Learning to innovate collaboratively with technology:
Exploring strategic workplace skill webs in a telecom services firm in Tehran

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Abstract

This thesis explores innovation and learning within the context of an entrepreneurial new technology based firm (NTBF), operating in the creative sector of telecommunications value-added services located in Tehran, Iran, along with a partner in London, UK. Whilst backgrounding the socioeconomic and geopolitical characteristics of the operating environment, and historical antecedents of independence and self-sufficiency, plus chronic sanctions within the economy, the argument focuses on the interplay between intermediated learning via strategic 'skill webs' leading to innovation. Drawing on innovation and workplace learning corpus, collaborative innovation with technologies is organised as a competitive action in an unstable and unpredictable market: learning and skill enhancement in firms provides the stabilisers to remain and compete in the market.

It is the juxtaposition of learning and innovation in service-innovation/-delivery design, while utilising pervasive and emerging telecoms technologies that provides the empirical base for this research. Conceptually, an emergent type of distributed learning, entitled as 'DEAL' (Design, Execute, Adjust and Learn) model, by enabling knowledge brokerage facilitated by 'skill webs', is identified and explored. This then acts as an analytical tool to examine the empirical elements which are in the form of longitudinal organisational ethnography on site visit waves, spanning 2004 to 2013, focusing on project learning breakthroughs and cul-de-sacs as observed by learning episodes, often utilising informal networks and skill webs in technical and non-technical tasks.

The case study findings within a conceptual model has implications for learning and education policy, and upskilling in firms located where regional clustering is not apparent. Furthermore, extrapolating on the theoretical and empirical inquiry and exploring policy vistas, emphasising the hybridised and socio-cultural nature of the innovation processes in transitional economies, the thesis highlights the paramount nature of NTBFs' inquiry-based learning capabilities, and distributed interprofessional judgement formation evolving in an incremental and context-dependent manner, duly shaping the sustainability of learning to innovate.

Declaration

I hereby declare that the work presented in this thesis is my own.

[Signed in printed examined version]

Náder Alyani

Acknowledgements

> *Love is the ark appointed for the righteous,*
> *Which annuls the danger and provides a way of escape;*
> *Sell your cleverness and buy bewilderment,*
> *Cleverness is mere opinion, bewilderment intuition.*

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Chapter One: Introduction and overview

This study makes a number of interconnected arguments, both conceptually and contextually, i.e. on a micro (firm), meso (sectoral) and macro (country and regional) levels. A central claim, uncovered as part of the thesis investigation, is the existence and enduring legacy of a relative professional isolation in the Iranian professional scene and subsequently ways to alleviate this.

On a micro level, the thesis explores the processes of learning that leads to innovation in a small entrepreneurial private firm, working collaboratively, initially as part of an international joint venture agreement[1], later turned into strategic and project-based alliances. These operations are manifested predominantly via projects undertaken across small project teams in Tehran and London, operating on the nexus of the high technology and creative sector (telecom value-added services), specifically applications programming and mobile business solutions development.

On a macro level, based on her geo-political orientation, and notwithstanding the post-2016 developments in her global relations, Iran was subject to chronic sanctions throughout the time the research was being undertaken. These have affected the knowledge 'circulation' and skill level of her technical cadre and technology entrepreneurs within the information and communications technologies (ICTs), whilst the means and mechanisms to circumvent these effects became an 'art form'.

Nonetheless, the abundance of qualified people and forms of cross-border geostrategic knowledge transfer within the ICT sector has meant that Iran has managed to utilise ideas and IT resources. One of the claims of the thesis which will be explored later is to shed light on Iran's hybridised engagement with modernity, through digital technology firms and solutions.

That said, whilst robust and recent labour market research examining Iran's economic sectors is a significantly under-studied field, Iran on an aggregate level is under-performing in terms of educational outcomes and professional learning. Aside from effecting skills needed for innovation, productivity and growth, the high-tech and creative sectoral profiles require significant upskilling to undertake imitation-to-innovation and full adaption of new technologies.

On a meso level, the digitised creative sector, as a sub-segment of the creative economy, is in a process of local emergence and evolution in Tehran and the learning and innovation of the local

participating firms plays a key role in its development and growth.

Practically, whilst "knowledge is global, learning is local"[2], and thus knowledge brokerage and skill sourcing plays a paramount role in the firm's ability to innovate. This applies equally today to small technology firms not only operating in Tehran[3], but also in a range of other places in the developing and developed economies.

Innovation and interprofessional learning, leading to and deriving from distributed knowledge sourcing, skill enhancement and judgement formation are interdependent processes (Guile, 2012a): this applies equally but in different ways on a macro and micro level of analysis (OECD, 2011, 2009), and with reference to the digitised creative sector (Handke and Towse, 2013) and within that, the software development segment (Lippoldt and Stryszowski, 2009), as examined by OECD. The thesis is therefore concerned with the above-mentioned kind of issues and the research questions that formally guide the thesis are stated at the end of this chapter.

1.1   Background to the thesis

This study, as an interdisciplinary exposition, has sought to bring in, expand and develop ideas that have had a longstanding tradition in the professional education and learning domain, with additional ideas that have emerged from other disciplinary traditions, such as management science and economics, innovation studies, economic geography and supplemented by comparative policy studies and area studies together, to assist me to explore and critically examine my concern about the relationship between innovation and interprofessional learning, within the context of enhancing 'performative nature of learning'[4] and skills at workplace.

These disciplinary domains have historically been treated quite differently, with clear 'self-sufficient' walled-gardens and disciplinary boundaries on and within the literature around innovation, learning, professions and skills. While there has been some attempt to bring these domains together[5], the issues of, and around, learning and skills are still under-worked within much of the innovation literature.

The empirical site for exploring the above issues is a small firm in Tehran, which classifies as a New Technology Based Firm (NTBF). The study is of an exploratory nature as there is scant

literature, if any, focusing on innovation, interprofessional learning and skills in Iran and by extension, other emerging regional economies (such as the Kingdom of Saudi Arabia and United Arab Emirates). The study adopts primarily an abductive reasoning, formulated and based upon an interdisciplinary review of literature, models and previous studies of relevance, in the shape of "integrative summaries, theoretical reviews [and/]or methodological reviews" (Creswell, 2003, p. 33) to better frame, grasp and understand the phenomenon and interactions. My core argument is predominantly conceptual and my reasoning builds upon and reflects experiences from larger empirical studies and reviews, as well as my own empirical single case study.

This research concern has emerged out of my personal and professional circumstances, having worked over the last decade in Tehran and regionally as part of a consultancy and later, new technology based firms (NTBFs)[6] as well as an adjunct research associateship at a local research-oriented university group, while weaving these into, and drawing upon my previous business and organisational exposures, and earlier studies examining learning from various perspectives[7].

This combination of area studies, grasping the cultural, language[8] and socio-economic background of the 'case' over a concerted and sustained period of time, has allowed me to gain an in-depth insight into the learning processes, and innovation priorities of these types of firms.

In the following sections of this chapter then, I start by offering an overview of a number of interconnected research strands. For this and following chapters, I have also provided, as an appendix (2), significant supplementary and explanatory material endnotes, where appropriate for technical debates and/or identification of key work, so as to clarify my departure points.

1.2   Innovation and learning: rethinking the relationship with 'skill webs'

As a way to ground this study, together with a longitudinal element, it soon became necessary to formulate a coherent and congruent research design, to take account of the impact of socio-economic, geopolitical and industrial/sectoral situation. As an exploratory study, a 'tight core' design, including a bespoke analytical model as a tool, is formulated and applied as it potentially reduces 'noise' and other factors that could confound and conflate relationships. Similarly, interdisciplinary theoretical ideas and concepts are used as a 'resource' to initially assist in framing, and then to unpack and tackle the research problem, in an attempt to offer connections between theory and practice (and policy), attentive of the study's ecological validity.

An aim of the study is thus to shed light on the dynamics of collaborative learning and interprofessional judgement within networks accessible to small firms, assisting and facilitating innovation processes. The empirical exposition sheds light on knowledge brokerage, for example by means such as 'bridging, linking and bonding'[9] in practice.

I have undertaken this by redefining and re-interpreting the concept of *skill webs*, at a more micro level of operation. The concept of skill webs was introduced as a mean to enable the researchers "to focus on the ways in which companies chose to generate and use skills and knowledge they require" (Ashton et al., 2009, p. 329). While the original research focus was on transnational corporations (TNCs) (Ashton et al., 2010) and pitched at a macro level of 'skills arbitrage' processes[10], I have extended and re-appropriated the concept to smaller, yet globally oriented, new technology based firms' (NTBFs) strategies.

Within this study, technological innovation is framed as a social activity and is viewed as the successful implementation of technical and technological ideas that possess novelty and utility to the initiators, developers and users of the innovation (cf. Branscomb, 2001).

The theoretical and analytical framework of the study are guided by the insights that within social sciences, research should not only examine the social impact and economic value of the new technology, whether on patterns of work and society, but also allow a nuanced exploration with a focus on the content and processes of the technological innovation, including learning, where

there is a 'social shaping' of technology[11].

Upon providing an overview in this preliminary chapter, the text follows the accumulative arguments in the next seven chapters, where I start from a relatively broad position of innovation and learning, before rapidly zooming-in selectively (Nicolini, 2013, 2009) and 'bracketing-out' various peripheral factors in the middle chapters, driven by the empirical query undertaken on the firm-level. I then return to broader discussion of findings, including meso level policy implications and conclusions in the last chapter.

On a micro level of analysis, the interactions and skills enhanced are embedded within, and facilitated by a hybrid form of 'Scrum' and 'Lean' methodologies[12] of agile software project management, in the operational theatre of global software development (GSD) practice. Based on the extant literature and analysis of longitudinal data into thematic clusters, I proceed to develop a conceptual, later turned into an analytical model of 'learning-to-innovate' in distributed collaborative project teams, and in the model's construction, take account of knowledge creation and skills enhancement activities within innovation, with a specific focus on the critical role of knowledge brokerage and sourcing.

While the innovation elements of the model draw on a unified strand of innovation studies literature, facilitated by brokerage within networks, the learning elements of the model are based, in a circumscribed manner, on the work of selected authors.

These include Guile's theorisation (2012a, 2011, 2010b, 2007) of learning challenges in the current economic and societal era, as applied to the firm level interprofessional learning tasks and is supplemented by Lundvall's work, revealing the nature of knowledge and learning in the learning economy (2009, 2005, 1996, 1988). Ashton and colleagues' conceptualisation on skill webs (2010, 2009) supplemented by other recent synthesis[13]; and the ongoing conceptual and empirical work of Edmondson over the last decade around networked teams and group learning processes, emphasising the local and variegated nature of learning (2002), examining learning episodes in dispersed teams (Sole and Edmondson, 2002), and recently articulated features of 'teaming' for innovation (Edmondson, 2012a, 2011, 2008), completes the picture of the conceptual landscape. It is in essence, the insights provided by Guile's sociological and philosophically oriented work, and Edmondson's psychological, group-dynamics and methodological orientation which provides a headlight and intrinsic coherence to detect the

weaving of the skill webs, and their attention to the sociological and labour market features, described by Ashton and colleagues, in the actual practice of the case study.

The sectoral context of the study falls within the nascent software, advertising and service design segment of the creative sector[14] in Tehran, enabled by the rapid rise of mobile and smart phone usage and technologies. Within the sectoral context, regional and local innovation systems' features are at full play, specifically with the key role of Tehran and London as two vibrant cities[15], with highly developed networks and geo-cultural hubs acting as 'innovative milieux' enabling physical and social propinquity for the transfer of knowledge, learning and skills[16].

Thus by viewing innovation as managing global collaboration networks that cross disciplinary boundaries, issues of social networks and connectivity has become critical in innovation studies. Research over the last two decades on both sides of the Atlantic, as well as in Asia-Pacific, has witnessed a profound shift in the theorisation of innovation, moving from an R&D, hence closely insular mode, to an 'open'[17] and highly connected mode with diverse networks acting in different capacities. As Andrew Hargadon, a long-standing management scholar active in the field concisely conceptualises it, innovation is about connecting, not inventing[18].

1.2.1 The context of the local telecoms sector: brief overview

Glancing at the context of the study, and so as to ground the core issues, it is worth recalling that the globally oriented small private sector firms (such as micro NTBFs) in Tehran face serious 'business climate' challenges. These will be expanded upon later, but it should be remembered that the combination of economic and geopolitical positioning of Iran, and the chronic (turned acute between 2012 and gradually relieved in 2016) sanctions, unilateral or internationally coordinated, increasingly deprived Iranian firms of learning and skills to participate and lead in technological innovation. By focusing on, and exploring the role of skill webs in the knowledge brokerage processes, I pursue the different strands of the core ideas around 'bridging, linking and bonding', to gain competitive advantage by learning and innovation.

These distinctions are then used in order to help explain how Iranian firms, given their previous quasi pariah state status in the Western world, which leads the trends in technological development trajectory (Patel, 2011; Royal Society, 2011; Silberglitt et al., 2006), are trying to

move beyond their immediate context[19].

Glancing at the focus of the empirical investigation, mobile and smart phones applications are significantly altering our social domain and professional interactions (Castells et al., 2006). These include, *inter alia*, innovative business models, content and eco-systems emerging glocally (globally modelled yet locally scaled) and/or in a hybridised format, resulting in the emerging 'mobile big bang'[20] and fusing the business and technical aspects of the mobile solutions development, in both developed and developing economies.

The emerging global 'mobile big bang' model is illustrated below in figure 1.2.1 (as outlined in *Samsung Economic Research Institute's* quarterly journal).

Figure 1 [1.2.1]: 'The mobile big bang' trends
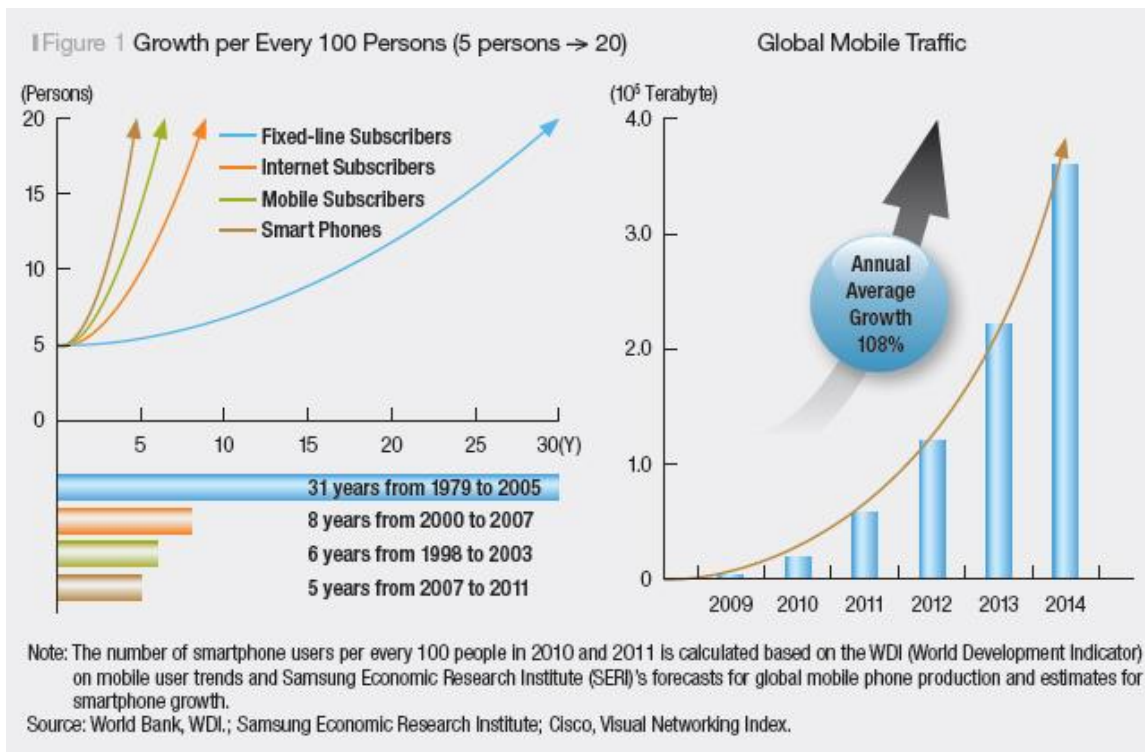
Source: **SERI Quarterly (Kang, 2010)**

As the *modus operandi* of mobile solutions' development is through project management, I have used episodes within the 'Scrum' and 'Sprint' cycles, as lean methods[21] which are widely used project-oriented 'agile' methods, as resources for examining and exploring learning, skill enhancement and interprofessional judgement in practice.

Scrum, as a project methodology, is perceived to have advantages in development of mobile applications based on having a disciplined and limited scope, high customer/end-user interaction, potentially distributed and collaborative iterative problem solving means, and condensed time to market cycles.

Drawing on innovation management and workplace learning corpus, distributed innovation with technologies and developing dynamic capabilities and enhancing skills, framed as the engine of the firm's sustainable competitive advantage[22], offers competitive action in an unstable and unpredictable market. Conversely, learning episodes[23] in distributed project activities, such as in Scrums, provides the learning firm with the stabilisers[24] to compete in a changing market.

The case study analysis, based on a longitudinal timeline (2004-2013) outlines a learning cycle in the exploration and exploitation phases of projects (cf. March, 1991), identified and expanded upon to highlight the 'learning episodes' in projects as a unit of analysis, leading to project 'break-through' or 'cul-de-sacs'. The 'break-through' seem to better utilise knowledge brokers enabling knowledge 'creation'/'inference' methods, and networking opportunities[25], as well as cross-border knowledge sourcing strategies by SMEs (Huggins et al., 2010), particularly micro New Technology Based Firms (NTBFs)[26] in technical and non-technical challenges.

It is also noted that NTBFs in developing economies, such as Iran, when endowed with skilled, technologically-alert and connected teams, in other words with a high level of social capital[27] and absorptive capacity[28], tend to mimic multinational/transnational corporation's (MNC/TNC) skill webs and associated brokerage processes, in order to survive and prosper.

I thus view and describe knowledge brokerage and sourcing in innovation[29], as formal and informal means to bring people together, and create new purposefully productive and expandable relationships, in order to define, design for, and solve problems by forming interprofessional judgements and inferring together in firms. An important by-product of these processes is learning and skill development, which derives out of workplace brokering, embedded in largely episodic, unrecognised and unplanned activities. Thus, this study aims to shed light on such situations of, and mechanisms for 'connectedness'.

As a way of further outlining the context, it is critical to note that the study was conducted during

a time of unprecedented growth both in the usage of mobile phones and expansion of its associated services in Iran (spanning 2003 to 2013), when and where the mobile penetration rates far exceeds the internet usage and many subscribers started to explore and use their mobile phones as personal and often primary communication devices.

With an estimated current population of over 80 million in a geographic area, approximately three times the size of France, the mobile penetration rates stood at about 140% in 2014-15; but were just over 58% in 2009-2010, from next to nothing, i.e. 0.4% to 0.8% based on ITU figures for 1998-1999 (Alyani, 2003), about a decade before. The increase in penetration rate whilst tapering off, remained robust for a decade, based on cheaper (variations of 'pay-as-you-go' and pre-paid) subscriptions and contracts, offered by incumbents and newer (3G/4G-LTE) mobile telecommunications license holders.

As the nascent information and communication technology market including the telecoms, and telecom value-added services segments, was still shaping, the firm examined in this study, re-labelled here (and hereafter) as AlphaCo was formed as a fully private company in 2002. As a small entrepreneurial NTBF, originally setting its sight on becoming a 'born global'[30], starting out with a few co-founders with technical (software, science and engineering) and business acumens, it initially engaged in testing the market with a range of software services based on the outsourcing model.

Whilst it had initial small successes in securing outsourcing contracts from EU, the internal market and particularly the niche market of mobile application software and solutions looked much more promising, based on an implicit 'Blue-Ocean' (Kim and Mauborgne, 2004) strategy emphasising strong technical innovation on sought-after global solutions for local needs. Examining the market and the rapid changing patterns of mobile handsets, AlphaCo made the 'pivot' to that niche, and set out to develop a stable mobile platform for business solutions, offered to both the public and private sector primarily in Tehran.

Technically, drawing on the partner in London[31] and *imitating-to-innovate*, it opted for building applications and solutions on a tested 'common denominator' of SMS[32] (short messaging service) as an embedded, and till then largely redundant feature (due to lack of popular use and small subscriber numbers mainly interested in core service of voice communication), within the Iranian national GSM network.

Software development and testing using Java Platform, Micro Edition (Java ME)[33], previously known as Java 2 Platform, Micro Edition (J2ME), as a Java platform designed for embedded systems (e.g. for mobile devices) were undertaken under local and later distributed scrum.

