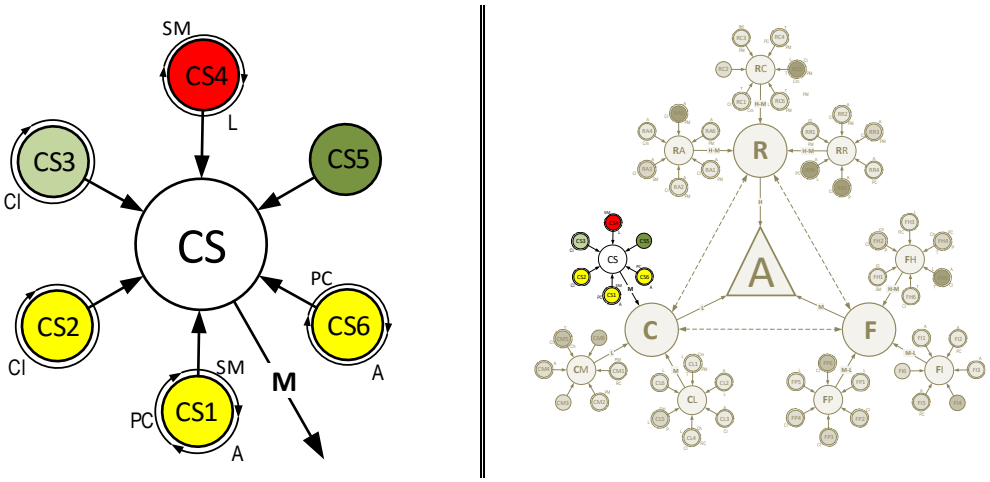


Figure 8.11 : Dynamics affecting CS capability.

CS1- Ability to develop an IT strategy aligned with business strategy

Once the business strategy of the organisation is clear, an IS strategy and an IT strategy should be developed, aligned to it. Unfortunately construction companies have problems in developing a clear and purpose fit IT strategy. The technologies that are being used, are usually determined according to the technical specifications of bids, instead of IT strategies. Even if such a strategy exists, the decision for new technology is given without making a detailed analysis (Table 8.44).

Table 8.44 : Rankings of the barriers of CS1 capability based on Delphi findings.

Ranking	Barrier	OD	ODC
1	Lack of a clearly identified IT and/or IS strategy	Strategic Man.	SM
2	Taking technical specifications as the only guide for the IT need	Awareness	A
3	Lack of a detailed analysis	Planning & Control	PC

Notes: OD-Organisational Dynamics; ODC- Organisational Dynamics Code

CS2- Ability to develop a diffusion program for new technology

After the determination of technology to be used, the organisation should develop a detailed program for its implementation. The plan includes the steps to be taken to provide a companywide implementation process; including trainings, infrastructure improvements, prototype projects and etc. Even though there are some companies that develop such plans during new technology implementation, most of the construction companies do not have such an approach (Table 8.45).

Table 8.45 : Rankings of the barriers of CS2 capability based on Delphi findings.

Ranking	Barrier	OD	ODC
1	Lack of such an approach	Culture	Cl

Notes: OD-Organisational Dynamics; ODC- Organisational Dynamics Code

CS3- Ability to employ IT and innovation ready staff

Along with giving trainings the company may follow a recruitment strategy that hires IT and innovation ready staff. However, this vision requires the existence of an innovative perspective and a structured recruitment strategy with the determined criteria, in order to provide equity (Table 8.46).

Table 8.46 : Rankings of the barriers of CS3 capability based on Delphi findings.

Ranking	Barrier	OD	ODC
1	Lack of innovative culture	Culture	Cl
2	Bilateral relationships are efficient on recruitment	Culture	Cl

Notes: OD-Organisational Dynamics; ODC- Organisational Dynamics Code

CS4- Ability to encourage staff to use new technology

As a part of HR strategy, the organisation should develop plans to encourage people to use new technology. Construction companies should focus on their HR strategies more and develop career plans for their employees. Investing in human capital will not only improve the sense of belonging in the organisation but also improve the efficiency. The development of these kind of encouragement plans are based upon the top management's commitment about the implementation of new technology (Table 8.47).

Table 8.47 : Rankings of the barriers of CS4 capability based on Delphi findings.

Ranking	Barrier	OD	ODC
1	Lack of career development plan	Strategic Man.	SM
2	Top Management's commitment to change	Leadership	L

Notes: OD-Organisational Dynamics; ODC- Organisational Dynamics Code

CS5- Ability to improve staffs' skill, knowledge and attitude towards new technology

Based on the determination of the technology to be used, the organisation should also develop its training strategy and plans attached to it. While people that will directly

use technology should have technical trainings, other staff should also be trained about using the output of the new technology.

CS6- Ability to improve top management's knowledge about new technology

Even though the top management or senior line managers usually do not use these technologies (as operators do), the benefits of new technology and its capabilities should be presented, in order to develop an understanding at the upper level. At this level, the managers do not attend these kind of meetings either because of their heavy workload or their indifference regarding the topic (Table 8.48).

Table 8.48 : Rankings of the barriers of CS6 capability based on Delphi findings.

Ranking	Barrier	OD	ODC
1	Heavy workload of top management	Planning & Control	PC
2	Management's indifference towards new technology	Awareness	A

Notes: OD-Organisational Dynamics; ODC- Organisational Dynamics Code

8.4 Framework Validation

This section presents the validation process of the CATER (Figure 8.12). It evaluates the applicability, reliability and generalisability of the framework within the academic and industrial context. The validation process involves four domain experts, who did not participate in any of the data collection phases. The domain experts had a high level of experience in construction management practices and all were seniors in their respective organisations.

8.4.1 Validation process

Validation phase of a conceptual framework aims to understand "whether the proposed framework and its concepts make sense not only the researcher but also the other scholars and practitioners" (Jabareen, 2009). In this sense collecting the reviews of domain experts is a valuable method of validation, covering both internal and external validity (Bock & Scheibe, 2001), which were defined in Chapter 5 in detail. In this regard, the participants of the validation process were asked to address the questions that were related with; the general construct and the applicability of CATER.

The validation process adopted a qualitative approach to capture the views and perceptions of the domain experts in regard to the CATER. A semi-structured interview was used and each interview took one and half hours.

As the initial step of the validation, the steps of the research process; ranking method, interviews and Delphi method, were explained to the domain experts. Subsequently, the framework and the factor tables were presented. Once the experts become familiar with the research results, the questions prepared to assess the construct and applicability of the framework were asked. The questions prepared for the domain experts were as follows;

Questions related to constructs;

- Do the "core capabilities", reflect the agility concerns of the construction industry, regarding the technology diffusion process?
- Do the rankings regarding the "sub capabilities" reflect the technology diffusion agility gaps of the internationally competitive construction organisations of Turkey?
- Do the rankings of "the barriers" present a proper guidance for providing agility for technology diffusion in construction organisations?

Questions related to applicability;

- How would you describe the framework's ability to define the concept, with respect to ease of understanding?
- Would you consider such a tool for defining the technology diffusion agility of your company?
- Would you consider such a tool as a guide for improving the agility of technology diffusion in your company?

The following sections present the findings of the validations process based on the responses of different domain experts.

8.4.2 Industry validation

The validation by the views of experts from the industry was conducted by two domain experts (DE1 and DE2). The findings based on the views of DE1 and DE2 are presented in Table 8.49 and the interview details are given below, respectively.

Table 8.49 : Views of the industry experts regarding the validation questions.

Questions	Expert view of DE1	Expert view of DE2
Do the "core capabilities", reflect the agility concerns of the construction industry, regarding the technology diffusion process?	Very comprehensive and covered most of the issues.	Generally agreed. However once the companies get more familiar with concepts such as "recovery from change" and "process flexibility" the rankings can slightly change.
Do the rankings regarding the "sub capabilities" reflect the technology diffusion agility gaps of the internationally competitive construction organisations of Turkey?	Agreed. It is saddening to see the industry's laxness about the "recovery from change" ability	Agreed.
Do the rankings of "the barriers" present a proper guidance for providing agility for technology diffusion in construction organisations?	Agreed.	Very useful
How would you describe the framework's ability to define the concept, with respect to ease of understanding?	Not very easy, but it is normal since it is very comprehensive	Not a simple representation but also not so hard to understand for the people who are familiar with construction project management.
Would you consider such a tool for defining the technology diffusion agility of your company?	Yes	Yes. Curious about the result from a company of different size or origin.
Would you consider such a tool as a guide for improving the agility of technology diffusion in your company?	Yes. Very useful. Would be appreciated if it would also highlight the road map to overcome the barriers.	Yes

8.4.2.1 Expert view of DE1

The DE1 was an expert on construction project management. The respondent was of the view that the conceptual framework is very comprehensive and covered most of the issues. However, the respondent claimed that the framework is embracing a large area of concepts and any parameter that is not written on the framework could easily be evaluated under one of the existing concepts. The respondent agreed with the rankings of the technology diffusion agility gaps of the internationally competitive construction companies and also emphasised that it is saddening to see the industry's laxness about the "recovery from change" ability. Yet, the respondent confirmed its ranking in the list. Regarding the content of the framework some additions were suggested. The importance to have top management's commitment in this process was highlighted. However, the respondent also claimed that this commitment should be stemmed from the proper and detailed knowledge about technology and the

awareness of internal connectivity. The respondent asserted that otherwise with insufficient knowledge, top management's commitment would harm the process, instead of facilitating it. It was also argued that there must be a unit that controls the agile diffusion process. Regarding the training, it was highlighted that there must be training programs to raise awareness of the agile diffusion process, giving employees information about the possible consequences of this change and hardships that they will face. The respondent also emphasised the importance of ownership and underlined that the employees should take the ownership of the process. It was claimed that there should be a legacy archive of the company in which the experiences of the agile diffusion process will be recorded and evaluated for the further attempts. The respondent agreed that the rankings of barriers present a proper guidance for providing agility for technology diffusion in construction organisations.