As the mobile telecom market grew in size, the SMS VAS[34] (short messaging service value-added services) segment grow with it. The full force of mobility, as a business service revolution (Steinbock, 2007), whilst delayed for about a decade compared to Western Europe and Far East, had at last arrived in Iran. With the development of technological tools, NTBFs such as AlphaCo, started to engage in pioneering service design and innovation initially starting in Tehran.

Having outlined a sketch of the contextual and sectoral factors of the study, we next turn our attention to the methodological approach utilised within the study.

1.3   Demarcation, methods and contribution of research

Following local access considerations, the empirical case study evolved into focusing on a firm currently operating within the value-added services engaged in designing joined-up advertising campaigns, banking and public services on mobile platforms.

In order to operationalise the empirical aspects of this research project, and by extension, sharpen the focus of the study, many choices have had to be made and limitations imposed. These include concentration on a single firm, in a single city, in a single country, namely Tehran, Iran linked to a single external entity in London, UK. Theoretically however, robust principles and fundamental concepts found in the academic (and at times, practice-based consultancy) literature are mobilised, and have guided and informed the directions pursued in the different stages of the study. Methodologically also, choices made around the 'unit of analysis' and the 'longitudinal design' intended to permit a deeper and more nuanced understanding of learning and innovation in the context of a firm operating in a transitional economy. An interdisciplinary approach is utilised backgrounding the macro- and meso-frameworks and factors, while paying close attention to the foregrounded micro level practices, which breaks away from a one-dimensional and 'cross-sectional' snap-shot analysis. As a researcher with some exposure to previous national and international level research, I was conscious of exploring methods that avoid primarily cross-sectional views. Instead, a 'tool kit' approach (Nicolini, 2013) is utilised, offering significantly higher fidelity, so as to better capture the nuances of context and practices.

The study's design of interpretive methodology is anchored around an abductive orientation and mixed-method approach[35] (cf. Morgan, 2007). This is within a tradition of longitudinal innovation studies[36] and applied qualitative research[37], set within a case study[38] framework. As will be expanded in later chapters, this is also closely congruent with the underlying epistemology and ontology of the study. The analysis anchored on the use of 'thematic clustering' (Braun and Clarke, 2006) with triangulation (Jonsen and Jehn, 2009) to validate the themes of processes: the themes categories of *'Resource Agility'; Search and Responsiveness'* and *'Unified Design and Prototyping'* were derived from previous studies, and later became part of the model formulation (Weiss, 1998, pp. 285–288) of the *DEAL* (Design, Execute, Adjust, Learn) model.

The approach, although time-consuming, resource-intensive and iterative, leads to shedding light

on interdependencies and interactions of often embedded social factors and institutions existing at the societal, sub-societal and subterranean level.

The study examines, en route, the changing relationship between the local and the global in Iran (and issues around glocality and hybridisation), in particular highlighting the contradictions and tensions in simultaneously promoting an 'insular' (accentuated by the promotion of self-sufficiency discourse which was significantly shaped by the Iran and Iraq war (1980-1988)[39]) and 'connective' approach within its economy and by extension, technological interactions.

Away from geo-strategy and geopolitics however, there is a dearth of nuanced and objective accounts on the complexities of Iran's post-revolutionary socio-economic position, especially policies related to human resource capital and development, skill formation and upskilling, and knowledge creation (Alyani, 2003; Alyani and Nahi, 2003; 2001) in its networked organisations and modes of operation, including means to circumvent the effects of long-term economic sanctions on technological and globally sought-after skills, while simultaneously confronting the gales of 'compressed modernity' (cf. Chang, 1999).

Suffice to state at this stage that Iran has ambitious plans to be a well-connected advanced regional power and to have the potential to 'project' its power. Thus, moves toward an advanced knowledge-based 'catching-up' development (Nelson, 2004, for two "bodies of knowledge", cf. 2000, p. 66) and knowledge-creating modes of operations (in science and technology) are prioritised and promoted (ILO, 2003, 1996, UNCTAD, 2006, 2005; UNIDO, 2003).

Lastly, 'context-cognisant' theories and theorisation[40], dealing with practices in developing and transitional economies, and even more so on small firms and learning within the Persian Gulf/West Asia environments are particularly attended to. Also within the study's empirical elements observed in the projects, spanning working days in London and Tehran[41], project time and practical collaboration opportunities in terms of the time and week differences are worth bearing in mind.

1.3.1 DEAL iterative model and a glance at methodology

Thus in formulating the analytical framework, based on thematic analysis (Braun and Clarke, 2006), 'methodological fit' research (Edmondson and McManus, 2007; Edmondson, 2011) and triangulation (Jonsen and Jehn, 2009), derived from the literature and the data, I took account of the scarcity of 'context-cognisant' and practice-based theories and attempted to ground my observations. As no single strand of literature provided the necessary theory, I brought together arguments of several theories and soon traced patterns of cyclical exploitation and exploration. Exploitation refers to the firm's refinement and development of existing knowledge with predictable outcomes, whereas exploration refers to the pursuit of new knowledge with uncertain outcomes (March, 1991). I further noted that the nature of learning is in the form of generative interactions between individual and collective inquiries (Elkjaer, 2004). Drawing on the 'learning episodes' in projects, I also take account of the fact that there are zones of 'collaboration' as well as zones of 'coordination and control' activities within projects, as articulated and facilitated by the cycles of Scrums and Sprints. As outlined later, these are placed and activated within the DEAL model.

Figure 2 [1.3.1]: A model of Scrum and Sprint cycles
along with roles, tasks and processes[42] (source: non-copyright wikipedia/wikimedia material)
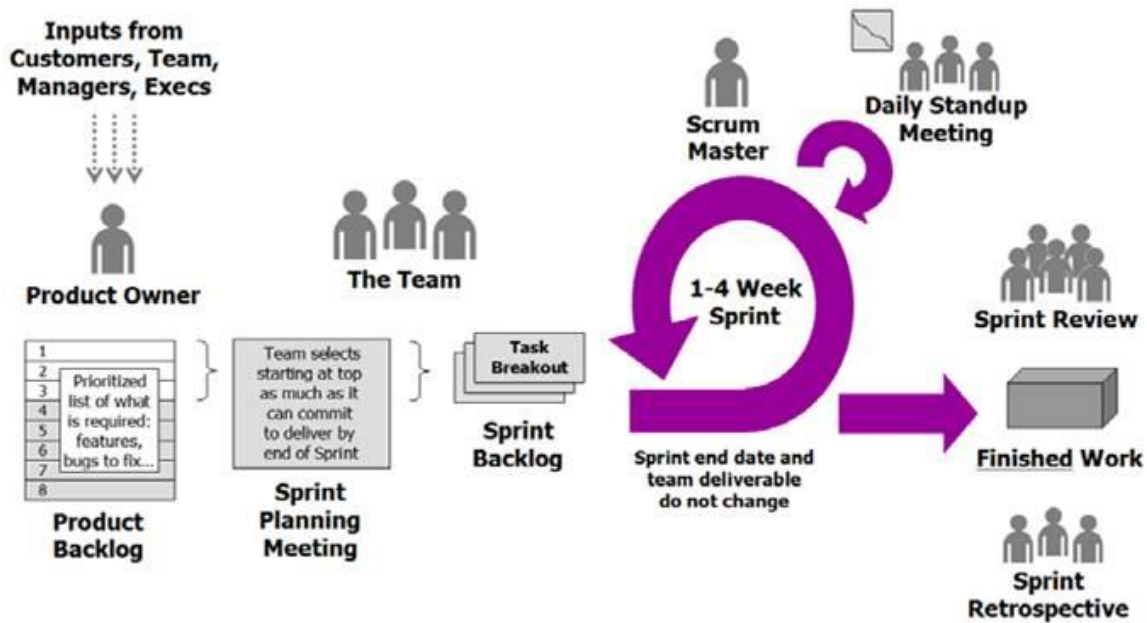
Figure 3 [1.3.2]: A stylised schematics for the Sprint and Scrum roles
(source: non-copyright wikipedia/wikimedia material)

The Sprint Cycle – Team Roles

Architects/Leads:

| Task Assignment | Mentoring | Code Review | Release Engineering | Sprint Planning |

Developers:

| Requirements Gathering | Create Unit Tests | Coding | Debugging | Release Assist. |

QA:

| Write Test Cases | Validate Tasks & Submit Bugs | Validate Test Cases |
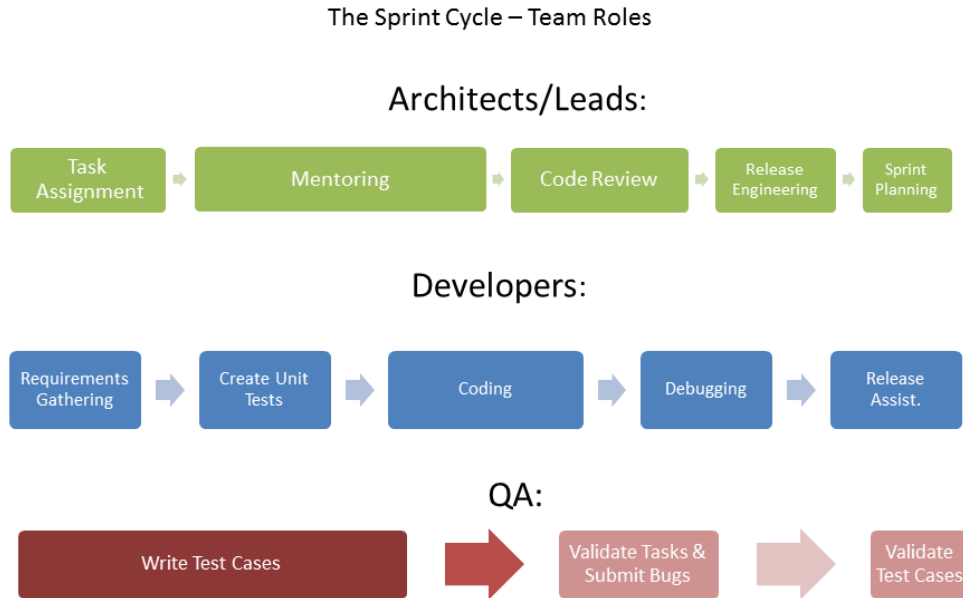
As the projects are part of a larger eco-system, there is a broader context of the case study, as represented in the figure 1.3.3 below.

Figure 4 [1.3.3]: Study's contextual and processes model
(also used as an 'analytical filter' for the case study)
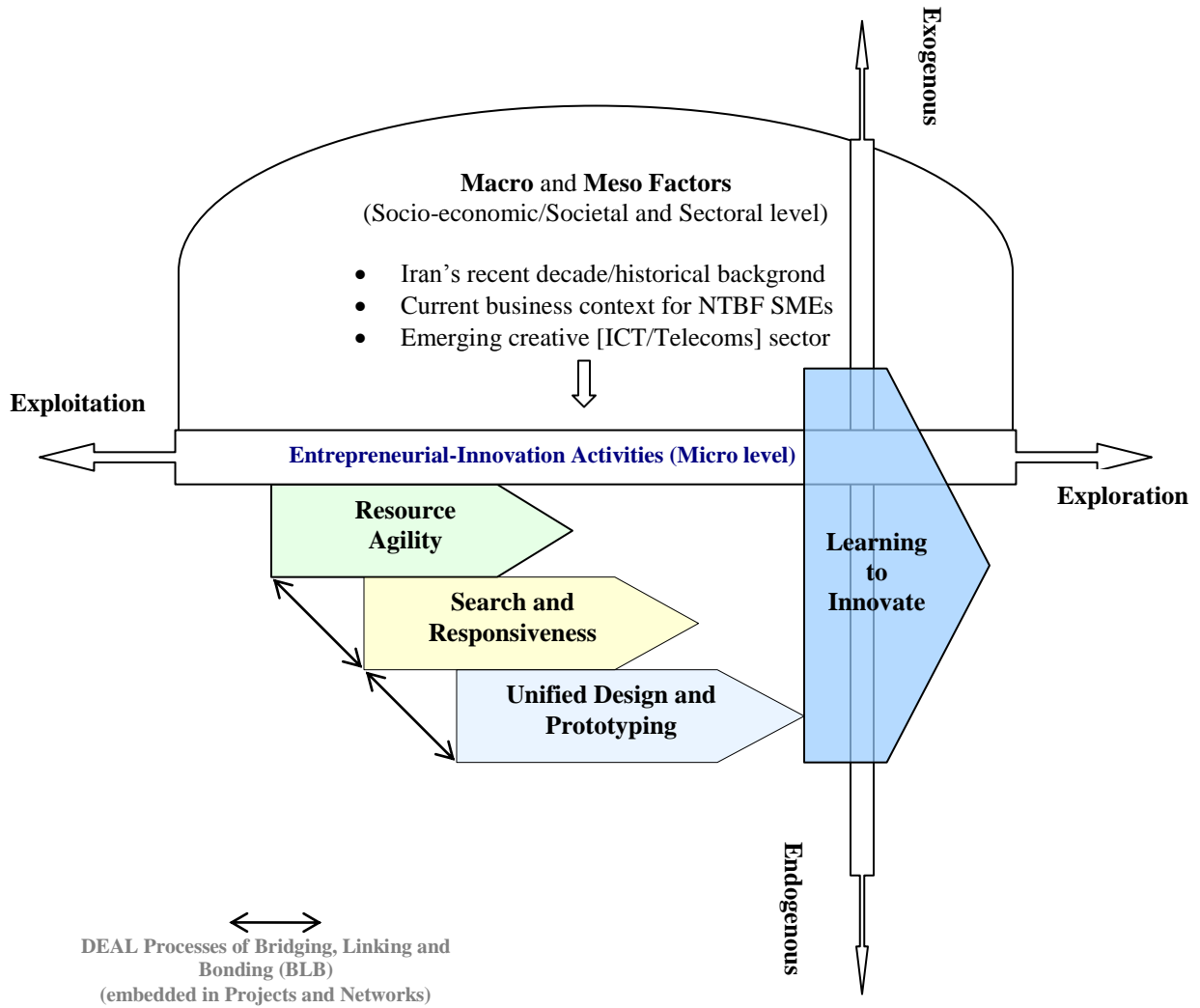
Exogenous

Macro and **Meso Factors**
(Socio-economic/Societal and Sectoral level)

- Iran's recent decade/historical backgrond
- Current business context for NTBF SMEs
- Emerging creative [ICT/Telecoms] sector

Exploitation

Entrepreneurial-Innovation Activities (Micro level)

Exploration

Resource Agility

Search and Responsiveness

Learning to Innovate

Unified Design and Prototyping

Endogenous

DEAL Processes of Bridging, Linking and Bonding (BLB)
(embedded in Projects and Networks)

As an exploratory study, within the Tehran based firm's context, this account attempts to capture a connected slices of time and place, via the filter of the firm's activity on technical projects, details of which are oultined in detail later.

The empirical elements investigated sharing of problem-reframing/-setting and problem-solving project judgement on the issues that emerge out of daily business challenges in projects, which is both of a technical (software) and a commercial (business model and service design) nature[43].

The research was conducted as a single case study (Yin, 2009a): the primary-sourced data within the firms[44] is of a longitudinal nature and comprises of two group interview meetings, initially 18 semi-structured interviews and ongoing organisational ethnographic observations across 2004 to 2013, plus ad-hoc London and Tehran-based meetings, 'issues-tracing' and 'feedback and validation' meetings. The longitudinal research design involved five waves of (one pilot and four actual) data collection, broadly in line with a 'panel design', where as far as possible the same people are contacted, observed and/or contacted and interacted with more than once, with the orientation and focal thematic questions mirroring previous research.

In terms of theoretical demarcation and scope, the thesis hovers on the knowledge brokerage[45] and sourcing role (Howells, 2006; Meyer, 2010; van Lente et al., 2003) to 'bridge and bond', different domains and reframe problems, in an effort to learn to solve the firm's problems. The theoretical line on learning draws on re-working of Schön's ideas, originated from Dewey and supplemented by Elkjaer (2004; Elkjaer and Simpson, 2011), leading on to inquiry-based learning.

Reworking Dewey's project, Schön (1992, p. 123) is acknowledged for raising, through the notion of inquiry, a series of important issues around teaching and learning of professional practice, and inquiry as an intrinsic feature of professional practice, within inherently complex and dynamic professional settings. A different and currently less publicised strand of his work however also examined technological change and how people in organisations and societies hit conundrums.

Inquiry-based learning in firms, in its practice-based definition, is what NTBFs, including the firms examined in this study, can identify with closely. In small firms, knowledge creation and the management of innovation processes are not a goal in themselves; rather these support the

economic goal of continuous innovation as a decisive factor of their competitive advantage and survival (Tidd and Bessant, 2009, pp. 514–518). Innovation is thus viewed as a derivative of the process of learning and knowledge creation, required for growth, and for gaining and maintaining sustainable competitive advantage. Conversely, learning can also be a derivative of the process of innovation.

Drawing on the two strands of innovation and learning in firms (and in later chapters, related policy, as articulated by global advisory organisations such as OECD and UNCTAD/UNIDO), and further developing the argument around inquiry in firms (originated from Dewey and Schön), facilitated by skill webs (conceptualised by Ashton et al. (2010, 2009)), the study provides a fresh way of thinking about, and looking at notions of innovating, along interconnected processes. The synthesis raises the key possibility to illustrate that innovation processes have an inherent relationship with one another and potentially provides a way to remove the apparent dichotomies.

It is therefore one of the initial conceptual contentions of this thesis, that as innovation occurs in practice, the route to innovation would be through conducting an inquiry (in the Deweyan terms) (1991, 1938a, 2007, 1998) and framing and reframing problems in "indeterminate zones of practice" (in the Schönian terms) (1987, p. 6, 1983, p. 65 and 357n38), inspired by Dewey's conceptualisation and terminology in *Logic: The Theory of Inquiry* (Dewey, 1938a).

The core research domain and questions of the study had an emergent nature as the research involved periods of in-depth immersion in the firm, within a longitudinal design, so as to explore and uncover the tacit nature of causal and often informal relationships and processes. Thus within the context of the firm, namely undertaking project-based tasks, in a transitional societal and sectoral state, the thesis poses the following research propositions which were constructed abductively[46]:

- What activities, as observed in 'learning episodes' and brokerage, do the project team members of the firms engage in, that facilitate their ability to innovate? [RQ1]
- Within the context of the study in contemporary Iran, what are the macro effects that influence the firm's capabilities to innovate? [RQ2]

A follow-up supplementary question, tackled primarily in the discussion and conclusion chapters that derives out of above inquiries draws attention to the role of national policy in up-skilling within knowledge-intensive sectors, with the following focus:

- Within the context of the study, what tangible policies could assist and promote firm-based learning episodes, with a view to innovation? [RQ3]

1.4   Thesis route plan and chapter outlines

The thesis is structured across eight chapters as follows. Chapter one has introduced the research topic and specific nexus of the interdisciplinary domain and its interconnected streams of research in brief. This then lays the foundation for the development of accumulative arguments proposed and fine-tuned in the follow-up chapters. I have also introduced, at a glance, a number of key terms of the thesis such as inquiry and innovation; brokerage and skill webs; exploration and exploitation; and on a more macro area studies' level, economic and sectoral 'catch-up'.

Chapter two starts by locating and commenting upon the socio-economic context of the firm, utilising the concepts of episodic and thematic policy framing in Iran's economic and technological endeavours in the last decade (including meso and micro level 'policy memory and implementation amnesia' on catching-up and major challenges in strategic incrementalism in operationalising sustainable implementation mechanisms).

As a socio-economic primer, the thesis outlines in brief the trajectory of Iran's policy makers initial en masse acceptance up to late 1960s/early 1970s, and then the wholesome confrontation with modernity in the last three and half decades. The argument specifically attends to the enduring pursuit of independence articulated in self-sufficiency and self-reliance as a powerful discourse of ideology, directly and indirectly influencing the drive for technological innovation. Some implications on contextualising the global and local debates, including the significant and reinforcing consequences of the Iran and Iraq War (1980-1988); chronic economic sanctions as a result of the turbulent US-Iranian relations, reaching potential détente in post-2015 realpolitik, and its effect on firm's skill strategies; and the role of informal networks as a way to circumvent and compensate for these, are raised by the end of the chapter, setting the scene for the next chapter.

Focusing in the contextual domains, chapter three initially introduces and briefly reviews the macro position on a strand of issues and most recent thinking on Iran's shift from a static industrial policy towards a more modern industrial policy and dynamic innovation policy. The argument rapidly focuses on Tehran, where the research unfolded, as a possible innovation milieu for the Creative ICT-enabled sector and considers talent, technology and tolerance issues, within

that context. A brief technical overview of the telecoms sector and its evolving characteristics is provided in this chapter too.