Regarding the applicability of the framework, it was claimed that it is absolutely useful and can be applicable in the companies. The respondent asserted that the framework could be considered as a tool for defining and improving the level of technology diffusion agility of a company.

8.4.2.2 Expert view of DE2

The DE2 was again an expert on construction project management. The respondent claimed that the core capabilities as well as the sub capabilities of CATER were determined very carefully and underlined the comprehensive coverage that these capabilities provide. The respondent stated his agreement regardin the rankings of the sub capabilities. However, it was also emphasised that concepts such as "recovery from change" and "process flexibility" are valuable concepts but most of the construction companies are not very familiar with them. In this regard the respondent claimed that there would be some slight changes in the rankings with the related concepts, when the companies gain a better awareness regarding their benefits. The definitions and rankings were found very useful and it was claimed that they would provide a proper guidance for enabling agile technology diffusion.

Regarding the ease of understanding, the respondent claimed that it is not a simple representation but also not so hard to understand for the people who are familiar with construction project management. Even though some implementations were offered (such as including names of the capabilities in the representation), the reasons for

their inapplicability were found reasonable. The respondent claimed that CATER could be used for both defining and improving the level of ATD. The respondent also stated that it would be interesting to see the results of this research when its conducted with companies from different levels or different origins (countries).

8.4.3 Academic validation

The validation by the views of experts from the Academia was conducted by two Academics (DE3 and DE4). The findings based on the views of DE3 and DE4 are presented in Table 8.50 and the interview details are given below, respectively.

Table 8.50 : Views of the academic experts regarding the validation questions.

Questions	Expert view of DE3	Expert view of DE4
Do the "core capabilities", reflect the agility concerns of the construction industry, regarding the technology diffusion process?	Agreed. The structure of the framework involves some niche capabilities that were carefully selected.	Agreed. Convinced with the methodological background.
Do the rankings regarding the "sub capabilities" reflect the technology diffusion agility gaps of the internationally competitive construction organisations of Turkey?	Even though the sample set is small, the respondents are from internationally well-known companies and they are highly experienced in the construction domain so the quality of the data that was collected is very high.	Agreed.
Do the rankings of "the barriers" present a proper guidance for providing agility for technology diffusion in construction organisations?	Agreed. Appreciated the effort and value of conducting a Delphi with these kinds of high ranked professionals.	Yes
How would you describe the framework's ability to define the concept,with respect to ease of understanding?	Comprehensive but understandable.	Easy to understand. Appreciated the general design and description capability
Would you consider such a tool for defining the technology diffusion agility of your company?	Yes. Useful framework that can be applicable in the construction organisations which are mature enough to claim agility in diffusion.	Yes.
Would you consider such a tool as a guide for improving the agility of technology diffusion in your company?	Yes.	Yes. It is possible to use CATER to measure the agility level in different companies

8.4.3.1 Expert view of DE3

The DE3 was familiar with construction management practices especially IT and innovation in construction but not with the agility concept. In this regard brief

information was given regarding the agility concept and its practices in the manufacturing industry. Since the academic had a comprehensive knowledge about construction production and the management of construction processes, could quickly get involved in the topic. With respect to the core capabilities of the framework, the respondent agreed that they reflect the agility concerns of construction industry. The respondent also added that the structure of the framework involves some niche capabilities that were carefully selected. Regarding the rankings of sub capabilities to determine the priority areas, the respondent stated that there can be some concerns about the sample size. However, also added that, the participants of the research are from internationally well-known companies and they are highly experienced in the construction domain so the quality of the data that was collected is very high. In this regard, the respondent confirmed the rankings and the reliability of the data.

Regarding the rankings of the barriers the respondent appreciated the effort and value of conducting a Delphi with these kinds of high ranked professionals and approved that the ranking of the barriers provide proper guidance for providing agility for technology diffusion in construction organisations.

Regarding the applicability of the framework, the academic claimed that it is a useful framework that can be applicable in the construction organisations which are mature enough to claim agility in diffusion. In other words, the companies, which have experienced difficulties in technology diffusion in their past will surely be eager to use this framework for defining and improving their technology diffusion agility level. However, the respondent also stated doubts about the existence of such mature companies in Turkish construction industry.

8.4.3.2 Expert view of DE4

The DE4 was familiar with construction management practices but not with the agility concept. Brief information was given regarding the research process, the agility concept and its practices in the manufacturing industry. The respondent especially questioned the development process of the CATER and how the core capabilities were established. Being convinced with the methodological background, the respondent confirmed that the core capabilities of the framework reflect the agility concerns of the construction industry, regarding the technology diffusion

process. The respondent also agreed that the rankings of the sub capabilities reflect the technology diffusion agility gaps of the internationally competitive construction organisations of Turkey and the barrier rankings present a proper guidance for providing agility for technology diffusion in construction organisations

Regarding the applicability of the framework the respondent appreciated the general design and description capability of the CATER. However the respondent also stated that it would be useful if there is a way to show the capability names on the general representation of the framework. Claiming that CATER is a powerful description of the relevant level of Agile Technology Capabilities of internationally competitive Turkish construction organisations, the respondent also highlighted the opportunity to use CATER to measure the agility level in different companies.

8.4.4 Responses for the validation findings

Domain experts were generally satisfied with the structure and the approach presented with the framework. The validation process recorded 11 comments as suggestions for future development of the model, which can be seen in Table 8.51.

Table 8.51 : Reflection on the validation comments.

Domain Experts Comments		**Response to Domain Experts Comments**
1.	Top management commitment is very important for this process	It is covered in the sub-capabilities of the motivating staff to use new technology (Leadership) and also in the capability to develop trust in the organisation.
2.	Top management should be aware of the benefits of the new technology and the inter-links that take place in the organisation	This is covered in the awareness capability embracing both being aware of the emerging technologies benefits and the connectivity
3.	There must be a unit to manage and control the agile diffusion process	This is about the management of diffusion process and it is highly important. This is a further development of a model that presents the development and management of the agile technology diffusion process.
4.	The employees should be informed about the possible hardships that they will face during the implementation	This is covered in the development of training strategy capability

Table 8.51 (continued) : Reflection on the validation comments.

Domain Experts Comments		Response to Domain Experts Comments
5.	The employees should take the ownership of this new implementation	This is covered in the development of culture that supports new technology implementation
6.	There should be a legacy archive in which the organisation stores its experiences in this process and use them in the future when needed	This is covered under the information and knowledge management capability.
7.	The factors for Responsiveness capabilities follow each other as a process. However, there is not such a flow in the other two core capabilities. In this regard, there may be another type of presentation for to show their difference.	The framework presents organisational capabilities and most of them do not represent a flow. In this regard a tree diagram is preferred instead of a process diagram for the presentation of the conceptual framework.
8.	Despite its importance, the construction professionals may have difficulty to understand the capability of recovery from change.	Unfortunately this is a weakness in the construction management literature as well. In this regard this should be focus of the further studies and the awareness level of the industry should be increased regarding this topic.
9.	Especially for the process flexibility, the views of different departments that will be affected, should be taken. This can be included in the process flexibility capability.	Even though this could not be shown in the framework, it is taken into account in the related capability
10.	The coordination and collaboration between employees is very important for this change so this should be included.	This is covered under the development of culture as the development of collaborative culture
11.	The organisation should monitor the process and measure the efficiency	The monitoring of the process is about the management of diffusion process and it is highly important. This is a further development of a model that presents the development and management of the agile technology diffusion process.

8.5 Summary of the Chapter

This chapter discussed the development and validation processes of the CATER. The rationale for the development was to lead the organisations to be agile in diffusing and using emerging technologies in the market, by capturing the perceptions and understandings of the professionals working in the Construction Industry. In this

regard, a consensus of different companies and management levels was provided using the Delphi approach, in order to create a shared and balanced understanding.

The chapter initially presented the Delphi process that was used to in the study and explained it in detail. For the next step the details of the conceptual framework provided and the chapter was concluded by the validation of the framework by domain experts.

The validation process created independence to allow neutrality-cognisant of bias and siloed positioning. The separate studies were conjoined and synthesised, the findings of which were presented in precise form in Chapter 10.5.2 to help and inform future research.