Chapter four covers, be it in a highly circumscribed and thematic manner, the first conceptual domain of interest in the thesis, namely innovation in firms. As the innovation literature is vast and sprawling, specific orientation applicable to the small firms and NTBFs operating in the creative sector are prioritised, with key debates on business development. Additionally, as innovation is framed as an intrinsically socio-technical activity, theoretical and practical conceptions on knowledge brokerage are expanded upon, as a resource for later utilisation.

Building on the previous chapter, chapter five acts as a bridging chapter and outlines the role of learning in and for innovation, and a pragmatic approach to learning on an individual and collective level, before moving towards summarising previous studies. Drawing on previous work in organisational studies and management, it identifies the emergence of key processes as potentially fertile concepts for closer conceptual examination and thematic clustering, later contributing to the formulation of the analytical model as empirics.

Chapter six is structured in two parts: firstly, it briefly addresses the key concerns of the empirical element of the research, around structuring a prolonged empirical inquiry. After outlining the research design, data collection and analytical means, it moves towards further developing and subsequently refining the analytical framework, to facilitate looking for patterns and themes in the empirical findings. The pragmatic approach, and the assumptions around a thematic typology and abductive reasoning, as a methodology, is also outlined.

Subsequently, in part two, it reasserts the justification of the methodological approach. It then provides detail segments of the multi-stranded data, consisting of individual and group interviews, observations, post-project follow-up discussions, as well as notes on the research site. An initial commentary is then offered on the strands within the data of the case study vignettes, based on the thematic analytics. It leads us to the next chapter for a further focused discussion.

Chapter seven offers a concise discussion on the analytical focus of the vignettes: skill webs as brokerage and intermediation. It then moves to outline the cyclical process of research and will revert back to previous theoretical sections in an effort to make sense of, and locate the context in the analysis. Based on a constellation of ideas and concepts, the use of DEAL model and skill

webs in facilitating the distributed development of interprofessional judgement[47] is outlined (expanded in the next chapter). A brief discussion on the implications of the case study vignettes closes this penultimate chapter.

Chapter eight reiterates the main findings and attempts to address the research domain and proposition, towards a synthesis both at a micro firm level and extrapolates tentatively on a meso and macro level, by commenting on policies promoted by international advisory bodies, specifically the elements of learning in the latest OECD's industrial policy (2013a) recommendations and specific thinking about the regional features (OECD, 2013b), in aid of catching-up. In addressing the research questions, I highlight features of successful "learning to innovate" processes operational at micro and meso level, via global skill webs, which are paradoxically not regionally or geographically clustered. The last section outlines the implications, mainly on a firm level and with brief reference to a meso and macro policy level, as well as shortcomings of the research, and reflecting on issues that have been raised but not fully resolved. This moves to conclude the argument by considering vistas for future directions.

Having outlined the route plan within the chapters of the thesis, we next turn to chapters 2 and 3 which deal with the context of study.

As these two chapters cover substantive historical and theoretical material, it is worth expanding on their contribution towards, and connections with the overall thesis. Chapter 2's argument on Iran's confrontation with modernity endeavours to provide the necessary background for the reader to detect the complexity and starting points of the multiple tensions in current policies. These include the ongoing tensions between isolationist or connective approaches in Iran's industrial policy on a macro (national economy) level, and interestingly as expanded in chapter 3 and later chapters, the meso (sectoral) and micro (firm level) attempts to work around the macro narratives and connect with the international activities within the ICT sector.

In so doing, the sectoral actors, specifically entrepreneurial individuals and the firms, within the Iran's ICT eco-system go above and beyond their imposed limitations and find ways not only to glocalise their products and services, but offer a hybridised engagement with problems to learn and innovate, finding solutions based on the local circumstances and resources.

As a result, brokerage, clustering and networking take on unique characteristics, as will be explored in later chapters and summarised in the concluding chapter.

Chapter Two: Iran's confrontation with modernity

The aim of this chapter is threefold. Firstly, the chapter acts as a primer by initially locating and subsequently providing a commentary on the socio-economic context of the innovating firms in Iran. This includes a brief glance at the significant historical elements of Iran's confrontation with modernity so as to briefly explain the different political, economic and religious impulses that bear down on innovation in Iran, and the evolution of that discourse in the recent years, in this and the following chapter. As there is now a considerable volume of material on Iran's socio-political and geopolitical features and geo-strategic activities, and yet, a continuing dearth of literature on Iranian firms and organisations, we retain our focus on the latter, particularly within the timeframe of the last two decades, matching this study's time-span. Notwithstanding, so as to provide the sources and some of the continuing tensions within the debates, occasionally we may need to look further back on a handful of core issues.

The thesis therefore outlines in brief the trajectory of Iran's initial en masse acceptance up to late 1960s/early 1970s, and then the wholesome confrontation with modernity (at its height, between mid to late 1970s, intensely for nearly two decades till 1989), and its continued rhetoric in the last two and half decades, leading up to the current path of 'moderation and prudence' advocated by the current (i.e. 12th) government of the Islamic Republic, led by the centrist President Hassan Rouhani (the 7th President of the Islamic Republic) from August 2013 onwards.

Secondly, we identify, trace and sign-post a deep and continuing paradox in the Iranian policy making and socio-economic evolution. Utilising the concepts of episodic and thematic policy framing in Iran's socio-economic and technological endeavours, two categories of broad policy objective, supplemented with lingering Islamic and revolutionary ideology are confronted.

These can be summarised as follows: firstly, the thematic policy frames of *independence and social justice*, which have been an ongoing premise since (and before) the 1978-79 revolution.

Secondly, the episodic policy frames of *catching-up*[48] *and economic development* (leading to *inclusive growth*, that links back to the *social justice* elements of thematic frame), that have oscillated on and off the policy agenda for about two and half decades, since the dying months of

the Iran and Iraq War (1980-88) and the passing-away of the leader of the revolution, Ayatollah Khomeini.

A brief explanatory note on the above concepts, and my use of them, may be useful here. Whilst widely used in the 'practice' of, and justification for, policy-making and policy-implementation, episodic and thematic framing has previously been mainly analysed and explored in communication studies, particularly news coverage. This is where episodic frames outline an issue in question by referring to a specific example, whereas thematic frames, places the example and the issue in a broader context of policy (Iyengar, 1991; Iyengar and Simon, 1993). Furthermore, research has highlighted that the prevalence of episodic framing diverts the collective attention away from societal responsibilities, and encourages a 'morselized' (as in the 'morse' code) understanding of the problems by presenting recurring issues as discrete instances (Iyengar, 1991, p. 136). This can then lead to the unsatisfactory situation, for the citizens who are exposed to a steady stream of episodic frames, to fail to see the interconnection between problems, as these have been presented as discrete and unconnected issues (e.g. in Iran's economy in 2016-17 onwards aiming for a steady growth rate and a significant improvement in the business environment ratings, controlling the range of three core prices of; energy and its subsidies, interest rates, and foreign exchange rates, are inter-related endeavours). The failure to see connections in problems, in turn have consequences, as it leads to individualistic (for episodic) and societal (for thematic) attributions.

As part of this debate, the thesis highlights the national facsination and (over-)emphasis with macro policy making, and till recently, a lack of serious acknowledgment of the difficulties and intricacies of implementation in meso and micro levels.

In short, macro 'policy-making memory', for too long, and in significant portions of policy agenda spectrum, has been followed by, meso and micro level 'policy-implementation amnesia' or at best, anaemic results.

It is fair to point out however that these are common problems in developing economies, to the extent that the World Bank (Kutznetsov, 2010) advice on catching-up has come to include a significant call on development of 'strategic incrementalism', i.e. operationalising stepwise and sustainable implementation mechanisms, which can take account of potential 'unintended consequences'. This is within the same ethos as sequencing of reforms (cf. Nsouli et al., 2005)

The 'policy-making memory' followed by 'policy-implementation amnesia' however, has been able to continue for decades in Iran based on deeply ingrained interest groups, and perhaps more pragmatically, the ability of the country to continue to draw on her natural (primarily hydrocarbon) resources, to pay for maintaining the 'status quo' quagmire, albeit with a significant and continuing reduction in her general economic indicators and ultimately, national wealth.

We specifically attend to the enduring pursuit of independence, articulated in the lexicon of self-sufficiency and self-reliance as a powerful discourse of ideology, directly and indirectly influencing the drive for technological innovation. Some implications on contextualising the global and local debates, including the significant and reinforcing consequences of the Iran-Iraq War (1980-1988); chronic economic sanctions as a result of the turbulent US-Iranian relations, which reached a détente in the 2015-2017 realpolitik, and their effect on firm's skill strategies; and the ascending role of informal networks as a way to circumvent and compensate for the effects, which are raised by the end of the chapter, setting the scene for the next chapter.

Third and finally in this chapter, and carried over to the next chapter, we trace the tentative steps in Iran's economic transition, by way of experimenting with and exploring new policy avenues. So as to create a natural link with the core of this study and the subsequent chapters, we keep the focus of these parts of this and the next chapter, on the role of innovation and SME firm policies, drawing out useful indicators and summaries from a related astute study undertaken by UNCTAD (2006, 2005), and a recent IMF report (IMF, 2014a), acting as an 'expert panel' and consultant to the Iranian government. We continue to draw on these to highlight the ongoing situation, in the next and follow-up chapters.

It is worth highlighting two caveats before starting our detailed discussions. Firstly, despite the ever increasing number of new (historical, 'ideological' and societal 'for or against', and journalistic) writing on Iran, including not only consultancy and scholarly texts but also memoirs, travel accounts and political digests (The Economist, 2006), there is a continuous dearth of robust reports and studies on Iranian organisations and firms, whether large or small, including their efforts on innovation, beyond a 'caricature'. Whilst there is a growing body of work produced inside Iran as part of undergraduate and postgraduate level final projects, these generally lack robustness, rigour and theoretical development. This has been a continuing issue and raised before by others, both on the management and organisational studies and the question of

academic quality and relevance in higher education. The over-emphasis on descriptive studies and lack of predictive theory-development and -connections in Iran (and regional states) social sciences reminds us of a similar situation in policy studies, and specifically policy learning, eloquently described as:

> "mountain islands of theoretical structure, intermingled with, and occasionally attached together by foothills of shared methods and concepts and empirical work, all of which is surrounded by oceans of descriptive work not attached to any mountain of theory". (Schlager, 1997, p. 14)

Equally, whilst there are many interesting studies undertaken in various prestigious universities outside Iran, (and notwithstanding the fact that many of these often tend to proselytise rather than analyse and interpret, and thus based on ideology or utopianism, miss out the nuances of the reality of practice), these are usually of a snapshot, and therefore of a disjointed, nature (that quickly become irrelevant), which have difficulty capturing the dynamic nature of the field and in connecting the past to present state of affairs. Equally, finding research of a longitudinal nature in firms and organisations is still extremely rare.

It would not be an exaggeration, to paraphrase Hirschman's eloquent quote (1989; 2013, p. 289), to the ongoing debates on Iran related issues, as an *overproduction* of opinionated opinions. Whilst writing in and about a different set of problems of his time, he (ibid, p.289) captured the dilemma by stating,

> "Hence there will be an *overproduction* of opinionated opinion [original italic]. The most straightforward way of avoiding this overproduction would be for individuals to change the value system under which they operate. Might they learn to value both having opinions and keeping an open mind, to mix the delights of winning an argument with the pleasure of being good listeners and of having Jane Austen's "persuadable temper"?

Having covered the caveats, we turn now to the next section in briefly discussing the sources of Iran's confrontation with modernity.

In this chapter and next, we outline the context of Iran's business environment and economy, in an effort to clarify the rich and complex context and historicity of the operating environment for the innovating firm, and its interactions. These insights are then used to better understand the challenges faced by the firm and the teams operating within them.

2.1 Iran's confrontation with modernity: from glocalisation to hybridisation

Iran's sustained and serious encounter with modernity dates back to 1850s when it systematically started to invest in its intellectual, cultural, economic and political resources. This was historically initiated at a time when her national sovereignty and boundaries were at stake from the British and Russian imperial powers and hence an ongoing programme for transformation into a modern nation-state started to be viewed as paramount.

There exists a basic contradiction that is not easily resolved in many developing regions of the globe, and it holds true for the Middle East and by extension, Iran. It is the tensions between a 'natural order' made up of family, clan, tribe, ethnicity and religion, which are basically pre-modern sociological associations, compared to forces of dynamic modernity that emphasises personal freedom over the community, the fundamental rights of human beings, respect for the individual man and woman, the promotion of educational ethos and the fulfilment of people's potential based on meritocratic structures irrespective of their specific ethnicity, class, or religion.

This and the next sections of this chapter thus aim to provide a constrained perspective on the socio-historical context of Iran, with a narrow spotlight on its influences on the focused themes of the thesis. I will tackle this aim by initially tracing, in a broad-brush sense, the related historical changes within the last century and then fast forward to the recent four decades, and then more specifically focus upon the events within the last decade, to outline the picture of the business operating environment for the firm studied.

Clearly, this is not intended to be a comprehensive coverage of poignant or related issues but primarily an effort to position my argument, whilst drawing a link between Iran's status on modernity, modernisation drive and globalisation/glocalisation or hybridised engagement with modernity, so far as these relate to the core argument of the thesis.

There exists a plethora of, and a lack of consensus on the definition and dating of modernity and other derivate terms such as post-modernity, modernism, post-modernism and to some extent, the experience of modernisation. In addition, it is worth recalling that 'modernity' may well be better understood pluralistically, as a 'multiple, rather than a unitary' concept, especially with the social

reactions in different parts of the world significantly diverging from the underlying roots and evolution of the European model (Eisenstadt, 2001). Added to these pluralistic approaches, there are elements of hybridisation that cut across these themes, as will be discussed later.

Bauman (cf. 2001) provides a concise summary based on the significant corpus of his previous work, as well as a useful commentary (1991, p. 3-4) on disentangling the concept of modernity. Building on the work of Matei Calinescu, he clearly distinguishes between modernity and cultural modernity (or modernism).

He (ibid) offers a definition, which is in line with most interpretations of the term, as

> "modernity as a stage in the history of Western Civilization – a product of scientific and technological progress, of the industrial revolution, of the sweeping economic and social changes brought about by capitalism."

He further expands (ibid) by calling

> "'modernity' a historical period that began in Western Europe with a series of profound social-structural and intellectual transformations of the seventeenth century and achieved its maturity: (1) as a cultural project – with the growth of Enlightenment; (2) as a socially accomplished form of life – with the growth of industrial (capitalist, and later also communist) society."

In a different concise summary, Bauman (2001) traces the facets of modernity, which I have selected and quoted at length here (which I draw upon later, based on thesis strands), as follows

> "Progress is, essentially, a human accomplishment. It consists in applying human reason (rationalizing) to the task of making the world better geared to serve human needs." (ibid, p.551)

> "[as part of the modernity project, modern] nation-states… promoted national unity over ethnic differentiation, deployed nationalism in the service of state authority, and adopted the promotion of national interests as the criterion and purpose of state policies." (ibid, p.552)

> "Most theoretical models of modernity select inner dynamism and the capacity for change and self-improvement as the central characteristics and the ultimate sources of modernity's worldwide ascendancy and attractiveness. […] In Karl Marx's picturesque expression, "everything solid melts into air, everything sacred is profaned"[49]: once the authority of tradition has been sapped and denied, nothing can prevent human courage

from setting ever more ambitious tasks and designing ever more effective ways of performing them." (ibid)

"Division and separation are indeed constant themes in the theoretical discourse of modernity. […] The more complex is the division of labor, the simpler and more straightforward are separated functions; therefore they may be better mastered and more efficiently performed by specialists, who can now concentrate fully on effective means of "problem resolution". Expertise becomes a trademark of modern economy, science, art, and politics alike." (ibid, p.552-553)

Whilst highlighting the cornerstone position of rationality and rational action in modernity, he also acknowledges the likely difficulties of such ideals in practice, and expands as follows

"… most choices stop short of the ideal. Means may be miscalculated because of inadequate or erroneous knowledge. Moreover, task oriented activity is seldom free from interference by "impure' factors, irrational insofar as they are irrelevant to the task at hand – like the actor's uncontrolled habits and traditional loyalties, affections that get in the way, or commitment to values that interfere with the efficient performance of the given task. Rationality is therefore a tendency rather than the accomplished reality of modernity; a continuous, though by and large inconclusive, trend discernible in all fields of social life" (ibid, p. 553)

The application of that definition and conceptual refinement however immediately raises the 'problematic' spectrum of time for a nation with over three millennia of written history, included amongst which are her ancient 'glorious days' as a cradle of ethics, 'modern' sciences, mathematics and medicine, with the Persian Empire acting as an opposing pole to the ancient Greece and later Rome. Even after the arrival of Islam in Persia (637-651), Iran continued to play an active role in science and technology in her surrounding region (Freely, 2011). Notwithstanding, it is useful to bear in mind that Persia, later (in 1935 and 1959 Iranian government directives) commonly referred to and known as Iran, has been exposed to modernity since early 1800s, and is continuing to face serious challenges to date, increasingly by forces of cultural and economic globalisation, channelled via means of modern mass communication.

Glancing back a bit further, it is worth recalling that for over two millennia, Iran is the only state in the contemporary boundaries of the Middle East that has continuously preserved its cultural identity, even when faced with the dominance of Greek, Mongol, Arab and Ottoman (Turkish) invasions. The rich tapestry of her culture now extend far beyond the current political boundaries of the Islamic republic, and as far as Anatolia, and the Caucasus in the west; Central Asia in the

north and the Indian subcontinent in the east. Upon accepting Islam, Iranian Muslims, did not follow the path of the people of other comparable deep-rooted ancient communities (and states), such as Egypt, North Africa and Syria: Iran adapted Arabic as a lingua franca, but retained Farsi (modern Persian as an Indo-European language, switched from the old Pahlavi into Arabic script, culminating in Perso-Arabic alphabet – with 4 extra letters than the 28 letters in Arabic alphabet – in the written format). Whilst Arabic remained the main written language of the new Islamic empire, from the tenth century onwards, Farsi (also referred to as 'Parsi') not only developed and retained its followers, but also emerged as a mature literary language, both in central and southern Iran, as well as in the northeast and Central Asian hubs cities such as Samarkand (Samarqand) and Bukhara. This was partly as a result of the systematic efforts of Ferdowsi (940-1020), the Persian poet-extraordinaire who composed much of his national epic masterpiece entitled the 'Shahnameh' (Book of Kings) in Farsi, during the Samanids rule in Central Asia and northeast Iran.

The Islamic revolution in 1979 heralded the rejection of centuries-old tradition of variations of the kingship and monarchy, and reorganised the popular rule on the basis of fundamental concepts from the combined ideas of a 'republic' and 'theosophy', derived from an interpretation of Shi'a Islam (combined with ancient Iranian traditions of religious heterodoxy): an entirely new political experiment in the region and one of the very few, with such revolutionary "neither-East, nor-West" orientation, globally.

Historical overviews of Iran's contact with modernity are offered in various guises and disciplines. Lambton (1987, pp. 207–208) for example, cogently assert that the initial glimpses to modernity in Iran originated from foreign travellers such as European diplomats, trade and military missions, religious missionaries, merchants and occasional independent travellers. The actual individuals and their actions, as well as the reformist agenda of a select few technocrats and ministers in securing the future of the nation, played a critical role in bringing forth the new predominantly Western ideas of science, medical and technological (within which 'military sciences' were of immense importance) knowledge to modern Iran.

As she summarises (ibid),

> "It was only the advent of foreigners to Persia which aroused interest in the outside world and simulated a desire for change and led to the provision of some modern education and medicine – even if it produced at the same time hostility… It was largely through the

channel of foreign travel [by Persians for diplomatic, commercial and educational purposes] that the main currents for reform came in the second half of the nineteenth century."

There is also some evidence that initial contacts originated via Christian missionaries involved in early attempts of formal and secular schooling in Persia, but the fascination paid to, and received from foreign travellers had little catalytic effect in changing the socio-cultural and structural fabrics of the country. The idea of a modern (and later-on, a universal) education system however had triggered a desire for a better comprehension of alternative solutions to problems of the day.

This desire was also strengthened as a consequence of the Western views on, and progress in science, economics, political science and philosophy propagated by a move to translate 'modern' (and classic) texts of science and fiction, into Farsi (Persian) language. As being 'moderately-literate' was significantly linked with the person's socio-class position, the Western ideas found a small and yet enthusiastic, often reform-minded and influential readership.