9. DISCUSSION

9.1 Introduction

The aim of this research was to develop a conceptual framework which will lead the organisations to be agile in diffusing and using emerging technologies in the market by capturing the perceptions and understandings of the professionals working in the Turkish Construction Industry. In this regard an extensive literature review was carried out to clarify and confirm the need for this research. The literature review presents the previous studies that aimed to explain the nature of technology diffusion process and the approaches to provide agility in different industries. However, no study is evident to define an approach that is trying to improve the efficiency of the technology diffusion process by transposing these two approaches and visualising them through and agility lens. In this research a case study approach was adopted in which a questionnaire and semi-structured interviews were used to collect the data, to fulfil the aim and objectives. This chapter discusses the findings of the research in the light of literature and also demonstrates the extent to which this research fulfilled the aim and objectives.

In this regard, the following section discusses the findings from the quantitative and qualitative approaches in the light of existing literature, under three core capabilities (responsiveness, flexibility and competence) of agility. The perceptions and understandings of the industry professionals were discussed based on the findings that are gathered as the result of within case analysis, cross case synthesis and modified Delphi technique.

9.2 Discussion of the Results

9.2.1 Responsiveness

Despite the past experiences about the importance and benefits of responsiveness to changing market conditions and emerging innovations (Jones & Saad, 2003), it is the most neglected capability of the construction organisations among the three core

capabilities of agility. Unlike manufacturing, project based production process is one of the main characteristics of construction industry (Gann & Salter, 2000). This causes a fragmented focus for the managers, regarding the determination of priorities in strategic planning and shows its reflections in most of the sub capabilities of responsiveness. The external awareness of the organisation embraces abilities such as; reaching out to international markets (Del Aguila-Obra & Padilla-Melendez, 2006), and market analysis and monitoring (Verhaeghe & Kfir, 2002). However, construction companies limit their external awareness about emerging technologies with taking owner needs in the bid specifications as the basis, instead of a trying to achieve the defined objectives of a well developed IT/IS strategy that is aligned with the business strategy of the company (Beaudry & Pinsonneault, 2005). From a deeper understanding, this means that companies chose to be guided, instead of leading themselves. This implementation is closely related with cultural values that are established within the organisation, through a long period of time. This also reveals the fact that, companies are still not fully aware of the benefits of new technologies (Flanagan & Marsh, 2000), which leads them to an approach that sees them as requirements to fulfil, other than sources of benefits.

As well as the external awareness, construction companies do not have a habit of having a full control and awareness of their own resources base, which is highly needed capability for adapting to changes (Ambrosini *et al.*, 2009). In fact, resources still evaluated as the elements that are used in construction production by most of the companies, which are not aware of the concept of organisational resources. Along with the lack of awareness of existence, overconfidence of the companies that stem from their high level of experience, has a negative impact on the level of awareness (Menkhoff *et al.*, 2013). This leads them to disregarding or not to being interested in the links and interdependencies of the actors and dynamics of the market. In addition to this, focussing on the projects and missing the big picture is a common habit of the construction companies, which also can be related with lacking a strong strategic plan (Jusoh *et al.*, 2007).

Even though they are the different units of the same organisation, headquarters and sites have different perspectives (Haupt & Whiteman, 2004). Thereupon their approaches to the process also show differences. Along with the communication

problems (Danowski, 1980), these differences are the main problems that lay behind lack of awareness of internal connectivity.

The unawareness of the organisational resources also brings the lack of awareness regarding the interactions between people, process and technology (Peansupap & Walker, 2005c). The amalgamation of this lack of awareness with the overconfidence of the companies, causes the ignorance of the analyses of the potential risks and consequences of change on organisational resources.

When required, organisations of this level can easily provide detailed statements about strategic vision. However, these statements are usually developed in order to satisfy the requirements of quality standards. Especially in the companies that lack innovative culture, strategic visions and plans are both developed and discussed only in top management level (Scholz, 1987). In a culture that sees strategic management as top management's business, it is possible to have communication lags regarding the transmission of the related information to lower levels. Along with the problems regarding the "source" of the message, "receiver" of the message may not show interest to the information, as a result of lack of sense of belonging.

Construction production is a big scaled process embracing various parties and implementations, which provide an information overload. However, construction companies are suffering from the deficiencies in the information management, especially with providing reliable data from the production. Actually the construction companies have problems, nearly in all phases of the information management process. This incapability appears as one of the main sources of inefficiency of construction processes (Love & Irani, 2004).

The efficiency in information management also provides speed in decision making (Huber, 1990). However, the choice of communication is usually left to the individuals' initiative, due to the inefficient information sharing protocols. This gap in the information sharing procedures also provides employees the chance to hide information, regarding the conflicts or power concerns between parties.

The low speed of decision making is the common problem for the organisations at this level. The need for having too many approvals from the upper levels is a factor that reduces the speed and acceptance of decisions (Fredrickson, 1986). Even though most of the staff complain about the number of these approvals, managers that have

been “raised” in this culture, prefer to continue this implentatio, since they think that this way is safer (Jeyaraj & Sabherwal, 2008). Ambiguousness of the roles and responsibilities provides lags not only in decision making but also in delegation of the authority to make decisions. Along with this, some managers may chose not to give the control, to someone else or as just the opposite; the staff may avoid taking initiative. This avoidance, stem from top management’s lack of understanding and support (Russell & Hoag, 2004).

As one of the three capabilities of responsiveness, recovery from change is a concept that the construction organisations are not very familiar with. Even though they meet some of its requirements the implementations are not pursued with the awareness of the concept. Since the people related issues usually disregarded compared to technical ones, the organisations are not aware of the benefits of such an implementation. In this regard, neither for sudden or planned change, the managers do not conduct a needs assessment based on defined procedures. Even though the companies at this level usually have very strong planning departments with high level of skills, development of a recovery plan is beyond the scope of these organisations. As a result of the lack of awareness in previous steps, the reorganisation or the recovery phases are seen as sources of extra cost and usually deferred as much as possible, till a significant problem occurs. Despite these deficiencies in the implementation of the steps and procedures of recovery from change, the organisations usually overcome the negative effects of this gap, by the help of their highly skilled and experienced human resources.

9.2.2 Flexibility

As the scale of the organisations gets bigger the rate of specialisation of the employees increases. The employees who are specialised in one task usually do not want to be moved to another. In spite of the possible negative impacts on technology adoption (Hameed *et al.*, 2012a), implementation of a rotation strategy for the employees, in order to provide them knowledge and understanding about the different processes and phases of work, is a relevant strategy in HR management domain. However, construction companies neither implement such an approach nor question the existence of such a capability, in the recruitment phase of the

employees. Still, they may expect employees to adapt different positions and work under various responsibilities when needed.

Although, most of the employees, especially the younger ones are happy to learn new skills and develop their abilities (Peansupap & Walker, 2005b), this rate decreases as their experience in company gets higher. In that sense, the average age of the company is a useful indicator in understanding the level of this need (Venkatesh *et al.*, 2003). Even though personality of the staff is the main determinant on this will, after some time the negative impact of heavy workload acts as the main determinant that causes this eagerness to fade away.

Internationally competitive construction companies, have highly skilled and experienced workforce. These people who have lived, worked and become successful within the corporate culture of the company, usually do not want to change the way that they work, since they believe in it. This brings the low tolerance to change (K. Davis & Songer, 2008). They are not usually interested in the new procedures since they see them immature and inefficient. Since these employees have been successful in the tasks that they were given, top management usually avoid applying sanctions. However, this avoidance can also be interpreted as the lack of top management's commitment to change.

Even though the project based approach brings the need for an efficient team play, employees usually cannot find time to share information and learn from each other because of the heavy workload. However, it is a highly important implementation for the company (Hameed *et al.*, 2012a) to adapt to new procedures quickly. Along with the personality of some employees that do not allow this sharing, power balances or lack of trust can also be effective in this process.

Top management's commitment to change is highly important in leading staff to change their work habits as a response to change demands (Aladwani, 2001). Awareness of the benefits of new technology, plays a crucial role on the development of this capability. Even though experienced staff usually stick to their old way of doing things (Hameed *et al.*, 2012a), when they are convinced about the benefits of new technology, they can put a serious effort in changing their habits, since they genuinely want to bring success to the company. On the contrary, if the

employees do not have a sense of belonging, they do not care much about the company and want to continue doing things, in their own way.

Even though the employees are highly skilled and experienced, they usually chose not to show a proactive approach in ambiguous and uncertain situations. In accordance with the views of Peansupap and Walker (2005b) they believe that, a possible mistake that is made can backfire to them. If top management cannot be aware of this approach on time and take precautions, after a while the corporate culture of the company shapes accordingly.

Along with the HR, IT infrastructure is also an important need to support new technology (Hameed *et al.*, 2012a; Jeyaraj & Sabherwal, 2008; Kamal, 2006). Construction companies of this level have highly skilled IT departments which provide sufficient support and quickly solve the IT related problems. However the main problem about the IT infrastructure flexibility is the lack of knowledge and awareness of top management about the benefits of IT infrastructure (Hu *et al.*, 2012). Top management sees IT infrastructure as a requirement to be met other than an asset to be benefitted. This perspective shows the ignorance of the importance and need for a clarified IT strategy. Another problematic approach is to acknowledge IT infrastructure as a source of cost (Verdegem & De Marez, 2011), especially if it is used for sites, which are evaluated as temporary structures. This approach of top management causes employees to lose their motivation and will, to provide innovative approaches and be productive. Furthermore, employees who do not feel the support of top management lose their sense of belonging towards the company.