The early launch platform of new ideas including translations of text into Farsi are often linked to Iran's first secular educational establishment, *Dar ul-Fonun* (an Arabic word meaning 'House of Techniques/Skills' i.e. *Polytechnic* - دارالفنون) in 1851, through its Western teachers and more importantly and sustainably, its graduates' social capital and their links with other intellectuals (Johari, 2002; Menashri, 1992). *Dar ul-Fonun* was founded on the tireless efforts, perseverance and driving vision of *Amir Kabir*, a reformist minister of the Qajar dynasty, modelling the curriculum on European educational institutions. The establishment of *Dar al-Fonun*, which is broadly considered to be the intellectual predecessor of University of Tehran (itself initiated as a result of a parliamentary inquiry, culminating in its foundation in 1934), was a pioneering act as it:

> "was the first educational institution in modern Iran to be set up by the political, rather than religious establishment, and the first to teach western (not religious) sciences" (Menashri, 1992, p. 53).

Previous, and in parallel to these developments in early to mid 1800s, were the effects of the small but increasing group of Iranian young persons who were sent to the West and Tsarist Russia on government sponsored educational or military missions in order to study and bring back the new science and technology. The individuals would often, although not always, be in a privileged position of being offered a secure and well-connected government career upon their return, which

in turn meant that their line of thinking, evaluation and analysis soon found its way to policy formation circles.

This trend continued well into the next century (and still does, however in a much more subtle manner) although by mid 1950s and especially the oil boom decades of 1960s and early 1970s, the expansion of the relationship between Iran and West has been to such an extent that Westerners, particularly American nationals, in increasing numbers travelled and worked in Iran. Large and multinational companies became highly operational in Iran and viewed the country as a critical node and base-station in the Middle East's regional market. This assisted the 'Westernisation' process as they imported with them aspects of their own liberal culture and tradition, and further assisted the intellectuals who promoted the ideas of wholesale 'Westernisation' as a sole and viable alternative path towards social and economic development.

There are some noteworthy ironies which have emerged as a result of 'development' oriented mindset and planning, with specific reference to education, training and professional learning. As Menashri's astute study (1992) amongst others point out, many of the initial government sponsored Iranian students sent abroad to the United Kingdom, France and Russia, in the late 1800s and early 1900s, went to become the State's strongest critics. The pattern has repeated itself more recently, with revolutionary and post-revolutionary figures and ideologues.

Writing on modernity in Iran, mainly with a focus on the mid to later years of the 20th century, Mirsepassi (2000) offers an interesting treatment of the subject. Its historical contextualising, which includes analogies of place and situation between early twentieth-century Germany and late twentieth-century Iran, makes the account provocative.

The failure by the expert panels of the day on Iran, as well as by the Soviet Union, to fully grasp and understand, let alone predict a quasi-religious revolution in the country in 1978-79, as well as a secular collapse, is painstakingly noted. He outlines (Mirsepassi, 2000, p. 13) that

> "the ideology of the Iranian Revolution, when viewed in detail, emerges less as a monolithic clash between 'modernity' and 'tradition', than as an attempt to actualize a modernity accommodated to national, cultural and local experiences."

It would be a demanding task, and one that will not be undertaken here, to offer a concise and balanced picture of the forces and elements that have shaped the trajectory of the modern nation,

ranging from the *Tobacco Revolt and Boycott* (1891), the *Constitutional Movement and Revolution* (1905-7) and *Mosaddeq*'s period (1951-3) leading to the nationalisation of Iranian oil, to the events leading up to the exile (1964) and the subsequent return (1978) of Ayatollah Ruhollah Khomeini and the establishment of an Islamic Republic (1978-9), and its first decade entangled with the Iran-Iraq War (1980-88). As well as Ayatollah Khomeini, in 1960s and 70s, ideological figures, such as *Jalal Al-e Ahmad* and *Ali Shari'ati*, prepared the ground for the near-universal critique of Western interference in Iran's affairs. This was a critique of the deformation of cultural forms that developed in old Persia and still lingered around in the mid-twentieth century.

The Left in Iran, whilst amongst the oldest political 'Leftist' movements in Asia and with an outstanding intellectual legacy, remained unimpressed by, and doubtful of the influence of Political Islam, and in this oversight, it was caught as oblivious as the Shah and his monarchist entourage (Behrooz, 1999).

Mirsepassi reveals an essential point when he argues that the [1978-9] revolution was far from an exclusively Islamic phenomenon. Rather it was the 'Islamists' who had proved themselves to be closer to the pulse of a traditional populous, and capable of organising a more coherent movement and far more pragmatic in their political thinking than the other groups including the Left. Elsewhere, he (Mirsepassi, 2000, p. 13) summarises the three phases of Iranian modernity as

> "(1) an uncritical embrace of modernity as a Western model designed to totally replace Iranian culture; (2) a shift to a leftist paradigm of modernity critiquing imperialism and capitalism; and (3) the turn towards Islamist discourses of authenticity."

Under the Pahlavi monarchist regime (reigning between 1925-1979, whilst Reza Shah Pahlavi (1878-1944) and then his son, Mohammad Reza Pahlavi (1919-1980) ruled), the 'modernisation' projects lead to the consolidation of an authoritarian state apparatus. This and the subsequent massive societal upheaval severely recontextualised the meanings attached to 'modernisation' and 'modernity' in Iran. Added to this, the systematic suppression of secular opponents created a political vacuum for the emerging Islamic movement, and supported its attempts to articulate an alternative to 'oppressive' Western models of modernisation. This vacuum rapidly fed the process of the politicisation of Shi'ism as a revolutionary ideology.

The Persian Shi'a ideological distinction and identity has evolved over many centuries in Iran and

based on numerous conflicts with the Ottomans during the Safavid era (1501-1722), was institutionalised into the government and taken up as the state's apparatus. Iranian-American historian, Keddie, suggests that the Safavid rulers encouraged conversion to Shi'ism in order to strengthen the unique (and different from the 'mainstream') ethno-religious and cultural identity of Iran, and consequently (and perhaps unintendedly), lay the foundation for

> "… a clear line of political demarcation and hostility between Twelver Shiism and Sunnism." (Keddie, 2006, pp. 11–13)

The unique case of the 'theosophy' (Keddie, 2006, p. 23) developed and propagated by Ayatollah Khomeini, some years before and then implemented as part of the revolution, was essentially to practically deal with the dilemmas around political governance in the Islamic republic, building on the foundation of the Islamic world order. Drawing heavily on the Shi'a clerical theorisation and traditions, the concept hinges around the rule of the leading jurisprudent ('Velayat-e Faqih'). With some similarities to the 'Philosopher-King' ideal of Plato in *The Republic* (Πολιτεία), as interpreted by Persian and Arab scholars, the kernel of the idea is that the 'Velayat' (rulership[50]) runs from Almighty God to Prophet Mohammad[PBUH] (c. 570-632), then through the bloodline (of Prophet's daughter, Fatimeh[AS] (c. 605 or 615-632) and his cousin and son-in-law, Ali[AS] (c. 600 or 601 or 607-661) as the first Imam – who the majority of Sunni Muslims also consider as the 4th Caliph of Rashidun Caliphate). This then runs to all hereditary Imams [12 within the Twelver Shi'a, starting with Ali[AS]], and finally to the learned and pious theologians ('Faqih'), manifest in the supreme ruler and leader who reigns until the arrival of Mahdi (Messiah) (Ramazani, 1986; Zaryāb, 1997).

Writing lucidly about the period for a *British Museum* landmark exhibition and publications, Canby (2009, pp. 8 & 10) highlights the period as follows:

> "When he became Shah, Isma'il [the first king of Safavid dynasty, coming to power in 1501] declared Shiism the state religion. This branch of Islam considers 'Ali ibn Abi Talib, the Prophet Muhammad's cousin and son-in-law, to be his rightful heir. Three of Muhammad's companions were appointed caliph, or successor, before 'Ali, so their partisans claimed that they represented the Sunna, or the right path. The Shi'i followers of 'Ali consider him to be the First Imam, or infallible religious guide, followed by other Imams who were his descendants. The Safavids accepted Twelve Imams, the last one of whom disappeared in AD 873 and, it is believed, will return as Mahdi, or Messiah, to establish the Shi'i dominion on earth. [...] By pronouncing Iran a Shi'i realm, Shah Isma'il emphasized a national identity that was distinct from that of Iran's Sunni Ottoman and Uzbek neighbours. Thus, even though Isma'il himself, as a native of Azarbaijan, spoke

Azari Turkish rather than Persian, his society would become rooted in a belief system that set it apart from earlier regimes and his enemies and that came to be recognized as particularly, though not exclusively, Iranian."

Before leaving this sub-topic, a look at Iran and the regional demographics is useful in further setting the current context. It is worth recalling that on a global level of about 1.6 billion people, an overwhelming proportion of Muslim demographics (in countries outside of the Middle East region, such as Indonesia, Pakistan, Bangladesh, and India - and in China), are adherents of one of the Sunni schools of thoughts. The position in Middle East and particularly the Gulf region is somewhat different and is depicted in the figures below, with the proportion of Shi'a adherents.

Figure 5 [2.1.A]: Muslim demographics in the Middle East

Muslims in the Mideast

Less than 15 per cent of the world's Muslims are Shiite, or Shia; most Muslims are Sunni.

	PER CENT OF POPULATION	
	SHIA MUSLIM	**SUNNI MUSLIM**
Bahrain	70%	30%
Egypt	–	90%
Iran	90%	9%
Iraq	63%	34%
Jordan	2%	92%
Lebanon	36%	22%
Qatar	14%	86%
Saudi Arabia	5%	95%
Syria	13%	74%
Turkey	15%	85%

SOURCE: Pew Forum on Religion and Public Life; CIA World Factbook; Adherents.com

PERCENTAGE OF SHIITES IN SELECTED COUNTRIES
LESS THAN 1%
1% TO 20%
21% TO 55%
56% TO 100%
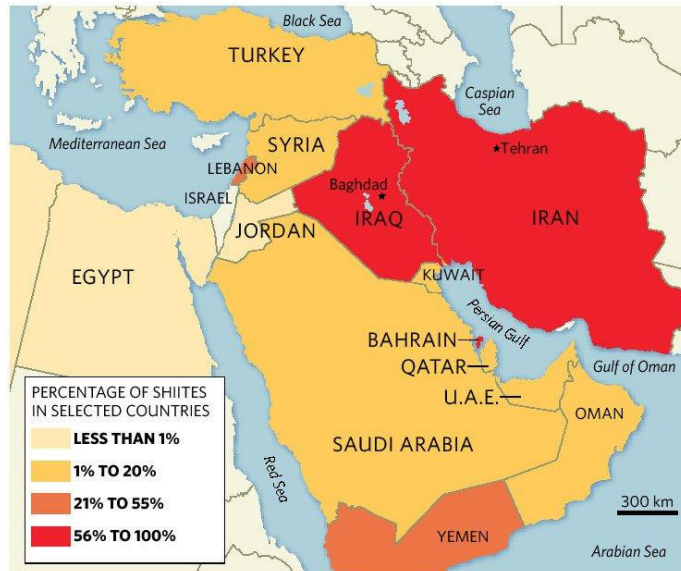
(Source: Toronto Star[51])

In addition, it is worth recalling that Iran's demographics are made-up of diverse racial, ethnic and linguistic communities: the demographic position inside Iran, in terms of ethnicity and religious distribution is depicted in the table below.

Figure 6 [2.1.B]: Iran's ethnicity and religious distribution

Source: (University of Texas at Austin, 2009)

Returning to the previous discussion, outside of the theological circles, political Islam, as an attempt to reconfigure modernity, had been explored by many scholars, including two of the most prominent intellectuals of 20th century Iran, before the 1979 revolution. These were *Jalal Al-e Ahmad* (1923-1969) and *Ali Shari'ati* (1933-1977). Al-e Ahmad developed the concept of *Gharbzadegi* ('*Westoxification*' - which has also been translated into English as *Westernstruck*, *Weststruckness* and *Occidentosis* - a term which he probably picked-up from a highly divisive University of Tehran's 'pseudo'-philosopher, Seyed Ahmad Fardid) and a powerful call for redeveloping a romanticised 'authentic' Islamic identity.

Writing graphically, as a competent literacy figure with his own avant-garde colloquial style in prose, who had previously trained as a teacher in Tehran Teachers College, Al-e Ahmad[52] wrote

> "'Westoxification:' I speak of being afflicted with 'Westitis" the way I would speak of being afflicted with cholera. […] If this is not palpable let us say it is akin to being stricken by heat or cold. But it is not that either. It is something more on the order of being attacked by tongue worm. Have you ever seen how wheat rots? From within. In any case we are dealing with an illness, a disease imported from abroad and developed in an environment receptive to it." (Al-e Ahmad, 1962, p.27 cited in Varzi, 2006, p. 8)

It should be noted that Al-e Ahmad, did not totally reject the project of modernisation, but argued that such modernisation should take place under the cultural and ideological base of an 'authentic' Islamic culture and government. It may be useful to recall that many years before and after the First and particularly Second World War and at the peak of the Cold War, Iran had become situated as a 'buffer state' and 'proxy ground' as an independent nation state between great Western powers and the Soviet Union. As such, in the heat of revolutionary fever, Al-e Ahmad's powerful discourse was soon precariously added to, and rapidly evolved in late 1970s into a message which emphasised not only 'cultural immunity' from the West, but also economic independence in most domains both from the Soviet Union and the dominant Western powers.

The idea and interpretations of economic independence would go on to have profound, and at times higly detrimental consequences to the present day. It created a prism, through which a large number of industrial policies would be distortededly viewed.

There was initially mass nationalisation of much of the private services and industry after the revolution (including the significant assets of the foundations controlled by the former Monarch,

such as the 'Pahlavi Foundation' - [*Bonyad-e Pahlavi*] - later becoming controlled by various revolutionary, war-veteran and martyrs, and religious foundations) and heralded the onset of self-reliance and self-sufficiency in national economic thoughts and planning.

Ali Shari'ati's intellectual project was similarly an idealistic attempt to reconcile Shi'a Islam with modernisation. Shari'ati contended that a nation must regain its cultural and religious traditions as a precursor to modernising on its own terms. A 'local' image of Iranian culture is constructed by both of these intellectual figures, in opposition to the 'universal' West. They do so however from within modernity, not from a 'resurgence of ancient impulses' or 'religious fanaticism.'

It is stating the obvious but the work of both Al-e Ahmad and Shari'ati is likely to have evolved and may have become unrecognisably different had they lived longer to develop their thinking as well as see the resulting socio-cultural effects of the success of the Iranian revolution, Iran-Iraq war and other major global events, by the end of 1980s, namely the collapse of the Berlin Wall, and later the Soviet Union's economic structure (and further afield, the initial rapid progress, followed by the onset of serious 'crack signs' in the *Juche* ideology in North Korea's economy).

In my re-assessment and the evolving nature of the kernel of the material around self-sufficiency and self-reliance, three core pillars are apparent. Al-e Ahmad (and Shari'ati)'s intellectual critique, together with other religious leaders' popular lectures[53], formed an important first pillar that has made the self-sufficiency and self-reliance concept appealing, which continues to date.

A second important pillar that has continued to support the promotion of self-sufficiency and self-reliance is Iran's traumatic experiences in the Iran-Iraq War (1980-1988) (which in many ways resembled societal and technological impacts of the First World War (1914-1918) with similarities in its trench warfare, war of attrition strategies and unrestraint use of chemical weapons – in this case by Iraq's Baathist regime) both in policy and practice, which will be referred to in the later sections of this chapter.

Self-reliance in the war effort, in practice (Chubin, 1994, pp. 18–19), meant

> "a mixture of domestic production, diversification of sources of supply and stockpiling of arms and spare parts sufficient to carry on in the event of major supply interruptions. The problems of equipment originating from a variety of sources, especially when it entails different weapon systems (aircrafts from the United States and Russia in inventory at the

same time, for instance) need not be belabored here. Suffice it to say that Iran's experience during the war proved the hazards of juggling differing parallel logistical requirements. […] To seek self-reliance to reduce vulnerability to supply cut-offs makes sense, but whether it is practicable is another matter. Adaptation, reverse engineering and improvisation may be possible where absolutely necessary, creating… skills and industries, but those do not equal an… [internationally competitive and viable] industry."

The point here, feeding the second supportive pillar is that 'supply chains' matter. So when there are few (or no) certain and secure supply chains, other measures need to planned and catered for.

The last pillar, which paradoxically is an 'unintended consequence' of the Western states action, is the ongoing regime of sanctions, over the last three and half decades, applied to differing degrees at different stages. Whilst the third pillar may not be as visible as the first two (i.e. the revolutionary 'intellectual/ideological'; and 'disconnected supply chain' issues during the war), it has in effect firmly cemented the first two into national policy sphere, by providing a background in continuous justification for an isolationist perspective, and the costly aspects of an ultimately problematic economic and industrial policy. Clearly, the self-reliance policy has also accumulated many positive lessons, with 'islands of excellence' and examples in industrial and sectoral confidence (UNCTAD, 2006, 2005). The challenge will however be to retain the existing 'good/best/promising practices' whilst balancing the rest of the industrial landscape.

As it was alluded to in the above quotation, whilst sectoral and industrial *adaptation, reverse engineering and improvisation* could take a sector, industry and ultimately a national economy some way towards self-reliance, and create associated skills and development pathways along the way, these efforts do not in fact pave the way for creating and nurturing an internationally competitive and sustainable sectoral system or industry.

Careful examination within the literature of sectoral development trajectories, such as the experience of newly industrialising economies, primary amongst which is the Republic of Korea (inspired by Japan), confirms that the pathway is better framed as 'from imitation – via sectoral learning and improvement – to regional and global innovation' (for Japan, see Bolton, 1993; Kim, 1997; for recent work, cf. Malerba and Nelson, 2012). Whilst Iran's infant industry protection policies (still viewing some sectors as an 'infant' and thus requiring protection from competition, after 45-plus years of operation), as part of an ongoing import-substitution strategy, have tried to 'imitate' (so as to later 'innovate'); even this stage has not been completed to an internationally satisfactory level. A prime example of this is found in the Iranian automotive and parts

manufacturing (within the 'heavy/-ier' industry value-chain) and the 'white goods' sector (home and kitchen appliances), in the light industries, which are essentially still unreformed based on protectionist policies, and thrive inside the Iranian market and yet, have not managed to find even a regional customer foothold, as a low cost alternative to the international brands. This is a core point that has too often been drowned in the battle of ideas, in the Iranian policy exchanges.

This balancing act is what the current administration (i.e. the 12th government of the Islamic Republic) is endeavouring to address, in an effort to create an equilibrium in the thematic policy frames of *independence and social justice*, and the episodic policy frames of *catching-up and economic development*, along with inclusive growth, further avoiding one or the other to be viewed as a binary choice and thus cyclically slipping on and off the policy agenda.

In the remaining parts of this section, I turn briefly to the issues of globalisation and more useful in this thesis, glocalistion. Defining globalisation, similar to concepts such as modernity, involves reaching out to extended volumes of work with contrasting perspectives. The position is not any clearer in the developing countries where initially the industrialisation and now increasingly, the internationalisation of trade and penetration of readily available technologies (such as internet and mobile phones, and facilitated ICT networks) has altered the socio-economic image of the society. Historically, the industrialisation process in developing countries has involved import of new technology, as 'industrialisation by invitation'. Broadly speaking, the various factors in globalisation include changes in production, technology, employment patterns, international finance and investment, trade patterns, as well as political inclinations and socio-cultural values.

There is little argument that the effect of these different forms of globalisation has lead to patterns and trends in, inter alia, lifestyle, employment, consumer exposure and expectations that can no longer be solely met within national policies or boundaries. The trans- or multinational companies (TNC/MNC) that act as hyper-mobile 'global enterprise webs' through their various joint-ventures, subsidiaries, franchises and affiliates, are viewed as the key to globalisation process (Reich, 1991). In seeking a concise summary, Pieterse (1995, p. 45) defines the overarching concept and the process, when starting his chapter as follows:

> "The most common interpretations of globalisation are the ideas that the world is becoming more uniform and standardised, through technological, commercial and cultural synchronisation emanating from the West, and that globalisation is tied up with modernity."

Whilst it is difficult to make an accurate assessment about the level of globalisation in Iran, in its broadest cultural, economic and societal, it is certainly the case that the Iranian economy has experienced a significant period of isolation.

A.T. Kearney and *Foreign Policy* magazine had tried this by producing a detailed regular 'Globalization Index' since 2000, with Iran dropping off the ratings at 2004. Although the index (A.T. Kearney/Foreign Policy, 2004), which tends to revolve around four variables of *economic integration*, *technological connectivity*, *personal contact* and *political engagement*, is accused of being crude on some indicators (Lockwood, 2004), it may still be worth a glance.