Highly skilled and experienced staff is one of the most important assets of the Turkish construction companies of this level, in covering the gaps related with the various management practices. Even though the companies are not familiar with the process flexibility approach, they could cope with the needs that stem from this gap with the high level of skills and experience of their staff. In this sense the capability of the companies to provide flexibility of their process needs, is highly related with the personality and leadership capability of the managerial levels. However, this also causes companies to rely on individuals, more than defined procedures, which bring fluctuations in the balance of power within the organisations (Shane, 1993).

9.2.3 Competence

Motivating staff to use new technology is an important indicator for the employees (Talke & Hultink, 2010), which fosters their sense of belonging and also lead them to understand the value and benefits of the new technology for the company. Empowerment of staff to take their own decisions during the implementation phase is a proven approach (Jeyaraj and Sabherwal 2008). However, managers in construction companies are not so keen to delegate their power to the employees. This reluctance stems from the perspective of the top management and expands to the lower levels, increasingly. The fear of failure and its possible consequences bring the need of establishing an intensive control. This approach also causes employees to avoid taking initiative which lead them away from having a proactive stance.

Not being fully aware of the importance of motivation and its benefits to the business, top management do not give importance to provide incentives as a reward for the efficient use of new technology (Shane, 1993). This lack of need is also an outcome of the approach, which sees efficient use of new technology, as the duty of staff.

Since the culture is the "complex whole which includes knowledge, belief, art, morals, law, custom and any other capabilities and habits acquired" (Tylor, 1871), development of a culture that supports IT diffusion through and innovative and collaborative approach is highly important, to positively affect the attitudes and understanding of staff towards new technology (S. Jackson, 2011). However, construction organisations' lack of awareness about the benefits of new technology, hampers this development. The establishment of the innovative culture brings out the need of an innovative approach of top management as the leaders of change and diffusion process. The spread and diffusion of the innovation approach within the organisations, is also one of the prerequisites of the development of a collaborative culture. In fostering collaboration, top management's commitment to change is an important determinant that supports the efforts of the change leaders. However, the will of collaboration to enable new technology diffusion in construction organisations is also affected by the personality of the staff and the level of change resistance in the company.

The positive affect of trust in technology diffusion has been stated by various researchers (Barson *et al.*, 2000; Ipe, 2003). However, the development of trust between peers in construction organisations is mainly hampered by the power balances within the organisation. The line managers, especially in the communication between sites and headquarters, chose to hide information regarding the different perspectives of two units. This gap of trust, acts as the main barrier for seamless information sharing within the company.

The insurance of the trust between employees and the upper levels is the sincerity of management level in their supports and actions (Kamal, 2006; Peansupap & Walker, 2005b). The employees, who do not believe in this sincerity, also do not trust their superiors or top management.

The construction companies at this level have the awareness of process management benefits and developed procedures for construction processes. However, the reengineering capability of the companies, regarding the change needs in processes, is not so powerful. According to Daim *et al.* (2008) this is an important gap in providing an efficient diffusion process. This gap in process reengineering shows its effects on the revisions of actual processes which causes and ambiguity in roles and responsibilities of the staff. When this ambiguity amalgamates with the lack of properly defined procedures, gaps in the transmission of the changes become apparent.

In accordance with the views of Del Aguila-Obra and Padilla-Melendez (2006), construction companies provide services and support to staff, regarding the new technology implementation process, with the help of their skilled and experienced IT departments. When needed, the companies can also provide technical support from the outside of the company (Kamal, 2006). However, employees are not always satisfied with the efficiency of these supports, stressing the specific nature of their work and the related problems.

The importance of the need for a high level communication has been emphasised by various researchers (Hivner *et al.*, 2003; Shane, 1993; Tolba & Mourad, 2011) .The people working in construction companies can easily share their views and opinions with their line managers or peers. Yet, any doubt about the sincerity of this communication hampers this exchange between the staff. Moreover, the sub-cultures

of the units in the company or the personality of the staff can act as barriers for the efficiency of this communication. Based on their high level of experience in both internal and external market, construction companies are capable of developing seamless communication with external parties easily, which is an important determinant that enables IT diffusion (Del Aguila-Obra & Padilla-Melendez, 2006).

Construction companies do not determine their IT needs due to according to a clarified IT strategy that is aligned with business strategy. The IT needs are usually determined by the demands of the projects. Yet, when they decide to use a new technology and if it has an impact on the majority of the units, they require technical support and consulting services. As an output of these services, diffusion programs are being developed and implemented within the supervision of these consultants.

IT ready employees and supervisors with the IT expertise and prior experience is an important asset to improve the efficiency of IT diffusion (Del Aguila-Obra & Padilla-Melendez, 2006; Legris *et al.*, 2003; Pan & Jang, 2008). In this regard, the recruitment of IT and innovation ready staff is another method to support and foster innovative culture within the organisations. However, construction companies are still not fully aware of the benefits of this approach and still pursue these processes based on the references instead of capabilities of the applicants.

Another gap in HR strategy to enable IT diffusion is the lack of incentive plans in the companies (Fichman, 1992). Lack of top management support in providing motivation for the staff also shows its impact on the HR strategies of the construction companies. HR departments do not provide relevant implementations and plans to encourage their staff in using new technology.

Despite the lack of recruitment strategies that focus on innovative and IT ready applicants, construction companies have structured training plans to develop the skills of the staff from different levels, aligned with the view of Venkatesh and Bala (2008). However, especially the management level trainings cannot be so efficient due to low level of attendance of upper level managers. This lack of attendance has a negative impact on the awareness of top management, regarding the benefits and use of new technology, and also slim down the level of their support for innovativeness and change accordingly.

9.3 Achievement of Research Aim and Objectives

Subsequent to the discussion of the main results of the research, this section demonstrates the extent of achievement, regarding the aim and objectives of the research. The aim of the research was to develop a conceptual framework which will lead the organisations to be agile in diffusing and using emerging technologies in the market by capturing the perceptions and understandings of the professionals working in the Turkish Construction Industry. In order to achieve this aim, seven objectives were defined to guide the research processes. How these objectives were addressed is given below;

9.3.1 Objective one

To understand the ways of achieving competitiveness

In order to achieve this objective, the origins of competitiveness and competitive advantage were investigated. The main theories of competitiveness were analysed and discussed to identify the approach, which will provide a sustainable competitive advantage for the construction companies. The analysis revealed the importance of resource based approach and the development of organisational capabilities in order to provide a sustained competitive advantage. The importance of organisational capabilities to achieve this advantage was confirmed by the participants' responses, in the case studies.

9.3.2 Objective two

To investigate the critical factors that affect technology diffusion

In order to achieve this objective, diffusion of innovations theory and theories of technology acceptance were examined thoroughly, with the aim of achieving an understanding about factors affecting the technology diffusion process and adoption decision of individuals. Along with these theories, a comprehensive literature review was conducted and the critical factors that affect technology diffusion were presented in four categories, which are the four determinants of technology diffusion process. The importance of the factors that are in the scope of the agile diffusion framework, were confirmed by the participants' responses, in both the questionnaire and the in-depth interviews.

9.3.3 Objective three

To investigate the casual factors that affect organisational agility

Agility concept was defined as the first step to achieve this objective. Subsequently, the nature of agility was investigated through the frameworks that had been developed, mainly for manufacturing industry.

9.3.4 Objective four

To establish and define the capabilities needed for agile technology diffusion

Using the nature of the core capabilities of agility as a "lens", a theoretical framework that is reflecting the perspective of Agile Technology Diffusion Capabilities was developed. These capabilities were confirmed by the industry experts both in the interviews and in the validation phase of the developed conceptual framework.

9.3.5 Objective five

To identify the priority areas and needs to be focussed in order to improve the agility of technology diffusion in Turkish construction organisations.

As the first step, a data collection tool (questionnaire) developed and used to capture the quantitative data from the respondents, regarding the existence of agile technology diffusion capabilities in their organisations. Using the main structure that is based on the agile technology diffusion capabilities, semi-structured interviews were conducted to collect in-depth qualitative data to capture the perceptions and understandings of construction industry professionals. Both types of data collected simultaneously from the same respondents with the aim of complementing each other. The sampling strategy was designed with the aim of collecting the views of different management levels, in order to have a balanced view that provides an assessment from different angles. The quantitative and the qualitative data of each case analysed separately, in within case analyses. The relative importance index approach was used to analyse the quantitative data and determine the priority areas to be focussed. The content analysis method was used to analyse the qualitative data in order to determine the barriers for each diffusion capability. After the within case analyses of the three cases, cross case synthesis was used to synthesise the evidence

that were gathered from these cases. The results of the cross case synthesis provided the organisational dynamics that affect the agile technology diffusion process.

9.3.6 Objective six

To develop a conceptual framework that codifies the key elements of Agile Technology Diffusion

The priority needs of the agile technology diffusion capabilities with the barriers and organisational dynamics that affect them were determined at the end of the previous analyses. However, the importance rankings of these barriers are also important for companies in developing a strategic plan to achieve these capabilities. At this point, a consensus of the professionals from the industry was needed on determining the importance levels of these factors. In order to achieve this, Delphi technique was selected as the most appropriate method. Once the consensus on the rankings were determined, the conceptual framework, CATER, was developed based on the superposition of the data coming from case study findings and the Delphi technique.