According to the index (in 2004)

> "Iran was dead last for the fourth consecutive year and ranked near the bottom in most categories." (A.T. Kearney/Foreign Policy, 2004, p. 67)

That however may seem easy to comprehend in an index model where multinational/trans-national corporations (MNCs/TNCs) are seen as the key catalyst and sustainable engines of the globalising forces. Since the 1979 revolution and the subsequent early nationalisation of much of private assets, Iran has performed rather unfavourably in attracting FDI and enticing MNC/TNC's activities. This is in spite of repeated formal and informal government's interventions on such lucrative sectors as energy, hydrocarbons and mining. There are complex and lingering reasons which include a general unfavourable contractual arrangements, and difficult and unstable operating condition, as well as geopolitical issue such as sanctions, and monetary and reputational penalties placed by the United States and EU on firms operating in Iran.

Despite the above pessimistic assessment however, Iran was not, and certainly does not remain in a *globalisation black-out*. Communication technologies, demographic profile as well as the reminiscence of its 'glorious' past (be it in the form of nostalgia for the ancient era or the more recent period of 1960s to 1970s, where Iran was the regional hub of many international companies) have seen to that.

Studies by comparative management scholar, Monir Tayeb, provides interesting glances of Iran's journey towards and away from modernity, via modernisation, and then in more recent years, an

authentic return to a moderated modernity in its universal values. She highlights (Tayeb, 2003, p. 25) that

> "In the twentieth century, the Shah's father [Reza Shah Pahlavi], the founder of the Pahlavi dynasty, was instrumental in modelling certain civic institutions, such as the legal system, education, the civil service, and the armed forces after those of France. Modernisation was invariably equated with westernisation (or to be precise, Europeanisation, initially at least)… [Western values and influences, in a range of societal activities] permeated cultural life, especially in [upper and upper middle class echelons of] cities and other urban areas... The 'swinging 60s' were as much alive in Tehran as they were in London and Paris. During the Shah's own reign, American influence in the country's affairs increased and to some extent replaced that of Europe.

> This long-term exposure to western culture, notwithstanding cultural [and religious] differences between various western cultures, arguably introduced the Iranians to certain secular industrial values and ideas such as economic and material growth, security, individualism, democracy, and comfort and enjoyment. However, what the Shah and his father did not encourage were the west's long fought-for and won democratic practices and respect for individual liberty and human rights."

The overall picture that emerges when examining Iran and globalisation is a multi-faceted one. The interactive legacy of the Persian culture, Islamic (and dominant Shi'a) values and significant revolutionary transitions in the last four decades have further confounded this picture. In the last decade, there has been an emergence of interest at policy and popular level in what is called the 'Iranian-Islamic' (or at times, 'Islamic-Iranian') model which attempts to simultaneously acknowledge and accommodate the similarities and differences, as well as the 'uniqueness' of Iran's position.

In essence, for our circumscribed purposes here, the terms glocalisation and better still, hybridised modernity is a better fit for the current situation in Iran, specifically the ICT and digital creative sector, examined within the themes of this study.

Robertson (1995) discusses the concept of 'glocalisation', defining it in terms of the co-presence of both 'universalising' and 'particularising' tendencies. He reveals that, contrary to common belief, the concept of glocalisation has its origins in Asia and particularly, Japan's business sector and not in the United States. Accordingly, the agricultural principle of adapting the farming technique to the local situation was adopted in Japanese business for global localisation as

> "a global outlook adapted to local conditions". (Robertson, 1995, p. 28)

Glocalisation also manifested itself as the 1990s business mantra of tailoring a company's products and services to the local market needs. This process is described as the nuanced and continuing efforts of corporations producing products and services for the global markets by adapting to local and other particular conditions as 'universalisation' and 'particularisation'.

As it will be expanded upon later, the problems encountered and tackled by the innovating firms in this study, in terms of telecoms value added services, are not *new-to-the-world* innovations and therefore fall more so in glocalisation and hybridised features. As Robertson's conceptual description of glocalisation has been mentioned alreday, it is worth to take a more specific look at my definition of hybridised engagement with modernity.

Whilst glocalisation can be viewed as the process and practice of conducting business according to both local and global considerations, hybridisation, drawing on evolutionary eco-systems is about the process of combining different varieties of core elements to create a hybrid solution, and on a social science theoretical level, the ongoing blending of cultures.

Exploring the challenges of different interpretations of modernity within the Muslim (Arab and non-Arab) societies, the work of Hisham Sharabi on hybridised modernity with reference to neopatriarchy, and Nilüfer Göle's metaphor of 'snapshots' into 'multiple modernities' (Sharabi, 1988; Göle, 2000) may act as a methodological entry point into this domain. Whilst the detail of their historical and sociological work is not of direct relevance to this study, their overarching argument for a hybridised engagement with current issues in Muslim societies is valuable as it is a testament to the hybrid features of the societies that undergo this process.

For Sharabi, some aspects of modernity and modernisation in the Middle East is viewed as 'unnatural' as the region did not experience a similar historical, socio-political and economic trajectory, thus making the modernisation 'dependent' or 'artificial'. Therefore a hybridised outcome is the only sustainable way forward to merge the values of the two systems.

For Göle (2000, p. 115), who conceptually builds on the notion of 'momentary images' from Georg Simmel's work

"snapshots are a methodological gateway for reproducing the significance of the ocular and the corporal, telling a different version of a story of Islamism and its asymmetrical reproductions of modernity".

Therefore operating within a hybridised engagement framework, each 'snapshot' provides further evidence of the distinctive aspects of the unique business eco-systems, as represented in the conceptual and case study material (on a meso and micro level).

This also points to the emergence, and consolidation of a type of technologically-mediated hybridised modernity in Iran (on a macro level) which as I will outline later, plays out in the character and features of business networks and clusters, in aid of interprofessional learning and innovation.

2.2 Iran's enduring pursuit of independence: revolutionary self-reliance and self-sufficiency

As discussed in the previous sub-sections, the question of national independence has been at the core of Iranian polity for many decades, both before and in different manifestations, after (and as a consequence of) the Islamic revolution and its economic planning. Aside from the revolutionary fervour, a historical event, which has played a critical role in constant shaping and continually sustaining this trend, is the total experience of the Iran-Iraq war (1980-1988).

Although the war ended, following a ceasefire in August 1988, the legacy of the war continues to date. This is not only in the form of official ceremonies and accounts of war veterans, and collective national memories, many of which highlight sacrifice, fortitude, resourcefulness and community trust, but also in a more nuanced way in thinking about and implementing national policies. The overarching policy lesson of the Iran-Iraq war, as well as the regional events since then, for Iran's policy makers has been to highly value the self-reliance and self-sufficiency that is a by-product of one interpretation of the notion of independence. Whilst over the last three and half decades, Iran's strategic objectives have oscillated between revolutionary and ideological, to nationalistic and pragmatic continuums, the value attached to independence has not altered. This continues to be demonstrated in Iran's legal insistence to retain a significant portion of its research and development capacities, both in her ballistic missiles programme (Elleman, 2010) and peaceful uses for nuclear energy development (International Crisis Group, 2014; Posch, 2013; The Economist, 2014a; Zarif, 2014; for a detailed unpacking of the historical issues, cf. Zarif, 2007). This was further exhibited by the humongous effort of Iranian scientist, a number of which were assassinated, based on their research specialty (The Economist, 2010a); and technologist, in dealing with issues such as the highly sophisticated *Stuxnet*[54] virus (Broad et al., 2011; Markoff, 2010; Sanger, 2012; Sutherland, 2011, pp. 151–152; The Economist, 2010b, 2010c) going to significant lengths (and on occasions, paying with their lives) to retain their research programme.

The next sub-section turns to offer a brief and circumscribed glance at tracing the ideas within the substantive argument around the trajectory and development of Iran's self-reliance and self-sufficiency discourse. Whilst this 'stripped-down' version[55] may seem simplistic, it serves for the

purposes of the later sections, where we look at the consequences of these ideas on the business operating environment, as well as the industrial and innovation policies, in plans and practice.

The strategic pursuit of economic independence and development has also indicated signs of both the ideological and pragmatic orientation, whilst loaded with historical significance. From the pragmatic perspective

> "[a]s the life blood of the Iranian economy, oil has affected every aspect of life in Iran from 1908…" (Ramazani, 1986, p. 197).

It was the development of the oil industry that elevated Iran's power and position during the Shah's reign and sustains the country (now classified as an *upper middle income* nation by the World Bank (2014, 2013)) to date. The natural resources and assets now include not only oil but large reserves of natural gas, second only to Russia, and other valuable mineral resources discovered in the last two decades.

With relatively accurate historical roots dating from the late 19th century, there is a perception and an ideological perspective that in order to secure their own stay in power, previous rulers had regularly and recklessly

> "mortgaged the nation's economy to foreign interests" (Ramazani, 1986, p. 200).

Dependence on foreign corporations and the perception of inequitable trade relationships has allowed the economy and economic transactions, including business relations, to be seen not just in financial, transactional and potentially mutually beneficial terms but as also as an arena of struggle for political independence, with the development and independence of Iran's economy viewed as a vital national strategic interest.

2.2.1 A brief re-assessment of the Iran and Iraq war (1980-1988)

It has been many years since the start, and the end of Iran-Iraq War (1980-1988) and in that time, many volumes have been written about the different aspects of the conflict.

Coming on the heels of the 1978-79 revolution, the Iraqi invasion of Iran in September 1980 is regularly analysed by various scholars, as arguably, the key factor in consolidating and normalising the revolution. Similar to the Iranian position, the Iraqi leadership was in a state of transition as Saddam Hussein, a former Ba'thist vice-president, had taken-over the Iraqi presidency in July 1979, shortly after the Iranian revolution. As such, he desperately needed to consolidate his power base internally and by extension, regionally. The war thus allowed both regimes to consolidate their hold politically, economically, and socially whilst sharply focusing the energies of their citizens (for a recent overview based on Iraqi declassified documents, cf. Murray and Woods, 2014; Woods et al., 2009).

As Stork (2001, p. 432) summarises, starting in September 1980, till a declared ceasefire in August 1988, it formed the

> " - the longest conventional interstate war of the twentieth century – recalled the infantry trench warfare of World War I, while its later phases incorporated modern ballistic missile technology to attack cities and economic targets."

And follows on to make an interesting and notable observation, now largely forgotten in light of the more recent events in Iraq (and Syria, and closer to EU, in Crimea and eastern Ukraine), on

> "… the durability of postcolonial nation-state. Iranian appeal to Shi'i coreligionist had no more impact on Iraqi morale or loyalty than did Iraq's efforts to enlist the ethnically Arab population of southern Iran. National rather than sectarian or ethnic solidarities prevailed." (Stork, 2001, p. 433)

Whilst in Iraq, the war was initially presented as an historical (Arab vs. Ajam [Persian]) and regional conflict and provided the Iraqi leadership with the mantle of 'Arab Nationalism' cause, in Iran, the war became the ideal stage for the manifestation of various revolutionary, ideological, religious and historical themes. There is now overwhelming historical evidence to support that Iraq was generally well-supported by both superpowers (United States and the Soviet Union), and as a result of an intricate and prolonged campaign of 'Iranophobia' and 'Shi'a-ophobia' orchestrated by Iraqi Ba'thist and other actors inside and outside of the region who stood to benefit, gained the support of many of the oil-rich Arab regional states, whilst Iran had little choice but to broadly stand on her own. As such, the case for self-sufficiency and self-reliance, as well as religious legitimacy and the sanctity of the Islamic regime were intimately weaved into the fabric of the war effort.

The war, coming within months of the revolution, therefore merged and intertwined indistinguishably. It was soon wrapped in a conventional and rapidly-turned-retrograde military conflict, with a confluence of ideological, religious and later nationalist and cultural ideas and actions. Events such as the Iran's decision to push forward into Iraqi territory in 1982 (recovering nearly all of its lost territory in the first two years of the conflict); the arms-for-hostages deal with the US; and the 1986 Faw Peninsula offensive (resulting in Iraq's desperate moves such as the large use of chemical weapons[56] and the "war of the cities") have raised difficult strategic questions inside Iran, yet to be fully accounted for, examined and justified.

Reviewing the interaction between the society, culture and the war, and the evolution of the rhetoric of the war continuing to date, Adib-Moghaddam (2006, p. 51) makes the following astute observations

> "Whilst the process of war reiterated the very raison d'etre of the Iraqi state, it took the movement in Iran out of the revolutionary context and brought it back into the 'real world' of international relations. […] As E. H. Carr noted in his Twenty Years' Crisis, once 'utopian' movements assume power, theory tends to be discarded in favour of practice; the 'leftist' gravitates towards the 'right'. [(Carr, 1961, pp. 19–20)] In the Iranian case the containment of the revolutionary ideals was not a matter of choice, but caused by a systemically legitimated war."

He continues and concludes his argument, by bringing it forward to the present day as follows

> "In the public imagination of the Islamic Republic, the Iran-Iraq war continued to be reproduced as *jangeh-tahmilli* ('the forced war') or *defahe-moghaddas* ('holy defence') , which by itself indicates the degree of emotions that were still attached to the eight-year conflict with the Ba'thist state." (Adib-Moghaddam, 2006, p. 74)

Whilst an in-depth analysis and the full scope of the operational, socio-cultural and economic issues are beyond this work, it is worth selectively recalling some of the other pertinent themes, raised in an article, marking the 30th anniversary of war (Takeyh, 2010, p. 365), as follows

> "The Islamic Republic of Iran's ritual celebration of its martyrs obscures a more deliberate and dispassionate assessment of the conflict. Iran fought the war with remarkable disadvantages, as it lacked reliable allies, a dependable supply of arms, and superpower goodwill. […] the regime's ability to sustain an eight-year conflict reflected its resilience and ability to mobilize society and consolidate its power under duress. The state that was often viewed as a passing and transient phenomenon proved that it could deal with domestic challenges and international isolation while waging a total war. […]

This was not an interstate conflict fought for territorial adjustment or limited political objectives. At stake was a contest of ideologies and a competition for power. […] The war and revolution had somehow fused in the clerical imagination."

Elsewhere, he (ibid, p.367) expands

"In its quest to defend the war, the clerical state did not neglect Persian nationalism, but rather fused it with the larger Islamic task."

In his concluding, Takeyh (2010, p. 283) returns to some of the substantive themes, discussed here, by stating

"[t]he Iran-Iraq war was one of the most important events in the history of Iran, and its legacy continues to haunt the Islamic Republic and shadow nearly all of its deliberations. […] Far from being a forgotten episode, the war remains alive in public consciousness and the government's calculations. The war has also left its imprint on Iran's international orientation. The notion of self-sufficiency and self-reliance are hallmarks of the Islamic Republic's foreign policy, as the guardians of the revolution recognized that the survival of their regime depends entirely on their own efforts. International organizations, global opinion, and prevailing conventions did not protect Iran from Iraq's chemical weapons assaults. Saddam's aggression, targeting of civilians, persistent interference with Persian Gulf commerce, and use of weapons of mass destruction were all condoned by the great powers. To suggest that Iran should forgo its national prerogatives for the sake of treaty obligations or Western sensibilities has a limited audience among the aggrieved clerics. Not unusual for such a prolonged conflict, the war is beginning to change the face of Iran's politics."

As an eye-witness account with first-hand access to the battlefields, and as an experienced BBC journalist, John Simpson, called it 'the war of attrition' and commented that

"The war took on a life of its own, as Siegfried Sassoon believed the First World War did. It existed for itself, with neither side being able finally to destroy the other. The balance between the two sides was drawn with a fineness that seemed almost to betray a malign intention: Iraqi weapons and money versus Iranian manpower, …". (Simpson, 1988, p. 315)

Furthermore, as a recent study and review of newly declassified Iraq-based evidence (Murray and Woods, 2014, p. 3) suggests,

"the war's duration, as well its casualties, forced both Iraq and Iran to adapt and learn. How and what they learned suggests much about the difficulties of learning in the midst of a war, especially a war for which neither side was intellectually prepared."

It is thus relatively transparent that the legacy of Iran-Iraq war, amalgamated with the historical and cultural legacy of unequal relationships with greater forces in (and from outside of) the region, has played a paramount role in policy learning and fine-tuning Iran's strategic plans including its position on the world stage and its power projection[57]. This extends to the economic and business spheres, which is explored further in the later sections and next chapter.

2.2.2 A glance at the chronic international sanctions of the last decade

As a buffer state between United States of America's interests and the Soviet Union, Iran as a sovereign and non-Arab state and with it the Iranian government, was long seen as the closest 'ally and friend' of the United States up until 1978-79 revolution. Much of that dynamics changed rapidly in the very early 1980s, not only as a result of the Islamic revolution and Iran-Iraq war, but also due to the US Embassy (locally referred to as 'the conquest of the American spy den') hostage crisis in Tehran, lastly 444 days between November 1979 and January 1981. The US Carter administration (1977-1981) enacted the first set of sanctions, and subsequent US administrations have broadened-out, and continued this policy albeit in different and parallel directions, as an attempt to apply ongoing international pressure on Iran (Clawson, 2010).

The exact evolving terms and efficiency, 'smartness' and effectiveness, and legality of the escalating sanctions regime has been discussed widely in the literature and in any case, falls outside the scope of this work. It will suffice to conclude that there was till recently, a raft of unilateral, and related to Iran's nuclear energy development activities, multilateral (US, EU and UN) economic sanctions placed on Iran (for a recent update, see International Crisis Group, 2014, pp. 44–46), directly and indirectly influencing every sphere of the nation's economic and social life, including its catching-up economic development, professional learning for new sector creation, and inclusive growth. As elsewhere applied, the first by-product of sanctions was to increase, at times significantly, the transaction cost and the creation of various unnecessary (often multiple) 'intermediary' trading nodes and structures. Whilst the position was slowly improved between 2015 and 2017, as of late 2017 and the repositioning of the US White House approach, the 'legacy issues' (e.g. on FDI) are likely to linger for many years to come.

Amongst all the literature however, a much neglected facet of these inter-generational sanctions is the effect it has on organisations and firms, and how they interact to learn and develop (Khalaf

and Bozorgmehr, 2009; for a view from industry, see Majidpour, 2013; cf. Tayeb, 2001, pp. 131–132). Equally, the professional standing of members of 'communities of practice and/or inquiry' is deeply mediated, when isolation becomes the norm and contact is at best minimal, hence little opportunity is afforded to develop professional trust.

In parallel, sanctions as well as mismanaged inflationary pressures, and 'multiple exchange' rates inside Iran (used by government and connected agencies, in theory, for import of essential goods) have added a significant element to the instability of the macro-structure that the firms operate within, particularly in the foreign exchange domain. Consider for example that one US dollar ($1) was worth 70 Iranian Rial (IRR70) in 1978, and about 2,000 Rial in 1994. After the implementation of the toughest set of sanctions, the Rial plummeted dramatically (Economist Intelligence Unit, 2012a, 2012b; on a "Hobson"s choice' to central banks across the globe, and the potential for use of US SPR, see Verleger, Jr., 2012). The US dollar which was hovering around 10,000 IRR jumped to 35,000 IRR, settling back to a little lower margin in weeks to come (the exchange rate for 1 USD as of mid 2016 and mid 2017 remained around 34,500 and 38,500 and in late 2017, on occasions reaching 42,000 IRR respectively). The figures below (Hanke, 2012) graphically highlight the changes in the currency exchange rate in mid 2010 and the end of 2012, as a result of efforts that the Obama administration described as

> "the strongest and most comprehensive set of sanctions that the Islamic Republic of Iran has ever faced" (Burns, 2010)

as it included co-ordinated efforts with extensive international (such as sovereign states in EU and Far East) and sectoral (individual company and cluster of companies, such as in banking and finance, energy and technology) partners.

Figure 7 [2.2.2.A]: Iran currency devaluation (IRR/USD) between June 2010 and October 2012

IRR/USD exchange rates

July 2010: President Obama signs the Comprehensive Iran Sanctions, Accountability and Divestment Act.

September 10th: 9.65% drop in the IRR/USD exchange rate.

October 2nd: Black market IRR/USD exchange rate hits 35,000.

···· Black market exchange rate
— Official exchange rate
— "Non reference" Official exchange rate
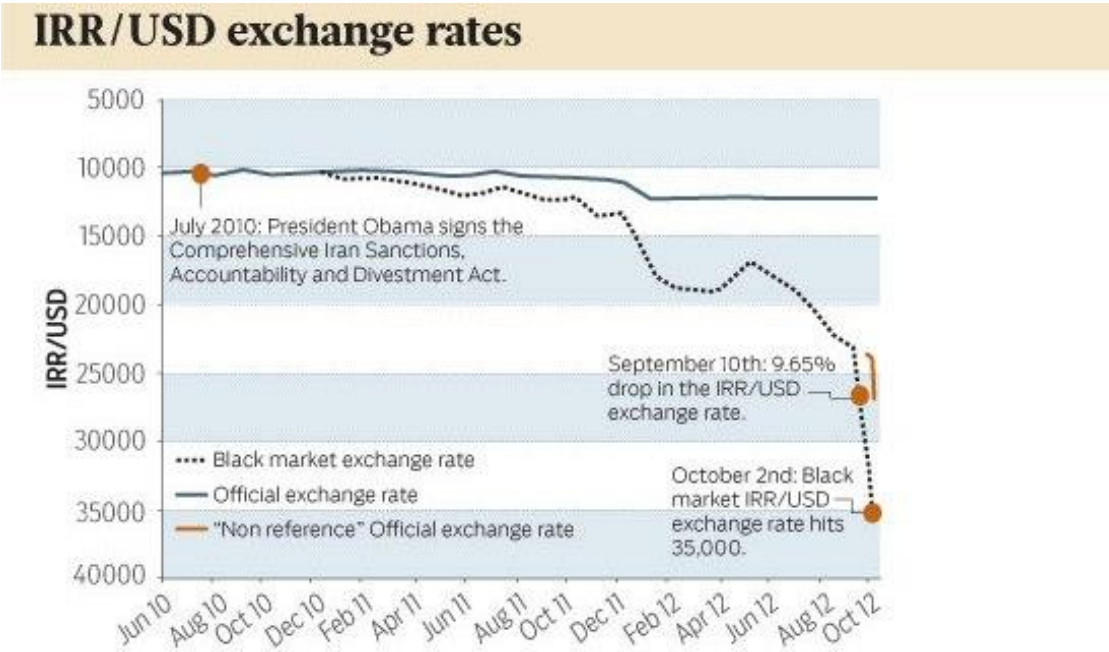
Amended version of a chart originally published in: S.H. Hanke (2012) "Iran: Down, but not out", Globe Asia (October).
Note: For purposes of illustrating the declining value of the Iranian Rial, relative to the US dollar, the Y-axis is inverted.

Source: (Hanke, 2012)

Figure 8 [2.2.2.B]: Iranian Misery Index between 1991 and 2012
Source: (Hanke, 2012)

Iranian Misery Index

Note: Misery Index = Inflation rate (end of year) + bank lending rates (average of manufacturing and mining rates) + unemployment rate (percentage of total labour force) - annual percent change in per capita GDP. Frequency: Annual Data.
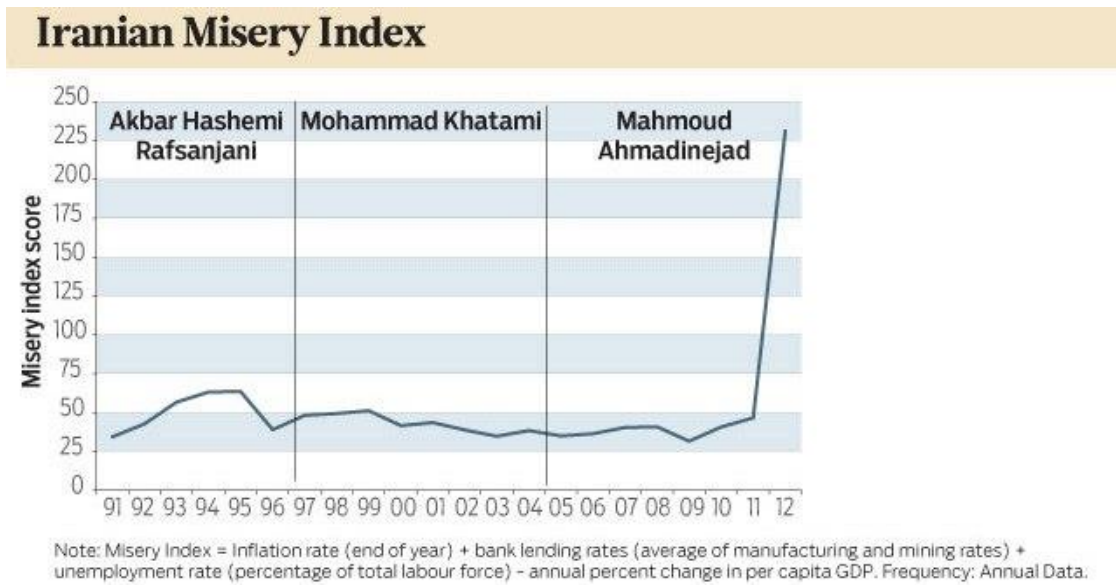
Figure 9 [2.2.2.C]: A timeline of the seven Iranian presidental administrations (1980 to Present)
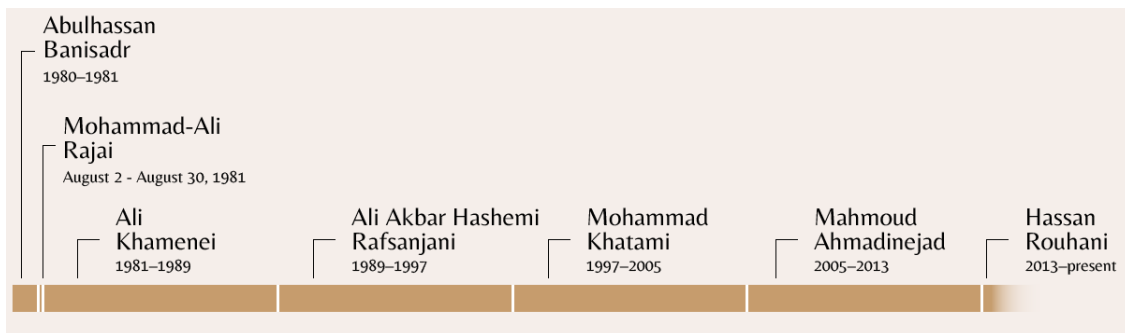
It may be stating the obvious but for small private sector firms that were already struggling with difficulties in the business operating environment, including lack of credit lines, based on conservative approaches of the Iranian banks and financial institutions favouring large and/or government related/State-Owned Enterprises (SEOs), these changes were severely disruptive to the point of destruction and bankruptcy. Equally on a macro level, the lack of fiscal discipline and government's incoherent economic policies widened the wealth gap (Bozorgmehr, 2013).

As the effects of sanctions increased, so did the role of informal ties in networks within the socio-economic spheres. Although not widely examined within the academic or disciplinary literature (Powell and Grodal, 2005, pp. 70–72), the utility of informal ties in networks has recently been given some attention in geopolitical studies (Evans, 2010), with policy research indicating that 'informal is normal' (ibid, pp.13-15); including specific cultural patterns such as *Guanxi* in China, *Blat* in Russia, *Sifarish* in Pakistan and *Big Man's (Pseudo-/Tribal-Chief) culture* in Nigeria, to which one can add *Wasta* in GCC/Arab states; *Wase'teh* or *Partibazi* in Iran, and *Old Boy network* and university alumni/professional clubs in the United Kingdom (and former colonies), and United States, and additionally mobilised through previous school/university (a relationship labelled *Hakyeon*), geographical origin, religious groups and even military service in South Korea – all essentially acting as intermediary connections for gaining influence.

Within the available literature in the public domain, examining Iran related business issues, a few analysts and researchers have recently attempted to make sense of the informal networks (Goodman, 2008; Rakel, 2009) mainly around political elite and leadership issues. Whilst not easily accessible in the public domain, there are also indications of significant research undertaken by research teams (namely in the US and EU based national intelligence organisations as well as US Department of Treasury) where fine-tuned sociometry and mapping exercises and analytics software, are brought to bear to uncover and trace patterns of socio-economic activities.

As the effects of sanctions accelerated, particularly around financial sanctions thus making financial transfers extremely burdensome, Iranian firms particularly smaller private firms have suffered disproportionately from the dire consequences of increased transactional costs and a more opaque relationship between the larger and government/SEO firms, who can better leverage on their more extensive and elaborate informal ties in a wider range of networks.

2.3 Concluding remarks: framing Iran's economic experiment and emerging transition

This chapter has outlined a number of interconnected themes related to the contextual settings of the research. Whilst wide ranging in its coverage, the substantive argument of the chapter is that the self-sufficiency and self-reliance discourse, developed and evolved through the cultural and historical filters and sediments, has and in all probability, will continue to play a significant role in the economic activities of Iran. The discourse, whether in macro, meso or micro levels feed into, and influences the company operations particularly when the private firms attempt to engage with external firms and foreign partners, be it on joint projects, inter-sectoral learning and/or joint ventures. These intricate factors will continue to be expanded upon in the later chapters.

Despite the geopolitical difficulties, a generation of *chronic-turned-acute* sanctions, and the vastly populist policies and fiscal imprudence of the Islamic Republic's 9th and 10th government administrations, the 11th and 12th government administration's intention is now to start designing, and where necessary redesigning 'implementable' policies, cautiously and coherently, so as to move away from an overwhelming national fiscal reliance on sale of hydrocarbon resources. Significant efforts to improve the Iranian tax and revenue (including value-added tax) systems, in its collection and contribution towards large health, education and housing programmes, are examples of such reorientation.

The Iranian anaemic industrial policy implementation of the last five decades has a lamentable record for a host of familiar reasons, which have culminated to make the current business climate continually unattractive (Donya-e-Eqtesad, 2014a; IMF, 2014a, 2014b; Laylaz, 2014; Mashayekhi and Behdad, 2014; on inclusive growth needs, cf. Nahavandian, 2014; World Bank and IFC, 2014, 2013). Iran, both before and after the revolution, although based on different set of reasons, has followed a hybrid version of import-substitution policy, injected with self-reliance and self-sufficiency factors in the last three decades, as outlined earlier in this chapter. With high unemployment constantly on national agenda, the sensitive issues around protection of jobs, in 'protected' and entrenched sectors has meant that the broad, yet massively outdated, logic of import-substitution has become a policy instrument and tool in the hands of well-meaning groups as well as vested factions and parties, to resist opening out of sectors to external and foreign

competition. This is then presented, in a simplistic analysis by some policy corners, as evidence of employment-protection policies.

In practice however, this has resulted in sheltered 'favoured firms' to continue with their low-productivity and operate inefficiently. Based on multiple levers of the interest groups, the Iranian industrial policy, and by extension, the sectoral policies such as the ICT sector, have attempted to be *everything to everyone* (Alyani, 2003), with an unsurprising lack of traction and progress. As a comparison, the Iranian related policies have broadly and consistently lacked the concerted direction and performative ruthlessness of the Republic of Korea, which resulted in 'the miracle on the Han river' economic state. In Republic of Korea, the infant industry policies were strictly time-bounded and the state's assistance and subsidies for businesses were temporary, and rapidly linked to export and export-led policies, and a relentless drive for learning and innovation.

Aware of this dismal implementation track record, the Islamic Republic's economic policy circles have become highly conscious of trying to avoid past mistakes, and move forward to develop, however gradually, a latent (such as 'blue ocean' strategies) or potential comparative advantage.

As well as the internal economic dilemmas, the Tehran-based think-tanks who advice the policy makers are well aware of the erosion of the Iran's long-term comparative advantage based on fossil fuel. Looking regionally, they see that even countries with larger reserves such as Kingdom of Saudi Arabia in oil and Russian Federation in natural gas, are not immune to the technological developments, restructuring the related industries and value-chains, and on a geo-strategic view, providing United States with self-sufficient energy assets and programmes, as well as industrial R&D dilemmas (e.g. into 'clean energy' and 'green tech') (Crooks, 2014; Crooks and Raval, 2014). As highlighted by the Financial Times,

> "The US industry has been transformed by the shale revolution, with advances in the techniques of hydraulic fracturing and horizontal drilling enabling the exploitation of oilfields… that were long considered to be uncommercial." (Crooks and Raval, 2014)

Thus, the Iranian policy makers and their advisors are starting to recall, recognise and slowly acknowledge the problems in, what I have labelled earlier as, macro 'policy-making memory' in significant portions of policy agenda spectrum, being followed by meso and micro level 'policy-implementation amnesia'. This proves the necessity of a concerted effort to create an equilibrium in the thematic policy frames of independence and social justice, and the episodic policy frames

of catching-up and economic development, along with inclusive growth, further avoiding one or the other to be viewed as a binary choice and thus cyclically slipping on and off the policy-design, and more importantly policy-implementation agenda.

The current government administration, consciously and consistently attempting to circumvent factional skirmishes, is thus determined to gradually take on the role of an enabler rather than a provider, and plans to limit its multi-faceted current interaction with, and interjection in the economic activities, only to intervene when remedies are required to address areas of 'market failure'. This is both to follow international advisory bodies' external advice in reducing its economic role (IMF, 2014a; Tejarate Farda, 2014a), and equally of importance, free-up its own internal systemic capacity for developing capabilities in policy design, experimentation and coherent policy portfolios.

The avoidance of factional politics is a strategic move by the administration as it would be unwise to invest in policy-designs which are likely to be rapidly grounded to a halt, in a new parliament (Majles), which took charge in Spring 2016. Whilst Iran has an *Expediency Council*, which acts as conciliatory and adjudication body to resolve differences between different branches (executive, legislation and judiciary) of the state; in practice however, policy analysts view it as a further

> "clutter[ing of] the already crowded institutional landscape" (Espahbodi et al., 2009, p. 321).

Figure 10 [2.3]: A simplified and highly streamlined depiction of Iran's governance institutions

A further seemingly tangential but highly potent point is also covered by the aforementioned researchers, effecting policy design. They highlight that the Iranian parliaments'

"institutional capacity is limited by a lack of a significant number of highly experienced legislators." [which is partly as a result of disqualification of the candidacy of returning members of parliament, based on factional priorities and balancing, by the Guardian Council]. (ibid, p.321)

Working within this structure then, the presidential administration has to continue to avoid factional politics so as to develop the capability and capacity for better policy design, implementation and post-implementation evaluation and feedback to refine future policies.

The new lexicon of, and policies around an 'economy of resistance' (BBC Persian, 2014c; Bozorgmehr, 2014, 2012; Khamenei, 2014) for example, despite retaining some stream-lined connection with the past policies, have generally attempted to oscillate away from an isolationist posture and towards a more connected, allbeit partial and selective, regional and global position, whilst retaining factors around national independence in 'mission critical' domains.

A nuanced look at the current situation at the meso and micro level, beyond external and macro factors such as sanctions, reveals much red-tape tinged with opportunistic behaviour for rent-seeking and administrative corruption, sub-standard infrastructure, a politically-charged operating environment (Hollis, 2007, p. 5; Tayeb, 2001, p. 132) and an educated, yet unskilled workforce

and the continued brain-drain of the skilled and professional cadre to greener pastures. Related to the last set of factors, and of particular interest to the case study and conceptual focus of this research, as a result of a combination of factors, there has been a deepening of *relative professional isolation* from the global leading trends and practices, within the new and emerging sectors, impoverishing the sector of interprofessional learning and judgment (Alyani and Guile, 2014), unless new and international skill webs are interwoven.

In parallel to the above described position, one of the largest medium to longer-term economic policy challenges for Iran[58] is how the state incubates and in time, catapults new higher-value sectors and industries, and how to do so without falling prey to vested interests and special pleading. Gaining forward traction in the technology-oriented creative sector (UNDP & UNESCO, 2013), with its associated high value-chains, technical upskilling attributes and sustainable job-creation properties is one such policy direction, with its own dilemmas.

Retaining the focus on the contextual domain, chapter three initially introduces and briefly reviews the macro position on a strand of issues and most recent thinking on Iran's shift from a static industrial policy towards a more dynamic innovation policy, as well as a portfolio set of 'productive development policies' and policy design. The chapter rapidly zooms down to focus particularly on Tehran, where the research unfolded, as an innovation milieu for the Creative ICT-enabled sector and consider talent, technology and tolerance issues (Florida, 2002; Florida et al., 2008), within that context.

In order to lay the ground for the later sections on the research site, a brief glance at the mobile segment of Iran's telecoms sector and its evolving characteristics is also provided by the end of the next chapter.

Chapter Three: Tehran as a hybridised site and operating environment for innovating firms

We have so far provided an insight into the historicity of the opearting environment in the last chapter. This chapter continues that debate and zooms in further on specific issues and factors: issues which should provide the reader with additional insights and help to avoid seeing the operating environment and the later empirical elements, through entirely 'Western lenses'.

Focusing on the contextual domains, this chapter initially introduces and selectively reviews the macro and meso factors on a strand of issues around the business environment in Iran. The chapter then turns to outline the natural resources and subsequently, the most recent thinking on Iran's shift from a static industrial policy towards a more dynamic innovation policy as well as a portfolio set of 'productive development policies' and policy design. The chapter then focuses particularly on Tehran, where the research unfolded, as an innovation milieu for the Creative ICT-enabled sector and consider talent, technology and tolerance issues (Florida, 2002; Florida et al., 2008), within that context.

3.1   Overview of Iran as a hybridised operating environment for the innovating firm

Observed from the perspective of developed economies, Iran has an unusual economic and market structure, although it is similar to other state dominated resource-rich economies in the Middle East. It is populous, rich in natural resources and apt to technological progress and keen on international developments. The country's natural resources create a significant, but mostly inadequately distributed wealth. Based on a resource-based evaluation, the Iranian economy is amongst the 20th strongest in the world.

However, the performance of the last four decades, including a revolution, war and a lack of coherency in economic management has led to a different practical reality to its potential.

The previous chapter has purposefully outlined some of the historical context, of the socio-cultural and economics background in Iran, germane to the study. With those in mind, the thesis now turns to concisely review Iran's general business operating environment, context and

ongoing challenges of the present times. These glances will then act as a backdrop for contextualising a link with the specific domains of learning and innovation, as well as interprofessional learning and judgement, enhanced by skill webs in firms, in later chapters.

The aim of this section is to trace the salient features of the debate about the economy and the continuing features of Iran's confrontation with modernity as manifested in this arena. It is not intended to provide a comprehensive account of the business context or economic history of Iran. There are a select number of key topics that I intend to include to allow me to engage with the wide ranging and diverse literature in the area, where possible broadly remaining with the thematic policy frames of independence and social justice, and the episodic policy frames of catching-up and economic development, along with inclusive growth.

I will also remain mindful of the ideas around the crisis of the deepening relative professional isolation for high technology digital firms and how the sector, and individuals within it, have attempted to bypass and circumvent barriers placed on their path.

Before delving into the topic, an important caveat is drawn to attention. This concerns the temporal aspect of the study which links also to the resources that have been drawn up and support the argument. The focus of this section of the study is to investigate organisational and business environment factors in firms in *present day* Iran. Although the historicity of the issues under investigation is of immense value in comprehending the present day position, great caution is also attempted in this exercise to bracket out issues where necessary, so as to prevent the analysis from becoming a prisoner of the past.

As an overall summary starting position, consider that following statements issued by the Central Bank of the Islamic Republic of Iran (CBI) in 2002, when issuing a Eurobond as sovereign debt (Gulf News, 2002) and amongst some of the most transparent communiqué in recent years, as follows

> "Since 1989, the domestic politics of the Islamic Republic of Iran… have witnessed a competition for power between conservatives and reformers within the same regime. […]
>
> In terms of assessing Iran as a credit, the rating agency, Fitch Ratings Ltd., in its report on Iran in May 2002 noted that the economy was largely state-controlled, inefficient, uncompetitive, without an effective banking system, not receptive (or appealing) to foreign investors and insufficiently diversified. Iran's economy is also exposed to

changes in international oil prices. […] Fitch also noted that Iran's strengths included its low gross external debt and the fact that it was a large net external creditor, that it was one of the most resource rich countries in the world, that it had recently established the Oil Stabilisation Fund [now relabelled as 'National Development Fund'] and that it has an impressive reform agenda." (Central Bank of Iran, 2002, p. 5)

Elsewhere, the report touches on the development of the banking sector and the capital market, as

"The third five year development plan [spanning 2000-2005] has sought to liberalise the banking system by allowing for the creation of private banks. Since the plan… [a number of] private banks have begun operations… remain[-ing] small, however, and are not yet real competitors to the State-owned sector. […] One of the principal threats to the banking and financial system is considered to be weak supervision of the large State-owned banks reflecting the lack of an appropriate infrastructure to collect the necessary data. […]"

"After the Iran-Iraq war, the government reactivated the TSE [Tehran Stock Exchange] as part of its commitment under the first five-year development plan to sell firms from the State-owned portfolio. Investment in shares is not affected by Islamic law restrictions on speculation as it is regarded as productive investment involving an element of risk." (Central Bank of Iran, 2002, p. 36)

Whilst the expression of 'Iran at the crossroads' is somewhat overused in the academic literature (Bradley, 2007), the most sober analysis also point to the fact that Iran is continuing to be in the midst of significant socio-economic and societal changes. Conducting a well-structured interdisciplinary literature review on the related themes for the Canadian International Development Research Centre, Bradley highlights that

"One of the most popular images to describe the political situation in Iran is a crossroads. Domestically, Iran stands at a crossroads between modernity and tradition, reform and conservatism, and democratization and political repression. Internationally, Iran finds itself at a crossroads in terms of its nuclear policy, and its relationship with its neighbour…". (2007, p. 6)

The exceptionally rapid changes have reshaped and are reshaping the Iranian society and business environment, in ways that have not been adequately envisaged or framed, as yet. The last sections of the last chapter highlighted the real practical difficulties of the citizens with gallivanting inflation (which averaged to about 40% by different accounts in 2013 (Tejarate Farda, 2013a) till recently significantly reduced by the new administration) and collapse of the Iranian currency on the foreign exchange market.