9.3.7 Objective seven

To test and validate the developed conceptual framework with domain experts; and draw comments for future research

The framework was validated by the four domain experts representing the industry and the academia. The domain experts were not a part of the previous phases of the research process and all of them were experienced in construction management field. Their experience in the in the field, provided them a quick and comprehensive understanding about the research approach. Besides their confirmation, their comments were also collected to provide guidance for the further developments of the framework.

9.4 Summary of the Chapter

This chapter discussed the findings of this research and demonstrated the impact on extant literature. The chapter demonstrated how the research aim and objectives were addressed supported by key findings that underpin CATER and the need to address the challenge elucidated in Chapters two, three and four. These observations are

analysed in greater detail in Chapter 10 regarding CATER's applicability to demonstrate impact on theory and practice.

10. CONCLUSION AND RECOMENDATIONS

10.1 Introduction

This chapter presents an overview of this research from problem articulation through to research design, analysis and discussion. The chapter present research novelty, particularly its contribution to the existing body of knowledge (theory and practice). Research limitations are also articulated, expressly to highlight impact on generalisability and repeatability. Finally, recommendations for further work are proffered as viable research trajectories.

10.2 Overview of the Research

The idea of this research stemmed from the will to provide a solution for construction organisations to improve the efficiency of their IT implementation and usage, which have been presented by various reports as a solution to overcome construction industry's poor performance.

Among various models to achieve competitive advantage, development of organisational capabilities provides the ability to thrive in the market by showing efficient response to various challenges. In this regard, the capabilities that are developed in line with the organisation's strategic vision, will surely provide a sustained success in achieving its objectives.

Referring to the fact that, efficient IT usage is the provider of competitive advantage for construction organisations, this research aimed to present a solution that provides an improvement on the efficiency of technology diffusion process in construction organisations. Based on the relevant literature of competitiveness, development of organisational capabilities that will facilitate this efficiency was selected as the method.

In order to develop these capabilities, technology diffusion and acceptance models were analysed, in order to clarify the dynamics that affects this process. Subsequently, an analysis on the literature was carried out to have a better

understanding about the agility concept and the organisational capabilities that provide it. The next step of the research was to transpose the technology diffusion drivers and the agility capabilities to develop a theoretical framework for agile technology diffusion capabilities.

While the perceptions and understandings of industry professionals were collected using a questionnaire and in-depth interviews, the theoretical framework that the data collection tools were based on was also validated.

Based on the analysis of the findings of research, a conceptual model was developed, which provides a road map for the organisations to determine their strategy for developing agile technology diffusion capabilities.

The framework was validated by the domain experts and their questions and suggestions were addressed.

10.3 General Findings of the Research

The research provides an in-depth analysis of the technology diffusion process of the construction organisations in the light of organisational behaviour and management practices through an agility lens. Based on the theories of technology diffusion, adoption and agility, the case study analyses presented a detailed evidence of how do the Turkish construction organisations become aware of the emerging technologies (awareness), prepare themselves to its impacts on the organisation (flexibility of resources), manage the technology diffusion process (competence) and recover from the impacts of new technology related change.

The main outcome of this research is a detailed conceptual framework-CATER-covering; the agile technology diffusion capabilities, their hierarchies, the barriers that affect these capabilities, the organisational dynamics that are affective on these capabilities and the importance rankings of these barriers. It reflects the actual level of agile technology diffusion capabilities of the internationally competitive Turkish construction companies. This reflection provides an insight and guidance for the companies at this level, to improve their capabilities of agile technology diffusion.

The findings of the study revealed the ranking of the three core capabilities in terms of weakness as; (1) responsiveness, (2) flexibility, and (3) competence. The general

findings about the barriers and organisational dynamics that affect ATD capabilities are as follows.

10.3.1 Responsiveness

Responsiveness to the change demands of new technology, covers; the ability to sense, perceive and anticipate changes in the environment; the ability to show immediate reaction to change and its demands; and the ability to recover from the negative impacts of change.

1) Organisation's ability *to sense, perceive and anticipate changes in the environment* requires; monitoring and reporting changes; being aware of the links and interdependencies; and the ability to analyse possible risks and consequences. The findings of the study show that, this ability is mainly affected by; overconfidence of the companies based on their high level of experience in the field; lack of awareness regarding the benefits of IT; not being aware of the interaction between people process and technology issues; and the approach that sees IT as a tool to fulfil requirements in bids, instead of acknowledging it as one of the main resources of the organisation.
2) In order *to show quick reaction to change,* organisations should possess the ability to provide; a strategic vision and outcome expectancy; efficient information and knowledge management; and devolved and responsive decision making. According to the findings, the efficiency of this ability is mainly affected by; ambiguousness of roles, responsibilities and procedures; leadership style of managers; and communication and information management related problems.
3) *Recovery from change* is capability of organisation which requires; the awareness of recovery need, development of a recovery plan and implementation of the recovery plan steps. The results of the study show that construction companies are not generally aware of this concept and it is generally neglected due to lack of such and understanding within the corporate culture. However, companies try to address the needs of this capability by the help of HR flexibility and highly skilled and experienced workforce.

The review of the main findings demonstrates that, organisation's ability to be responsive to change demands of new technology is mainly affected by; awareness, culture and process management dynamics.

10.3.2 Flexibility

Ability to provide flexibility of the organisational resources embodies the flexibility of human resources, information technologies and processes.

1) *HR flexibility* can be discussed under the abilities of the staff; to work in different positions and/or responsibilities if needed; to learn new procedures and solve specific problems quickly; and to change work habits as a response to change requirements. The efficiency of this ability is significantly affected by; the lack of an HR strategy that supports HR flexibility; employee's (especially the old ones') resistance to change; the lack of top management commitment to change; and the lack of awareness of the benefits and use of new technology.

2) *IT flexibility* presents organisation's ability to develop an IT infrastructure design; that can work efficiently despite the changes in the numbers of users, workloads and transactions; uses well known modern hardware / software and can be used by ease; that possesses electronic linkages among departments, branches and external parties. The efficiency of this ability is affected by; the lack of awareness of the benefits and use of IT; the lack of IT strategy that supports IT flexibility; and the lack of awareness about the actual resource base.

3) *Process flexibility* is defined as organisation's ability to provide; a range of different process solutions, pre-designed or just-in-time designed, as a response to change; different solutions within optimum time and cost difference; similar results within the alternative solutions. Even though the construction organisations are familiar with process management, they are not very familiar with process flexibility concept. However, they can solve problems that need the flexibility of processes with the highly skilled and experienced staff. In this regard the factors that hamper the efficiency of process flexibility can be presented as; the lack of culture that is aware of the

needs and implementations of process flexibility; and the lack of leadership abilities.

The results show that, organisation's ability to provide flexibility of the organisational resources is mainly affected by the dynamics of; awareness, culture, leadership and change resistance.

10.3.3 Competence

Competence to manage diffusion process includes the abilities of; leadership; management of change processes; and strategy development.

1) In order to *lead the organisation during technology diffusion process* efficiently, abilities to; motivate staff to implement new technology; develop culture that supports new technology implementation; develop trust are needed. According to the findings, the main barriers of leadership ability were identified as; leadership style of the managers; lack of top management's support and commitment to change; power balances; and lack of innovative culture in the organisation.
2) Ability *to manage new technology related change process* was defined to embrace the abilities of; reengineering the processes due to the change demands of new technology implementation; providing services and support for the to the staff to improve the efficiency of implementation; developing a powerful communication network both internal (between employees, superiors and departments) and external (government and stakeholders). The main dynamics that hamper the success of effective management of new technology related change process are; ambiguousness of roles, responsibilities and procedures due to lack of process management ability; lack of trust to managers and top management; and resistance to change.
3) Ability to *develop strategy* embraces the development of IT, HR and training strategies that are aligned with business strategy, with the aim of providing support to enable IT diffusion. The main factors that hamper the efficiency of this ability are; the lack of clearly defined business strategy; the lack of awareness about the benefits and use of IT; and the lack of innovative culture in the organisation.

The results show that, organisation's competence to manage diffusion process is mainly affected by; awareness, culture and leadership dynamics.

10.4 Contribution to Existing Body of Knowledge

10.4.1 Contribution to theory

Literature on technology diffusion and 'acceptance' presents numerous theories and models such as DoI, TAM TPB and UTAUT, to describe the nature of the process. Yet, these studies typically provide approaches that examine technology diffusion as a linear process (of a discrete event), rather than an interconnected pervasive series of multiple events. Given this, organisations have to contemplate various technologies with concomitant technology diffusion issues. In this regard, this research presented a perspective that accepts technology diffusion as a repetitive process; where, the repetitive nature also brings out the need for improvement in terms of efficiency. This research proposed a novel approach of technology diffusion based on organisational capabilities. Since the focus was to improve the agility of organisations (to emerging technologies), a richer and more meaningful approach of Agile Technology Diffusion (and the organisational capabilities needed to provide it) was presented as a solution. This solution is orchestrated through a conceptual framework (CATER), which presents the hierarchy and links of ATD capabilities into three levels. In particular, CATER presents a general overview of the ATD capabilities of Turkish construction organisations, which demonstrates the priority areas to be focussed by the organisations to enable ATD. The conceptual framework clarifies the barriers that often hinder or impede the efficiency of construction organisations' ATD capabilities, by providing a ranking of importance for each barrier regarding its effect on the related capability. The organisational dynamics that affect the efficiency of these capabilities are also included in this conceptual framework.

From a contribution to theory perspective, this work impinges on a number of core theoretical and philosophical foundations, including the Human Relations Movement and Systems Theory (Mayo, 1933; Senge, 2006; Swanson & Holton, 2001); Communications and Decision Theory (Peansupap & Walker, 2005a; Robertson & Gatignon, 1986; Rogers, 2010) and Organisational Learning Theory (Argyris & Schön, 1978; Dodgson, 1993; Huber, 1990) by presenting a new perspective for

technology diffusion process, the links and interdependencies of organisational dynamics and link/foundations of Agile Technology Diffusion. In this regard, new perspectives are garnered on the relevance in particular to the Turkish Construction Industry viz: innovation diffusion (Kale & Arditi, 2009), leadership (Giritli *et al.*, 2013a; Giritli & Topcu-Oraz, 2004), organisational culture (Dulaimi *et al.*, 2007), motivation (Giritli *et al.*, 2013b), importance of personality (Giritli & Civan, 2008) and organisational competence (Isik *et al.*, 2009), by presenting their links, interdependencies and impact on the system that constitute ATD capabilities of Turkish construction organisations. In addition to this, novel approaches such as; impact of organisational resources' flexibility and recovery from change were also introduced to the construction management research domain in Turkey.

Additionally, this work aligns to the field of Psychology (esp. Behaviorism and Postmodernism), as it uncovers new understand and meaning of how learning experiences shape behaviour/thinking, including the impact of societal drivers. The conceptual framework also provides contribution to Decision Making and Management Theory (Edwards, 1954; F. W. Taylor, 1914), especially in IT Management and Strategic Management (K. Davis & Songer, 2008; J. S. Goulding & Lou, 2013; Peteraf, 1993; Porter & Millar, 1985; Rumelt, 1991; Wernerfelt, 1984) domains by presenting the organisational capabilities needed to decide and efficiently manage the implementation process of the emerging technologies, which fit to organisations' strategic plans; for example, the priority rankings of the barriers of the organisational capabilities can be used as a template for the development of strategic plans. In this regard, from a sector-specific perspective, the conceptual framework provides contribution to studies that focus on the Turkish Construction Industry in: strategic management (Gundes, 2011; Kazaz & Ulubeyli, 2009; Korkmaz & Messner, 2008), decision making (Dikmen & Birgonul, 2004), risk management (Dikmen & Birgonul, 2006; Yildiz *et al.*, 2012), crisis management (Öcal *et al.*, 2006), and IT strategies and management (Isikdag *et al.*, 2009; Underwood *et al.*, 2010) by providing ATD capabilities and the steps to be followed. A fundamental outcome of this research highlighted the need for organisational responsiveness (to emerging technologies), including the opportunities for leveraging competitive advantage within the Turkish market.

10.4.2 Contribution to practice

Along with the contribution to existing body knowledge, the results of the research provide guidance for the construction organisations that are aiming to achieve agility in technology diffusion. The research's contribution to practice can be summarised as below;

1) The research underlines the importance of technology as an enabler of efficiency in construction production and highlights the importance of effective technology diffusion process to gain the maximum benefit from emerging technologies.
2) It presents a new perspective for technology diffusion process and introduces the need of developing organisational capabilities to ensure the success of this process.
3) The research introduces a new approach to the construction companies for achieving competitive advantage in both domestic and international markets.
4) The research argues that the efficient diffusion of new technologies is a capability that can be developed and introduces the organisational capabilities that will improve the agility of technology diffusion and provide efficiency of the process.
5) The research identifies the organisational capabilities, needed to be developed, to enable ATD.
6) The research identifies the organisational barriers that affect the development of ATD capabilities, for Turkish construction organisations.
7) The research provides a ranking for the barriers according to their impact on the development of ATD capabilities, for Turkish construction organisations.
8) The research identifies the organisational dynamics that affect ATD capabilities, for Turkish construction organisations.
9) The conceptual framework serves as a tool to assess the ATD level of the companies, which gives the organisations the chance to make a comparison, determine trajectories and develop strategies for further improvement.

10) The research presents the actual level of ATD capabilities of the high levelled Turkish construction organisations, which serves as a valuable template to assess the weaknesses and the strong sides of the organisations in terms of ATD, and a valuable knowledge base for Turkish construction companies to develop business, IS, IT and training strategies.

11) The research presents a valuable guide for the managers to understand the links and interdependencies of the organisational dynamics within the organisational setting.

12) The research highlights the importance and links of the soft issues to provide strategic advantage and profit to the construction organisations.

10.5 Limitations and Recommendations for Future Research

This section gives an outline about the limitations of this research that should be taken into consideration while interpreting the results

10.5.1 Limitations of the research

The conceptual framework that is developed, based on the research findings, is validated by the domain experts. However, the limitations of the research should be taken into consideration when interpreting the results, in order to provide the generalisability and repeatability of the research.

The cases, which the interviews were conducted, had been chosen among the Turkish construction organisations which are listed in the top internationally competitive organisations list. In this regard, the perceptions of the professionals that are working in these organisations were collected and discussed. So, the findings of the research would provide better results for the organisations at this level.

Another limitation regarding the sample was the number of respondents for the quantitative analysis. The quantitative analysis was used to support and complement the in-depth interviews of the study. In this regard, the quantitative and qualitative data collections were conducted with the purposively selected, identical sample of respondents. Even though the number of the respondents was low, all the participants were high level professionals with comprehensive knowledge and experience in Turkish construction industry. Therefore, the quality of the data was very high,

compared to a possible, larger but random sample. However, the sample size can be wideand deepen or the context delimiters can be expanded, in order to improve representativeness.

This research targeted the Turkish construction companies that are internationally competitive. In this context the findings and results of the study can be evaluated as Turkey specific, which may limit the chances for generalisation of results for a wider context. However, since these companies have been in the international market for a long time, they have developed a corporate culture that provides them a successful integration with the clients in other countries. This positive impact should also be taken into consideration regarding the generalisability of the findings to outer context.

10.5.2 Recommendations for future work

10.5.2.1 Recommendations for organisations

Based on the overall findings of the research, recommendations for the construction companies, which aim to enable agile technology diffusion capabilities, are presented as follows.

1) Construction organisations should depend on defined strategies and procedures, instead of relying on individuals with high level of skills and experience.
2) Construction organisations should develop a high level of communication network based to provide seamless information flow, based on defined procedures.
3) Top management should adopt an innovative approach and be aware of the benefits and use of new technologies.
4) Construction organisations should be aware of the links and interdependencies between the organisational resources; people, process and technology.
5) Construction organisations should have a HR strategy aligned with business and IT strategies, in order to develop the required human resource base and flexibility to enable technology diffusion.

6) Construction organisations should acknowledge technology and processes as organisational resources along with the people (HR) and should give importance to their management accordingly.

7) Construction organisations should provide managerial level trainings to the staff about leadership capabilities such as; motivation, development of culture, development of trust, etc. in order to raise the awareness of the management levels regarding the people issues.

10.5.2.2 Recommendations for academic and suggestions for future work

The primary recommendation for the future research would be to target the limitations that are identified in the previous section. In this regard;

1) The developed framework presents the; agile technology diffusion capabilities, priority areas to be focused, and the barriers and organisational dynamics that are affective in the process. However, the framework does not provide steps to overcome these barriers to enable agile technology diffusion capabilities. Therefore, a further study can be carried out to investigate the solutions to overcome these barriers and enable these capabilities, by either focussing the whole framework or only a part of it.

2) The developed framework can be improved and shaped as a tool, to specifically measure the agility levels of construction organisations.

3) The developed framework can be used as a template to develop the Agile Technology Diffusion Maturity Model in order to bring a more robust and clear guide for the organisations from all different levels.

4) The same study can be conducted with construction companies from another country and a comparative analysis can be conducted in order to understand the effects of different contexts.

5) Further studies can be carried out to capture hard data on performance of the conceptual framework.

10.6 Summary of the Chapter

This chapter provided an overview of the research process that is carried out to achieve the aim of developing a conceptual framework which will lead the

organisations to be agile in diffusing and using emerging technologies in the market by capturing the perceptions and understandings of the professionals working in the construction industry. Subsequently, the main findings of the research were revisited and research's contribution to existing body of knowledge, in theory and practice, were discussed. The limitations of the study which can be accepted as the focus of further research were presented and recommendations for construction organisations and academia for new research directions that can stem from the results of this study were proposed.

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APPENDICES

APPENDIX A: Questionnaire A

APPENDIX B: Questionnaire B

APPENDIX C: Turkish construction firms that take place in top 250 contractors list

APPENDIX A: Questionnaire A

1) How many years have you been working in the Architecture Engineering and Construction (AEC) industry?

☐ 0 - 5 ☐ 6 - 10 ☐ 11 - 15 ☐ 16 - 20 ☐ 21 -

2) Which of these levels best describes your position within your organisation?

☐ Top Management *(Board of Directors, Chief Executive Officer, General Manager,* Managing Director, President, etc.)