The regular televised debates in Iran, initially in 2009 (inspired by US media televised coverage of the US presidential debates and election), as part of the disputed 2009 presidential election (cf. Harris, 2012) and more professionally and systematically undertaken, in 2013, 2014 and 2017 (both as part of the 2013 and 2017 presidential elections, and ongoing debates on international relations and the state of economy (Alizadeh and Hakimian, 2014; for details, see Harris, 2013)) has afforded an interesting opportunity, for open and protracted discussions and a version of a national dialogue on the economic vision ahead (e.g. Vaezi et al., 2014). With the population reaching well over 80 millions in 2017, the issue of jobs and sustainable decent employment creation is high amongst most policy priorities. The constant impact of globalisation, in market products and mass media (via satellite television broadcast, narrowcasts and social media) has contributed to the emergence of new social formations and values, including significant fragmentation in societal values; and the technology-enhanced evolution of communications ensures that Iran is not a closed society.

It is worth recalling that a significant number of scholarly analyses in English language still draw on accounts which depict a previous era, highlighting an outdated grasp of the scale and depth of the societal changes in progress. As Tayeb, writing about the human resource management (and the scantly researched topic of labour market features) in Iran, succinctly foresaw and highlighted, nearly two decades ago

> "Although many foreign commentators still speak of an Iran that is obsessed with revolution and radicalism, nevertheless, Iran has been evolving. Social, political and economic realities have caused the radicalism and revolutionary romanticism to subside". (Tayeb, 2001, p. 123)

Due to the pace of the transition and the dearth of nuanced scholarly publications, I have drawn on a selection of the academic, journalistic and other reputable resources both in English and Farsi for parts of this chapter. Wherever possible, quotations have been drawn from published scholarly work but the emerging nature of the topic under study has warranted drawing on newspapers, magazines, business, policy and regulatory documents, and on occasions, personal conjunctures (supported by professional and policy interviews). This is a conscious effort, however modest of an attempt, to address the need for cross-fertilization of work undertaken specifically relating to recent organisational, technological and innovation policies in Iran.

Historically, the role of the government in business in Iran has long and deep roots (Amid and Hadjikhani, 2005). Significant increases in the state interventionism were added, initially by confiscating and nationalising large scale industries, banks, insurance and financial companies, and subsequently by managing the economic rationing of essential goods to deal with eight years of Iran-Iraq war, during the first decade of the revolution (Hakimian and Karshenas, 2000). True to recent years, populist economic policies (Alizadeh and Hakimian, 2014; Behdad, 2000, 1988), and policy design, sustained primarily by Iran's natural hydrocarbon resources, has played a key role in the economic decision making and vision.

Journalistic analysis of the past two decades often states that the direct and indirect role of the Iranian government (plus state-owned enterprises - SEOs) in its economy is somewhere around the 80% mark. Scholarly work seems to support this dominance. As Tayeb (Tayeb, 2001, p. 123) highlighted (for that moment in time)

> "The economy, although it is a capitalist one, is run on a strict protectionist and statist model. Many industries and firms which in a large number of capitalist countries would normally be in private hands, are owned and managed by the state in Iran. It is estimated that the government share of the ownership of the economy is 80 percent."

Regrettably, this is inevitably reported in the vacuum of what economic and business life was like before the 1978-79 revolution. Insightful and historically conscious analysis (Eftekhari, 1982), drawing on the seminal earlier work of Halliday (1979) however outlined that economic development planning in Iran has for long been part and parcel of an integrated political system, including the modern policy planning era, since the first (pre-revolutionary) five-year development plan was devised and implemented in 1947. Headed by Mohammad Reza Pahlavi, within a structure of absolute power, a system of "monarchist dictatorship" had authority and power over and above the Parliament (Majles), the Judiciary or the Administration.

Till the end of 1950s, Iran was still predominately an agricultural economy, exporting mainly oil, carpet and some agricultural products and in return, importing manufactured goods. Reviewing the period between 1960 and 1979, economic indicators overwhelmingly suggest a radical structural change and impressive industrial growth clearly paving the way for the country to become an industrial nation. This however was in conjunction with relatively well-regulated exports and imports since 1930s and the aspirations for an import substitution policy from 1960 onwards. This import substitution strategy, congruent with mainstream development paradigms of

the time, had severe associated consequences, as outlined by related analysis (Amid and Hadjikhani, 2005).

Historical analysis on a sectoral level powerfully and demonstrably argues that the regulatory and trade restriction provided a protective shield which not only protected the Iranian infant industries from unwelcome market predators, but it also allowed many of these industries to retain a monopolistic position in the market and thus be able to long continue to operate at sub-standard and inefficient levels. By the late 1970s, the 'infants' did not [and some would argue, still have not] demonstrate significant signs of maturity as they continued to enjoy the government subsidies and support, as well as retaining a high dependency on imported inputs and raw material.

So whilst much was asserted about self-reliance and self-sufficiency policies, oil revenues availability for industrial activities had in effect formed a habitual addiction to imported raw materials, intermediate and capital goods, for a large swath of the industrial landscape.

Two other aspects of the economy and industrialisation in Iran, particularly in the recent decades are worth a glance: firstly, the extremely modest success-rate of attracting foreign direct investment (FDI), which has continued to date, and has become tied to the sanctions regime (for 2007 to 2012 "dismal" figures, see tables UNCTAD, 2013, p. 214, 222 and 227) and secondly, an ever increasing role of the government, ever since 1960s. The 3rd and 4th (pre-revolutionary) five-year plans (1962-1968, 1968-1973) became contradictory on the role and active engagement of the private sector, with the private sector presuming a leading role, only to be changed mid way and orienting towards an extensive support for state-owned enterprises (SEOs) and industries. This was at the time justified on the basis of the private sector's inability to provide the investment and technical know-how required for heavy industries (Amid and Hadjikhani, 2005).

Other factors such as the role of the political elite (including the monarchist entourage) also started to play heavily in conducting business in Iran. Whilst nostalgia may make it easier to recall the better times, the business context was far from optimal, even prior to the change in regime, as business policy research (Alyani and Nahi, 2003, p. 10) has highlighted and outlined;

> "Analysts critical of the Islamic Republic assert that managerial inefficiency was born of the prioritisation of religious and revolutionary commitments over professional competence in the selection of managers. Although that is by and large accurate,

managerial accounts suggest that the inefficiencies may build on many aspects of the corruption that flourished in the monarchist era. While incompetence and systematic maladministration dogged the Qajar dynasty, Pahlavi's rule became the pinnacle of corruption and nepotism. This in spite of two major anti-corruption campaigns, spearheaded by the former Shah… These were ineffective, as they did not coherently address corruption within the imperial entourage."

As it was acknowledged in the previous sections, the national business context that had been developing since the 1960s, had to be significantly altered due to the ideology of the revolutionary forces in 1978-1979. Although the revolutionary groups that took power in 1979, all ultimately falling into line under the leadership of Ayatollah Khomeini, did not present any detailed, explicit or specific economic programmes, issues such as independence from foreign economic influence and social justice were a priority in early policy statements and declarations.

Soon after the success of the revolution, the country was driven towards agricultural and industrial self-sufficiency. The outbreak of war with Iraq (1980-1988), during the time of serious trade sanctions as a result of political tensions with various Western countries, as well as the Tehran's US Embassy hostage crisis, further exacerbated this orientation.

The [re-]nationalisation of many industries and large businesses which had gained significant private ownership, in the early months of the revolution, created the illusion that building capacity for self-sufficiency was merely a matter of working harder, and generally promoted an insular political economy while keeping a strict import and export regime, to deal with the immediate destructive effects and spiralling cost of the Iran-Iraq eight years of war.

Many large industries, organisations and firms, as well as public institutions (such as universities and research centres) in Iran started to lose contact and practice-based cooperation with the outside world and as such, fell behind the trends and the times, becoming increasingly detached. With the advent of the ceasefire with Iraq in August 1988 and then the subsequent peace leading to a reconstruction effort, the trends started to shift, however slowly, towards a measured reconnection with the West and other industrially and technologically advanced nations.

With digital technology in mind, remaining high on this policy debate of measured and gradual reconnection (versus continued economic isolation and hence marginalisation) with the global trends, there has remained two key factors: first, is the pursuit of self-sufficiency (as a proxy measure for 'independence') and the second is on absorbing the technological advancements,

without buying into the associated 'cultural onslaught' of Western (and the perceived 'culturally incongruent and decedent') influences.

Related to the early isolationist perspectives, reaching a peak around the first few years after the 1979 revolution, self-sufficiency as a cornerstone concepts of a revolutionary aspiration, was keen to break its links with its consumerist past. Self-sufficiency soon became a mere policy discourse as Iran discovered that it could not entirely rely on her own efforts, however ingenious and well-intentioned, to gain a positive position in the war with Iraq, as it desperately lacked the new technology to minimise troops and civilian casualties, and materialise sustainable advantageous tactics. By mid 1980s, some four to five year into the war, faced with demoralising campaigns and decreases in the personnel recruitment for the war front, Iran sought different methods to obtain new technology and required arms, via the various formal and informal means.

The ethos of self-sufficiency however has remained in the policy arena and tends to get raised regularly, increasingly linked with patriotic and nationalistic orientation (Vincent, 2010) and revolutionary fervour, or political-faction's sponsored 'spin' and propaganda. As an intellectual and practical project however, it has produced some successes in the agriculture and light industrial sectors, as well as a few other non-high tech industries, which has in turn led to a perception of increased national industrial confidence.

With the memories of the war very much alive, this has followed in the military domain with emphasis on improvement and creation of an independent ballistic missiles programme, which is now generally considered as globally advanced (utilising solid fuel in projectiles) and more recently, advanced research on drones and unmanned aerial vehicles (UAV) (BBC News, 2011; cf. The Economist, 2014b; Wikipedia, 2014a). The pursuit of nuclear technology, and the expertise around the nuclear fuel cycle, for future national energy demands, has been, and continues to be a well-publicised case in question. Notwithstanding the strategic sectors, as a universal national policy aspiration however, practical self-sufficiency directives are unlikely to be proactively back on the agenda, as to put it simply, times and economic structures have moved on. The sectoral value-chains of most industries are predominantly global: for a developing economy, attempts to build a foothold on the global value chains (GVCs) are thus viewed with increasing priority (UNCTAD, 2013).

Within the digital technology, analysis has also raised the issues and challenges of 'de-contextualised technological solutions' and a prime example of such tensions is captured by the evolving policies on access and use of the internet in Iran, and in recent years, 3G and 4G/LTE telecoms services which provide fast internet access via mobile phone handsets. Consider that Iran now has a large mobile subscription rate, based on a combination of pre-paid and post paid model, with a very high mobile penetration rate (of active SIM cards, provided by one of the three mobile operators) as of 2015.

Although seeking knowledge (including modern technology and sciences) is interpreted highly favourably and positively advocated as an Islamic obligation and tradition, the practice of gaining that knowledge, especially at the interaction of social sciences and humanities curricula (Mina, 2014), without the "Western culture" has been an ongoing problematic issue in Iran, both before (around the Left's political ideology and thoughts) as well as after the revolution. Educational research (Johari, 2002, p. 134) highlights Ayatollah Khomeini's beliefs, as documented in his broadcast on *Radio Tehran* in 1982, cited in Menashri (1992), as follows;

> "a pure Islamic system would lead to 'progress and independence' and… what makes a nation prosperous is a 'correct culture'".

Hence while the cultural influences of the West were criticised during the cultural revolution in Iran, announced by Ayatollah Khomeini in 1980 (till 1983, when the Universities reopened), some products of the West, in particular technology, were entirely exempt from this criticism. It is worth stating that the ethos of the Cultural revolution, similar to the self-sufficiency aspirations, has in the recent years become more of policy rhetoric than reality.

As Johari (2002, p. 133 and 135) expands

> "[throughout its long history] Iran has survived foreign invasions by the Greeks, Arabs and Moghuls… [In the current era] Although the Iranian government clearly wants to restrict elements of Western culture it finds negative and objectionable, there is much in the West that is valued and Iranians historically have adapted positive and useful elements from other cultures into their own."

A similar point on culture is taken-up by comparative management research: on the question of culture (large or small), Tayeb (2001, p. 126) cites a collection of empirical and theoretical research, arguing that

"[the] Iranian culture is a mixture of three different cultures which have co-exited for centuries: Ancient Persian culture, with about 6,000 years of history; Islamic culture, with about 1,400 years of history; and [modern] Western culture, with over 200 years of history. […] The way that Iranian people coped [with their internal and external difficulties and strife]… was through either resistance and struggle or 'false adaptation' (Bazargan, 1958)".

Returning to the economy, with the passage of time and the major changes in the global economic and business trends, new calls for promoting the private sector and curtailing the government activities as an enabler rather than a provider have gained momentum, particularly in the aftermath of the 2013 presidential election and 2017 re-election. Whilst this 'policy oscillation' is not new, it comes at a time that the Iranian economy has experienced one of its lowest points in living memory, and has culminated in an ambitious, and yet largely unfulfilled programme of private sector promotion, improvement of business environment factors and entrepreneurship promotion, so as to create sustainable employment.

Similar programmes, including privatisation of government assets (in practice, leading to much 'creative-/pseudo-privatisation' (Alyani and Nahi, 2003; Harris, 2013)) has been the on-going agenda, although with an uneven pace, for the last two decades and has included programmes of major regulatory and policy reconsiderations (Jbili et al., 2007; World Bank, 2003).

The privatisation drive has been framed into the Iranian current government's agenda by the 3rd, 4th, 5th, and 6th (post-revolutionary) five-year development plans (spanning 2000-2005, 2005-2010, 2010-2015 and 2015-2020 respectively) in an effort to gradually privatise much of the SOEs, which accounts for the lion's share of the overall national industrial and economic activities. The development plans (which act as both the plan and the law) essentially try to commit the administration to a range of fiscal, monetary and structural reforms designed to boost economic growth, support the private sector, generate employment and reduce Iran's reliance on the oil export industry.

As indicated earlier, since 1946-47, the Iranian government's national development policy has been structured around a series of five-year plans. These plans in essence have the task of creating a framework for distributing oil revenue inflows toward capita-based development. The plans' major inadequacies however include being far too macro-oriented, primarily centrally planned and aimed at achieving targeted output and expenditure, without due regards for

implementation and cyclical monitoring mechanisms. In a slow move away from import-substitution policies, the latest sets of plans have in recent years tried to at least consider some of the features of an *export-led* growth model, in effect, orienting toward hybrid models (World Bank, 2011). However, as Iran continues to heavily rely on her hydrocarbon reserves, for a range of development and fiscal plans both fed through annual government budgets and Iran's National Development Fund (acting as a Sovereign Wealth Fund), in moving towards an export-led growth, and notwithstanding the major gap in upskilling for international markets, the critical issue is

> "how to design [and implement] mechanisms for smoothing the financial and fiscal impact of [commodities, e.g. oil and gas] price fluctuations." (Haggard, 2001, p. 271)

At a glance, there may appear to be some similarities between Iran's current economic and structural reforms and transition plans, with the economic aspirations of the Peoples' Republic of China over two decades ago. As China's 'developmental ladder' strategies have been, and are continuing to be relatively vigorously and methodically studied in the West, they may provide useful comparative indicators to the position of Iran as a country in transition. The similarities however diverge significantly within a nuanced examination of details, mainly due to Iran hydrocarbon reserves and relatively shallow industrial development and weak linkages with global value-chains, but on some specific themes such as the business strategies for the private sector and the role of state-owned enterprises (SOEs), there may still remain close parallels and policy lessons. These include factors such as the emergence of 'creative-/pseudo privatisation' in Iran which continues to be subject of both popular and technical debate.

It should be clear that this chapter (and the thesis) is not arguing for an 'either/or' position in the relationship between the government, state-owned enterprises and the private sector, but rather a more nuanced, strategic and transparent relationship in their interactions and transactions.

Notwithstanding the global 2008 financial crisis and the interjection of many central banks in their respective economies via *Quantitative Easing* (QE), in developing economies in general, it seems common practice for the state to be extensively involved in the running of the economy in a multifaceted manner. A 'paternal state' engages at multiple points of the national economy, and as Blum (1995, pp. 47–48) highlights the policy tensions,

"the choice within a developing country is not whether government should be involved in the economic life, but how much [and in what ways] should government be involved."

In light of the privatisation drives, promoted by the respective development plans and the need for far greater foreign direct investment (FDI) levels, Iranian government and its modern business community regularly renew their drive and aspiration to join the membership of the World Trade Organisation (WTO). This is to strengthen the private sector and is based on the fact that they still retain their wider aspirations to ultimately become part of the global economic order. The membership application, by far the most obvious manifestation of this drive, has so far been objected to, and blocked on numerous pre-2017 occasions by the United States, but the continued effort and attention paid to this matter herald further support for a re-orientation away from economic insularity to global connectedness.

Taken together, the overall results of the aforementioned situation in Iran's business and operating environment has meant that there are, from time to time, a growing space and niche in the specific sectors of the market, as well as social and policy terms, for private firms to operate, expand and where they have the potential, compete. Whilst there still are, and will continue to be major impediments to businesses operating situation for the private sector especially the very small and start-up firms, nonetheless clear efforts are being coordinated to improve the situation.

So far the predominant emphasis of this section has been on the historicity elements and macro policies. Turning from macro to meso (sectoral) and micro levels, where there is a thin supporting literature, the issues appear to have received little coherent attention in the overall economic and business policy analysis. As the focus of this work aims to explore and unfold learning interactions of groups of professionals leading to innovation within firms, some unpacking of the link between the macro, meso and micro issues are required and hence much of the currently available reported research are at best, only of a peripheral and context-setting value.

Linking the macro with the meso and micro level, Tayeb (2000, p. 322) reveals an interesting insight. She argues that due to the protectionist and statist economic policies, managers [in the public and pseudo-public sector such as SOEs] lack the serious incentives to invest in product innovation and vigorous professionalism. Nevertheless, she asserts that with the gradual introduction of market forces and privatisation plans of State-owned enterprises (SOEs), the protectionist and statist position will gradually lessen and a slow transition may occur. She views

some of the possible ways ahead, mainly through FDI, joint ventures and strategic alliances, for this transition to accelerate.

She (ibid) concludes by stating that although the business operating environment has constraint the managers, by increased engagement with foreign partners out of necessity, the economy could be injected with much needed competition, managerial and higher level skills and advanced technologies. This skill element is viewed as a core area of development, as she rightly highlights and (nearly two decades ago) forecasts Iran's position of having a significant young 'educated' yet 'unskilled' pool in its demography, as

> "…a young and largely educated population eager to learn new skills and participate in the economy […] there are… [equally significant constraints such as] shortage of skilled workforce…". (Tayeb, 2000, p. 322)

Tayeb is in fact amongst one of the very few scholars who has looked consistently and over a significant period of time of over two decades, whilst not directly but at related management issues around learning in Iranian firms. She (2001, p. 131) outlines and later expands on a coherent argument when she considers the intricacies of learning from foreign companies, by stating that

> "[while professionals] the world over attempt to learn from their more successful counterparts at home and abroad… adaptability to socio-cultural and political economic characteristics contributes significantly to the success of such cross-border learning processes."

She proceeds to outline that whilst in some countries, US-grown management techniques and ideas (such as the introduction of quality circles in Japan by Deming and Juran) were embraced and adapted locally (i.e. 'glocalised'), this was not the case in Iran.

Historically, the introduction of such techniques in Iran in 1950s and 1960s were considered a 'total disaster' (ibid, p.131), as

> "Practices such as participative decision making, quality circles, total quality management and multi-skilled team work presupposes, among other things, a willingness to participate in group decision-making and decision implementing and a strong commitment to the workplace, on the part of employees… [as well as] a certain degree of confidence and trust in employees and willingness to delegate authority to team members, on the part of their managers."

She argues that the Iranian workplace culture had [and may still retain] a significant role to play in this failure. Writing in early 2000s, she concludes positively however on the prospects for future, especially with the necessity for economic inter-connections, in aid of national and sectoral development.