☐ Middle Management *(Department Heads, Branch Managers, Junior Executives, etc.)*

☐ First Line Management*(Engineers, Architects, Surveyors, Technicians working* under the middle management)

3) How many years have you been working in this level?

☐ 0 - 5 ☐ 6 - 10 ☐ 11 - 15 ☐ 16 - 20 ☐ 21 -

4) Please indicate the extent to which you agree that the following conditions are present on your organisation.

Regarding your answers the meaning of the numbers given are as follows;

Absolutely Disagree	(1)	Agree	(4)
Disagree	(2)	Absolutely Agree	(5)
Neither Agree nor Disagree	(3)		

Responsiveness *Sense, perceive and anticipate changes and risks in the environment*		*Absolutely Disagree*				*Absolutely Agree*
4.1.	My organisation is aware of and tracks emerging technologies, trends and changes in the industry	1	2	3	4	5
4.2.	The organisation periodically assesses its resources base.	1	2	3	4	5
4.3.	The organisation has a good understanding how quickly we would be affected if it cannot keep in pace with the changes in the industry.	1	2	3	4	5
4.4.	Top management is aware of how a "change" in one department will affect the whole organisation.	1	2	3	4	5
4.5.	The organisation conducts a detailed analysis about the potential risks that will show up by the adoption or ignorance of emerging technologies.	1	2	3	4	5
4.6.	The organisation fully understands the impact of new technology on the actual resource base of the organisation.	1	2	3	4	5
Responsiveness *Show immediate reaction to change and its demands*		*Absolutely Disagree*				*Absolutely Agree*
4.7.	The purpose and the primary objectives of the organisation have been fully understood by all staff and management levels.	1	2	3	4	5
4.8.	The organisation takes the mission and vision statements as a guide when engaging in the response to a sudden change.	1	2	3	4	5

Responsiveness *Sense, perceive and anticipate changes and risks in the environment*		*Absolutely Disagree*				*Absolutely Agree*
4.9.	The organisation, captures, develops and shares all information efficiently.	1	2	3	4	5
4.10.	The organisation gives importance to keeping people informed about the changes related to the work, in order to ensure quick and successful decisions.	1	2	3	4	5
4.11.	The organisation is capable of making though decisions quickly.	1	2	3	4	5
4.12.	There is always someone with the authority to deal with problems.	1	2	3	4	5
Responsiveness *Recovery from change*		*Absolutely Disagree*				*Absolutely Agree*
4.13.	The organisation quickly determines the recovery needs caused by unpredicted change.	1	2	3	4	5
4.14.	When the organisation decides to change, an analysis is always conducted about the areas that will need recovery.	1	2	3	4	5
4.15.	The organisation always develops a recovery plan to deal with sudden change.	1	2	3	4	5
4.16.	The organisation is aware of any transitional challenges prior to new technology implementation.	1	2	3	4	5
4.17.	When faced with sudden change, the organisation acts quickly to reorganise the resources that needs to be recovered.	1	2	3	4	5
4.18.	The organisation strictly follows the recovery plan to facilitate new technology use.	1	2	3	4	5

Flexibility *Human Resources Flexibility*		*Absolutely Disagree*				*Absolutely Agree*
4.19.	People in the organisation are able to work effectively, in the different positions, under different responsibilities	1	2	3	4	5
4.20.	The people in the organisation try constantly to update their skills and abilities.	1	2	3	4	5
4.21.	People in the organisation are able to learn new procedures quickly.	1	2	3	4	5
4.22.	The people in the organisation regularly share information and learn from each other.	1	2	3	4	5
4.23.	People in the organisation can change their habits in order to provide a successful response to change demands	1	2	3	4	5
4.24.	Employees in my organisation act efficiently when a problem emerges, even in cases in which they do not have full information about the problem.	1	2	3	4	5
Flexibility *IT Flexibility*		*Absolutely Disagree*				*Absolutely Agree*
4.25.	The organisation's IT infrastructure is capable of working efficiently despite changes in the numbers of users, workloads or transactions.	1	2	3	4	5

4.26.	New software can easily be added to, modified or removed from the existing IT infrastructure with very few problems	1	2	3	4	5
4.27.	The interfaces of the systems used in different departments are similar enough to provide quick adaptation by the staff.	1	2	3	4	5
4.28.	The hardware and software that are used in the organisation are based on well-known products.	1	2	3	4	5
4.29.	The IT infrastructure allows staff to share information among different departments, and sites easily and securely.	1	2	3	4	5
4.30.	The systems that are used in the organisation can share data with each other and use the data, without having problems.	1	2	3	4	5
Flexibility *Process Flexibility*		*Absolutely Disagree*				*Absolutely Agree*
4.31.	The organisation is capable of creating a range of new process paths to address the unpredicted changes and the demands caused by them.	1	2	3	4	5
4.32.	The organisation is capable of designing a range of different process paths after the decision of new technology adoption.	1	2	3	4	5
4.33.	When faced with sudden change, the organisation is capable of developing alternative processes that will be completed in similar time and cost.	1	2	3	4	5
4.34.	The organisation is capable of planning new process paths that will be completed in similar time and cost.	1	2	3	4	5
4.35.	The organisation is capable of developing alternative process solutions with similar results, even faced with unpredicted change.	1	2	3	4	5
4.36.	The organisation is capable of planning alternative process paths with similar results for successful adoption of new technology.	1	2	3	4	5

Competence *Leadership*		*Absolutely Disagree*				*Absolutely Agree*
4.37.	The staff responsible for the processes are always encouraged to take decisions on their own.	1	2	3	4	5
4.38.	The organisation provides incentives for efficient use of new technology.	1	2	3	4	5
4.39.	People in the organisation believe in the importance of using new technologies in business.	1	2	3	4	5
4.40.	Once the decision to use new technology is introduced, all staff work collaboratively to achieve desired targets.	1	2	3	4	5
4.41.	Departments within the organisation actively share information with each other.	1	2	3	4	5
4.42.	Senior management support efforts, during new technology adoption.	1	2	3	4	5

Competence *Management of Change Process*		*Absolutely Disagree*				*Absolutely Agree*
4.43.	When new technology has been implemented business processes are always organised to provide a seamless flow of implementation. (to avoid conflicts).	1	2	3	4	5
4.44.	The organisation informs all staff about the changes in roles and responsibilities caused by new technology related process changes.	1	2	3	4	5
4.45.	Organisation provides required services and technical support to improve efficiency of new technology implementation.	1	2	3	4	5
4.46.	The organisation employs external consultants to improve efficiency, when needed.	1	2	3	4	5
4.47.	Staff can easily exchange views or feedback about the implementation process with their colleagues or peers.	1	2	3	4	5
4.48.	The organisation can easily share information with external parties (government agencies, stakeholders etc.)	1	2	3	4	5
Competence *Development of Business Strategy*		*Absolutely Disagree*				*Absolutely Agree*
4.49.	The (new) technology that is being used provides advantage to the organisation in achieving its goals.	1	2	3	4	5
4.50.	When the organisation decides the use a new technology, a diffusion program that embraces the implementation steps of new technology is developed and followed.	1	2	3	4	5
4.51.	The capability of using new technology is a valuable asset for being employed and taking promotion in my organisation.	1	2	3	4	5
4.52.	The organisation develops plans and encourages people in order to facilitate efficient use of new technology.	1	2	3	4	5
4.53.	The organisation provides a detailed training program for staff about how to use new technology.	1	2	3	4	5
4.54.	Managerial level trainings are provided to line managers and top management to improve their knowledge and understanding about new technology and its benefits.	1	2	3	4	5

APPENDIX B: Questionnaire B

Please rank the following factors, which are given as the possible reasons for the related phrases, according to the organisational dynamics in your organisation.

1. My organisation is not aware of emerging technologies, trends and changes in the industry

   ___Overconfidence based on experience

   ___Taking technical specifications as the only guide for the IT need

   ___Corporate culture does not support this

   ___Lack of a specified unit/person to track these changes

   ___Lack of defined procedures for this

2. The organisation does not conduct a periodic assessment about its resources base.

   ___Corporate culture does not support this (lack of innovative culture)

   ___Lack of defined procedures for this

   ___Seeing bid preparations enough for this assessment

3. The organisation has not got an understanding how quickly we would be affected if it cannot keep in pace with the changes in the industry.

   ___Overconfidence based on experience

   ___Focussing on projects too much and missing the big picture

   ___Lack of mid and long term strategic planning

   ___Corporate culture does not support this

   ___Having different priorities

4. Top management is not aware of how a "change" in one department will affect the whole organisation.

   ___Communication problems between units (departments)

   ___Different perspectives of headquarters and the sites

   ___Disregarding the interaction between its units

   ___Disregarding the motivation of staff

5. The organisation does not conduct a detailed analysis about the potential risks that will show up by the adoption or ignorance of emerging technologies.

   ___Unawareness of the interaction between People Process and Technology

   ___Overconfidence based on experience

   ___Corporate culture does not support this

   ___Lack of defined procedures for this

6. The organisation does not fully understand the impact of new technology on the actual resource base of the organisation.

   ___Unawareness of the interaction between People Process and Technology

   ___Lack of defined procedures for this

7. The purpose and the primary objectives of the organisation have not been fully understood by all staff and management levels.

___Vertical communication problems

___Lack of sense of belonging

___Corporate culture does not support this

8. The organisation may not take the mission and vision statements as a guide when engaging in the response to a sudden change.

9. The organisation has problems in capturing, developing and sharing information efficiently.

___Data collection problems

___Data and information sharing problems

___Problems with transforming data to information

___Data storage problems

___Inefficient procedures for information management

___Lack of defined procedures for information management

10. The organisation does not give importance to keeping people informed about the changes related to the work, in order to ensure quick and successful decisions.

___Leaving communication to individuals' initiative

___Hiding information (individual and departmental levels)

___Heavy workload

___Lack of defined procedures

11. The organisation is not capable of making though decisions quickly.

___Organisational structure does not allow quick decisions

___Existence of old decision mechanisms based on culture

___Ambiguousness of roles and responsibilities

___Communication problems

___Staff’s avoidance from taking initiative

12. Sometimes it is not possible to find someone with the authority to deal with problems.

___Ambiguousness of roles and responsibilities

___Leadership style of the managers (delegation)

___Staff avoid taking initiative

13. The organisation has problems in determining the recovery needs caused by unpredicted change.

___Lack of such an understanding (Culture)

___Lack of defined procedures for this

14. Organisation do not have a habit of conducting an analysis about the areas that will need recovery when it decides to change.

___Disregarding the opinions of the staff that will be affected by the implementation

___Lack of such understanding

___Lack of defined procedures for this

15. The organisation does not develop a recovery plan to deal with sudden change.

___Lack of such understanding

___Seeing this as additional work and avoiding taking responsibility

___Lack of defined procedures for this

16. The organisation is not aware of any transitional challenges prior to new technology implementation.

___Being unaware of the benefits of such a plan

___Being unaware of internal connectivity

___Lack of a detailed analysis as a result of heavy workload

17. When faced with sudden change, the organisation cannot act quickly to reorganise the resources that needs to be recovered.

___Lack of such a plan

___Desire to protect the power balances

___Top management/managers see this as a source of cost

18. The organisation does not follow the recovery plan to facilitate new technology use.

___Being unaware of the benefits of such an implementation

___Lack of sanctions for not implementing the developed plans

___Difficulties in the control of the implementation due to the size of the company

19. People in the organisation are not able to work effectively, in the different positions, under different responsibilities

___Corporate culture does not support this

___HR strategy does not have a rotation plan for staff

___Recruitment strategy does not question the existence of this capability

20. The people in the organisation do not try to update their skills and abilities.

___Personality of the staff

___Heavy workload

___Corporate culture does not support this

___Age of the company

21. People in the organisation are not able to learn new procedures quickly.

___Staff's indifference towards new procedures

___Experienced staff do not want to change the way that they do things

___Lack of sanctions

___Passive resistance from the ones that are opposing change

___Lack of top management's commitment to change

22. The people in the organisation do not share information regularly and learn from each other.

___Personality of the staff

___Heavy workload

___Power balances

___Department related secrecy

23. People in the organisation do not want to change their habits in order to provide a successful response to change demands

    ___Lack of top management's commitment to change

    ___Being unaware of the benefits of new technology

    ___Corporate culture does not support this

    ___Staff does not have a sense of belonging

24. Employees in my organisation do not act efficiently when a problem emerges, especially in cases which they do not have full information about the problem.

    ___Employees do not show a proactive approach (personality)

    ___Corporate culture does not support this

25. The organisation's IT infrastructure is not capable of working efficiently despite changes in the numbers of users, workloads or transactions.

    ___Being unaware of the importance and benefits of IT infrastructure

    ___Seeing sites as temporary bases and keeps investments at minimum

    ___Being unaware of the actual resource base

26. Serious problems occur when, new software added to, modified or removed from the existing IT infrastructure

    ___Neglected during the development of IT strategy

    ___Lack of detailed analysis about the compatibility of products

27. The interfaces of the systems used in different departments are not similar enough to provide quick adaptation by the staff.

    ___Being unaware of the benefits of IT facility

28. The hardware and software that are used in the organisation are not based on well-known products.

    ___The IT infrastructure of the area that the project will take place

    ___Being aware of the importance and benefits of IT infrastructure

    ___Seeing sites as temporary bases and keeps investments at minimum

29. The IT infrastructure does not allow staff to share information among different departments, and sites easily and securely.

30. The systems that are used in the organisation have problems in sharing data with each other and use the data, without having problems.

    ___The leadership characteristics of the managers

31. The organisation is not capable of creating a range of new process paths to address the unpredicted changes and the demands caused by them.

    ___The company does not have this approach

32. The organisation is not capable of designing a range different process paths after the decision of new technology adoption.

    ___The company does not have this approach

33. When faced with sudden change, the organisation has problems in developing alternative processes that will be completed in similar time and cost.

___The company does not have this approach

34. The organisation is not capable of planning new process paths that will be completed in similar time and cost.

___Missing opportunities due to slow decisions

35. The organisation is not capable of developing alternative process solutions with similar results, even faced with unpredicted change.

___The company does not have this approach

36. The organisation is not capable of planning alternative process paths with similar results for successful adoption of new technology.

37. The staff responsible for the processes are not encouraged to take decisions on their own.

___Managers do not want to delegate their power of decision making

___Roles and responsibilities are not clear

___Vertical communication problems

___Staff avoid taking initiative

38. The organisation does not provide incentives for efficient use of new technology.

___Top management's lack of awareness about the benefits of such an implementation

___Top management's approach which sees using new technology efficiently as staff's duty

39. People in the organisation do not believe in the importance of using new technologies in business.

___Organisation's awareness about the benefits of new technology

___Innovative approach of the top management

40. When the decision to use new technology is introduced, collaboration of staff to achieve desired targets in technology diffusion may not always be achieved

___Top Management's commitment to change

___Personality of the staff

___Old / experienced staff's resistance to change

___Lack of innovative culture in the company

41. Departments within the organisation have problems in sharing information with each other, related with trust

___Different perspectives of headquarters and the sites

___Power balances between departments

___Personal characteristics of the line managers

42. Senior management do not provide support for efforts, during new technology adoption.

___Sincerity of management in their support and actions

43. When new technology has been implemented business processes may be quickly reorganised.

___The organisation's incapability in process management

___Resistance to new processes

44. Staff may not be informed about the changes in roles and responsibilities caused by new technology related process changes.

___Leaving communication to individuals' initiative

___Ambiguous roles and responsibilities

45. Organisation fails to provide required services and technical support to improve efficiency of new technology implementation.

46. The organisation does not employ external consultants to improve efficiency.

___Being aware of how to benefit from external consultancy services

47. Staff cannot easily exchange views or feedback about the implementation process with their colleagues or peers.

___Organisation’s sincerity regarding the exchange of ideas

___Problems in superior-subordinate communication

___Personality of the staff

___Corporate culture does not support this

48. The organisation cannot easily share information with external parties (government agencies, stakeholders etc.)

49. The (new) technology that is being used does not always provide advantage to the organisation in achieving its goals.

___Lack of a clearly identified IT and/or IS strategy

___Taking technical specifications as the only guide for the IT need

___Lack of a detailed analysis

50. The organisation does not develop a diffusion program that embraces the implementation steps of new technology

___Lack of such an approach

51. The capability of using new technology is not such a valuable asset for being employed and taking promotion in my organisation.

___Lack of innovative culture

___Bilateral relationships are efficient on recruitment

52. The organisation does not develop plans or encourage people to facilitate efficient use of new technology.

___Lack of career development plan

___Top Management’s commitment to change

53. The organisation does not provide a detailed training program for staff about how to use new technology.

54. The organisation does not provide managerial level trainings for line managers and top management to improve their knowledge and understanding about new technology and its benefits.

___Heavy workload of top management

___Management's indifference towards new technology

APPENDIX C: Turkish construction firms that take place in top 250 contractors list

NO	FIRM	INT.RANK
1	Renaissance Construction, Ankara, Turkey	64
2	Enka Construction & Industry Co. Inc., Istanbul, Turkey	79
3	Tekfen Construction and Installation Co. Inc., Istanbul, Turkey	85
4	PolimeksInsaatTaahhutve San Tic. AS, Istanbul, Turkey	90
5	ANT YAPI Industry & Trade JSC, Istanbul, Turkey	94
6	TAV Construction, Istanbul, Turkey	103
7	CalikEnerjiSanayiVeTicaretAnonimSirketi, Istanbul, Turkey	111
8	GAMA, Ankara, Turkey	118
9	YukselInsaat Co. Inc., Ankara, Turkey	124
10	Cengiz Construction Industry & Trade Co. Inc., Istanbul, Turkey	127
11	IC IctasInsaatSanayiVeTicaret AS, Ankara, Turkey	129
12	OnurTaahhutTicaret Ltd. Stl., Ankara, Turkey	135
13	Atlas Group, Ankara, Turkey	145
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CURRICULUM VITAE

Name Surname: Volkan Ezcan

Place and Date of Birth: Tekirdağ / 1977

E-Mail: vezcan@gmail.com

EDUCATION:

B.Sc.:	2001, Yildiz Technical University, Civil Engineering Faculty, Civil Engineering Department
M.Sc.:	2006, Istanbul Technical University, Construction Management Department

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