Another empirical study on Iranian SMEs, is also worth outlining. Ghanatabadi (2005) investigated internationalisation of selected Iranian manufacturing SMEs based in Tehran. Conducting quantitative case studies of 20 'manufacturing' firms (including one software company), she examined the role of the owners/entrepreneurs (with the 'entrepreneur' seen as the *persona causa* of economic development and thus the unit of analysis) in the process of decision making for internationalization of SMEs' activities. Using informal, semi-structured interviews and 'snapshot' methods, she concludes that the course of internationalization of SMEs in Iranian manufacturing firms is primarily an entrepreneurial and opportunity-based process.

As part of her study, primarily at the conceptual stage, she considers network science, particularly social network theory and makes some partial conceptual (Ghanatabadi, 2005, pp. 45–49), rather than direct methodological use of it (such as for mapping relationships and calculating network churn) so as to better trace the relationships between the small firms, and their search for entrepreneurial discovery. This is significant as she is probably the first economics and management scholar to attempt to apply the theory (later followed by others, more as a bolt-on methodology, such as (Soofi and Ghazinoory, 2011)), however conceptually impoverished and partial, on an Iranian organisational context (in Tehran based SMEs). She also considers the issue of skills in some detail, but does so primarily from an 'individualistic' perspective, as an asset and capital held by the entrepreneur, and thereafter unwittingly conflates skills and experience, and therefore becomes insensitive to the distribution of skills. She considers the entrepreneur's network, equally as a personal asset brought to play in effort to internationalise the market activities of the small firms.

The work and research strand of management and organisational studies scholars such as Ghanatabadi and Tayeb (and their doctoral students) glanced at above, is clearly illuminating with pioneering case study arrangements. However, their work is essentially descriptive and with strong historical elements, 'backward looking' and thus focuses on conditions which have led the firms to where they find themselves, rather than theory-generating.

It is worth recalling the that the operation of MNCs and TNCs in Iran, including operating in international joint ventures (IJVs) (normally with a legal requirement of 51% local content) have been subject to significant restraint in the post-revolutionary Iran, due to geo-political and economic factors, such as serious and sustained sanctions, and MNCs/TNCs operational congruency with the host (Soltani and Wilkinson, 2011). Travelling to the business districts of Tehran, there are very few Western MNCs/TNCs that would catch one's attention. Equally, Eastern MNCs/TNCs, such as Samsung and LG, may have large advertising and market segments to sell their products on the Iranian market but do not build jointly and locally (Jahangard, 2014a).

Tayeb (2001, p. 131) is highly observant of this factor and cogently highlights that this situation

> "deprives Iranian firms of exposure to the latest 'best practices' carried out by successful multinational firms operating in their back garden."

It is within this state of affairs that smaller, agile firms, such as the new technology-based firms (NTBFs) under study in this thesis, mimic MNCs/TNCs sourcing and skill formation behaviour, be it in their own glocalised, curtailed and financially constraint manner. Whilst use of networks, including networks for innovation and learning by SMEs and NTBFs is an established pattern, it is this *mimicking* of the behaviour and attempt to find a niche in and fit into the larger global value-chains (GVCs) (UNCTAD, 2013, pp. 159–161, 181) which are viewed as a relatively new phenomenon, within the sector studied in this research. The networks and networking needs of the small firms is further covered in later sections examining NTBFs collaborating for innovation.

Before bringing this section to an end, it is worth returning to the specific context of Iran's telecommunication, specifically mobile telecommunications sector. It is generally evident that there has been a near exponential expansion over the past decade (Business Monitor International, 2012, 2011) in the Iranian telecommunication sector, and with more, this time potentially on data traffic on the way. The expansion programme has been ongoing and involves, inter alia, expansion of landline and mobile subscriptions, increased telecom applications, increased and further development of mobile (SMS) application for businesses, and since 2014, a significant forward traction on 3G and 4G/LTE services and locally produced/congruent content (Donya-e-Eqtesad, 2014b, 2014c; Jahangard, 2014b), and importantly for this research, a series of policies to develop mobile eco-systems and firms for innovative solutions and job-creation.

Lastly, to ensure that there is consistency between my account of the mobile telecommunication sector and the previous section that have outlined the business environment in Iran; I intend to use the same cluster of thematic and episodic themes, around independence and social justice, and catching-up and economic development respectively, outlined earlier.

3.1.1 Moving from an static industrial policy to a dynamic innovation policy

Before proceeding to discuss specific sectoral features, particularly on the evolution and the current state of the mobile telecommunication sector in Iran, a brief pause and recap may be useful.

The preceding details of the state of the Iranian economy, as well as the recommendations of a range of recent external consultancy studies (IMF, 2014a, 2014b; for a turn towards "inclusive growth", see Movahedi, 2012; UNCTAD, 2006, 2005, cf. for global advice on creative sectors UNIDO, 2007, 2003), together with new arguments from the policy makers (Financial Times, 2013; Mehr News, 2013; Rachman and Aglionby, 2014; Rouhani, 2014a, 2014b, 2010) have paved the way for rethinking Iran's future economic path. The move from an static (primarily well-endowed natural resource-based) industrial and economic policies towards a more dynamic innovation-led policies, will have to be multi-faceted, and will need to involve at its heart, capacity and skills development on various levels.

The intention of this brief section is not (at this stage) to offer an in-depth analysis or potential frameworks for resolution of the situation but drawing on the studies, selectively highlight factors which would be of direct relevance to the creative ICT firms, explored later in the empirical parts of this study. One of the core issues of the last decade for small firms, severely exacerbating in the last 3 to 4 years, has been the existence of (or lack thereof) relative macro-economic stability. The tightening of international trading and financial sanctions aside, the 9th and 10th governments' populist economic policies and lack of fiscal discipline which created havoc in credit lines and loans, inflation, interest and currency exchange rates, proved near fatal for many small firms with insignificant reserves to fall back on. The 11th and 12th administration whilst still struggling with growth factors, has so far – as re-elected till 2021 -, managed to significantly tame the inflation, reconstitute fiscal discipline in the government budgets, and provide a stabilising macro-economic platform, in line with advice from internal economic and socioeconomic planning experts and the IMF/World Bank (whilst being well aware of the 'chequered history' of the IMF and World Bank, at times 'costly' interventions and solutions, and ironically, their own internal strife (Donnan, 2014) - for a brief review of policy issues, see (Babai, 2001a, 2001b)).

As the comprehensive UNCTAD STIP (*Science, Technology and Innovation Policy Review*) study, examining overall sectoral policies, as well as two sectoral clusters (the oil, gas and petrochemical; and the biopharmaceutical) in considerable depth, highlights, inter alia;

> "the shift to a more knowledge-based economy will require a national innovation system that can not only import and adapt technologies, but also improve upon them, innovate new technologies and diffuse them economy wide." (UNCTAD, 2005, p. 1)

> "a unique feature of Iran's innovation system is the marginal role played by the foreign companies... Foreign companies bring in new technologies in the form of new products, processes and management techniques. The local operations of foreign companies lead to spillover effects and diffusion of new technologies [and processes] into wider economy… [to] spur competition and motivate domestic companies to upgrade and their technologies and innovate in order to compete." (ibid, p.2)

> "[there is a] continued emphasis in Iran on production rather than on innovation as the core of the development process." (ibid, p.3)

And of direct relevance to the case study of this thesis, outlines the following summaries;

> "With the exception of a small number of high-tech start-up enterprises, the contribution of the private sector to innovation and technology development is limited." (ibid, pp.20-21)

> "the role of foreign investment in the Iranian innovation system is at present insignificant. Globally, transnational corporations (TNCs) play a profound role in shaping the structure of markets and the pace and direction of technological change. Their presence in a host country provides an opportunity for learning, transfer of skills and knowledge through supplier networks and spillover effects. But, TNCs play only a marginal role in the Iranian economy…" (ibid, p.23)

> "the role of FDI in the Iranian innovation system is at present marginal. […] The government of Iran should give a 'big push' to the development of small and medium enterprises (SMEs), one of the weakest links in the innovation system. […] Development of innovative SMEs requires dynamic entrepreneurs… [which is presently] weak in Iran." (ibid, p.25)

Amongst the many challenges facing Iran's economic policy domain, is an overarching issue that stands out: that is the core challenge of policy design and coordination so that various national and regional, and sectoral policies, do not in effect contradict each other and produce 'unintended consequences'. These issues will be returned to towards the end of the thesis with links to the new policy ideas around strategic incrementalism (and 'smart specialisation').

3.1.2 Debates on socio-economic dynamics of natural resources as a blessing or a curse

As outlined in the last section, the Iranian industrial and economic policies, on a comparison to the international *best practice* on competition and connectedness, leaves much to be desired. This will be further demonstrated in a later section, when briefly discussing the recent set of findings by the Global Competitiveness Index report, along its 12 pillars (Schwab and Sala-i-Martin, 2014).

In searching for a way forward, primarily amongst Iranian economists and business planning community (a significant proportion of whom highly value mathematical economics and econometrics, as a seemingly 'tangible and accurate' framing mechanism, despite its recent 2007-2008 global crisis failing models (The Economist, 2013a, 2012a)), there has been an ongoing debate on natural resources as a blessing or a curse. The debate which still creates much heat (and little guiding light or policy insights) in Iran, originated from the international academic community and outside of Iran. In a highly abridged and abstracted format, I offer a summary as follows.

Development economics theory, traditionally, has looked closely at how developing economies may capitalise on their natural resources, as a developmental cornerstone (Rostow, 1960). Soon after country specific studies and disaggregation of data became the norm however, researchers started to pose not only the advantages but also the disadvantages of natural resource wealth, based on some (including correlational) evidence, which suggested that natural resources actually act more as a drag, rather than a facilitator on national growth (for a review, cf. Gylfason, 2001). This led to the notion of natural resource 'curse', referring as a label to the proposition that high dependence on natural resource extraction and manipulation hinders economic growth.

A fair amount of the related debates and discussions has also linked with, and converged on a metaphorical 'syndrome', entitled the 'Dutch disease' (first coined by *the Economist* in late 1977 when historically reviewing the problems in the economy of Holland, upon discovering a large natural gas field in 1959). The idea of Dutch disease suggests that when there is an abundance of natural and easily tradable resource, foreign exchange earnings are bolstered which leads to the appreciation of the national currency in the exchange rates. This currency appreciation subsequently causes a 'crowding out' of the other economic activities, particularly

manufacturing, in the open and tradable part of the economy, as well as highly accommodating and increasing public sector growth and non-trading activities.

Parallel to these factors, natural resource extraction and production are generally capital-intensive activities, broadly requiring high fixed costs, but may not (certainly with the advances in the current decade) lead to significant employment creation, based on high level of specialised and technological processes. Also, the price of natural resources, or commodities as far as the stock exchanges recognise them, are generally volatile, which means that a fiscal reliance on them bring with it, an inevitable risk of severe macroeconomic fluctuations, with significant peaks and troughs in returns. These fluctuations may not only negatively affect growth performance but also the high volatility undermines any significant actual or policy support in long-term investment activities, primarily amongst which is economy-wide, sectoral, or private-sector led research and development (R&D).

However, as time has gone by, it has become increasingly obvious that whilst relevant, macroeconomic considerations do not portray the entire picture. A range of other factors around human and societal (accountability and governance) processes and systems seem to play an equally critical role. Abundant natural resources, which generally tend to accrue directly to the government, serve as an attractive lure for rent-seeking – that is seeking to gain privilege and a share of the assets and returns through political clout and connections rather than economic activity and achievements – and subsequently *rentier* arrangements in economies and states (Mahdavy, 1970), a phrase coined by an Iranian economist during a conference at SOAS, University of London, and later refined by others (Beblawi and Luciani, 1987; Shambayati, 1994).

There is now a rich and varied literature on both the natural resource 'curse' and 'blessing', and Dutch disease (and related terms such as 'Norwegian paradox', where low R&D and high economic performance are equally apparent), spanning several decades. The literature has broadly moved on, and many have pointed to the importance of micro (and much more recently, meso) level activities and highlight that the causal link (rather than correlational relationship) between resource abundance and growth remains highly contestable. A recent line of research has evaluated a range of recent statistical studies and is now concluding against the presence of a natural resource 'curse', particularly when it refers to oil and mineral wealth (Alexeev and Conrad, 2009; Herb, 2005).

Studies on the experience of a number of other developed economies, such as Australia, Canada, Norway, Finland and Sweden (with reference to two latter's pulp and paper industry as the source of important spillovers and spinoffs, benefiting their long-term growth potentials (Blomström and Kokko, 2007; for a brief overview, see Lederman and Maloney, 2007)) is in line with the non-existence of a resource curse conclusion.

Others have moved the debate on by suggesting that better descriptive labels such as 'innovation and human capital poor' may in fact act as a more accurate conceptual frame (Papyrakis and Gerlagh, 2005; Ross, 1999; Smith, 2007). Whatever label is used however, it is clear that the circumstances described do create a tendency towards weak incentives and motivation for R&D activities, entrepreneurial risk-taking and up-skilling required of technology start-ups for innovation activities.

Notwithstanding, following this brief synopsis, one could quite legitimately hold the opinion, developed out of recent rethinking in the field (Collier, 2014), that the Iranian economist and economic planning community's continuing interest in resources curse and blessing, and Dutch disease, within neat but ultimately irrelevant mathematical analysis, expressions and formulas (as *Greek-lettered* economics (cf. Beinhocker, 1997)), has become rather esoteric. The debate is certainly not producing any guiding light, and worse still, may lead to numerous cul-de-sacs on growth and generative sectoral policies. In short, the agenda and tools to deal with the underlying problems may well have moved on and as the problems are often not given, they need to be reframed and worked-up to, in their own space and time.

That said, for we remain grateful the insights that the debates in the community and the reviews of the extant literature has provided, and would assert that it is not merely the Dutch disease and resource curse that continues to weigh down economic development in Iran, but the 'Dutch knowledge disease', in actual sectoral practices. 'Dutch knowledge disease', a term and phenomenon introduced tangentially by an innovation economist (Soete, 2005), when reviewing the shift from traditional national industrial to innovation policies, has been summarised as

> "a lack of knowledge renewal in both industrial and services sectors based on a dual phenomenon of "crowding out". First, a crowding out of basic research in the private sector, with for instance many domestic champions having drastically, under international pressure, cut back their own privately funded fundamental research activities. And,

secondly, a crowding out of more applied and market driven research in universities as a result of domestic competition putting a strong premium on academic, basic research." (Soete, 2007, p. 282- Fn 10)

It is the 'Dutch knowledge disease' which is much more apparent in the Tehran based context of this study.

Lastly in this section, it is worth mentioning that a few scholars and consultants in the Iranian academia specialising on innovation policy, and working and hypothesising in isolation of the realities of the industrial landscape and external interactions with the evolving corpus of the field, may have inadvertently misjudged the intricacies and interdependences of the situation (Soofi et al., 2013).

Upon providing a useful description of the Iranian STI institutions and mapping stakeholders, as well as outlining Iran's strategic *Vision 2025 AD* (1404 AP), Soofi et al's chapter proceeds in a unexpected direction in the discussion and conclusion stages. Comparing Iran's situation with a historical review of the industrial policy of Japan and the former Soviet Union, (neither of which are currently viewed as progressive, nor best practice), they seem to suggest that the self-sufficiency and self-reliance oriented industrial policies have been positively generative.

Whilst shedding some light, they appear to be drawing on a somewhat eclectic historical and sectoral research particularly on NSI (national systems of innovation) and conflating these with more conceptual research on Western entrepreneurship ideas. These are then complemented with the result of a survey, undertaken on behalf of the *Iranian Ministry of Science, Research and Technology (MSRT)* by an internal research team, as a questionnaire type survey to seek the opinion of influential individuals in Iranian S&T [Science and Technology] policy-making circles. Whilst the original research and its reporting in Farsi (cited as 'IRPHL 2009') [a report by Tehran-based *Institute of Research and Planning for Higher Learning* (IRPHL, 2009)] seems robust, with insightful and vocal critique of the Iranian NSI arrangements, based on Soofi and colleagues' reporting seems incoherent.

Additionally, in the discussion and summary stages of their chapter, they seem to conceptually conflate S&T (science and technology) and R&D (research and development) activities, as well as entrepreneurial innovation activities (drawing on GEMS studies for Iran and Turkey).

In their summary, they offer some useful general insights on Iran's current inability to 'convert knowledge to wealth' at the industry level. Being concerned with the NSI as a system however, they have not looked at or taken into account (or if they did, have reported on it inadequately) what it is that they view as the work-process and/or sector knowledge; how current and worthy it was; and where it was located, before the 'conversion into wealth' can take place. Similarly they conflate changes brought about by innovation at levels of sectors and later within the economy, and assume that it always leads to additional job-creation. That is clearly erroneous, as significant research now points to the opposite direction of cycles of skill-redundancy and job-destruction at initial stages, before additional employment can be created in other similar, value-chain or emerging sectors (Pianta, 2005), which then calls for a coherent and nuanced policy-design on re-training, upskilling and labour mobility schemes, programmes and policies.

Whilst I have previously acknowledged the potentiality for 'islands of excellence', their simplistic claim extends this to the entire economy, and concludes the chapter's propositions as;

> "the Western economic sanctions against Iran have created a bittersweet condition for the country. On one hand, sanctions have reduced, if not completely eliminated, the transfer of technology from abroad. On the other, they have stimulated efforts in the country to rely on its human resources and domestic capabilities to develop S&T [Science and Technology] independent of imported technology. […] the technological "shock" of sanctions to the country, instead of retarding its growth, has worked as a powerful force to advance technological development by leaps and bounds". (Soofi et al., 2013, p. 83)

This oversight is partly an indication of the lack of sectoral and better-grounded studies. In the same book of edited chapters, the following chapter (chapter 5) looks closely at the ICT sector and outlines quite a different and divergent view to above summary (Ghazinoory and Jamali, 2013). This is not only a testament to the different views, and the subject-grasp of the researchers in the field, but also the importance, and in many ways, the primacy of sectoral studies, where trends are analysed and viewed in an unpacked manner (Malerba and Nelson, 2012), rather than the mass aggregation of the NSI studies.

As a broader point, in recent years, international policy bodies and organisations, whilst acknowledging their heuristic benefits and unified approach, have increasingly moved away from NSI based analysis due to disaggregation issues, towards sectoral and regional analysis and policies. This is manifested, for example in the recent rise of ideas on *smart specialisation* in EU and OECD policy circles (Foray and Goenaga, 2013; OECD, 2012).

In line with the final note in this section, the next section turns to cover some of the related issues in brief, in the specific context of the study and the particular sector.

3.2 A glance at Iran's digital technology policy: debates and details of Iran's telecoms sector

An earlier section highlighted the roots of the ideological ambivalence of Iran with digital technology, which can essentially be summarised as the dilemma in seeking advanced technology infrastructure but free from the 'excesses' of Western culture and content: the aim of this section is to further fine-tune that ambivalence, firstly in the current period of time; and secondly, in the specific sector of interest in this study, i.e. broadly defined, the 'cyberspace' afforded by mobile technologies, with mobile operators and VAS (value-added services) firms and content providers as the core technology providers and partners. Apart from some preliminary guidelines, the underlying ambivalence in the policy has not yet been clarified and is not expected to be resolved conclusively in the near future (Asre Ertebat, 2014a, 2014b; BBC News, 2009; BBC Persian, 2014d; Donya-e-Eqtesad, 2014b; Financial Times, 2014; Sharif, 2013; Tejarate Farda, 2013b).

Due to its tight remit, this section does not describe the fixed line and other non-mobile telecoms developments, of which the promotion of national broadband is the most appealing and relevant. However, in line with our thematic frames, it is worth mentioning the plans on *Iran National Internet Network* (ININ). The Iranian government has had continued concerns about data privacy and security of its citizens, as well as rapid spread of outside information within the country, via digital communication means, as a critical national security risk. The ININ plans have been altered and amended on a number of occasions since their approval by the 9th administration's Cabinet in May 2007. The disputed presidential election in June 2009 (soon becoming part of a wave of regional protests which went on to form the 'Arab Spring'/'Islamic Uprising' in neighbouring countries), in which the social media played a key role in disseminating news and images, further convinced the authorities of the potential risks with the rapid spread of information (Business Monitor International, 2012, p. 42). The core idea with ININ acting as a domestic 'intranet' however is beyond that of control as a range of policy circles are already well aware that the architecture of the internet, by its nature, makes such task ultimately futile. The pragmatic argument, with the sophistication of the *Stuxnet* virus in mind and within post-*PRISM* realities, revolves around enhanced data security and storage, as well as internet traffic speed and costs.

The irony, relatively accurately pointed out by the national technical and security analysts is that for an average e-mail and enclosing documents to travel from Tehran to any other recipient within the city or other national cities, let alone outside of the country, it will probably be routed through the global networks, which generally travel through the United States. A domestic network will make that redundant and by so doing, could potentially significant increase the internet speed and bandwidth, currently a major problem in Iran. The argument, again technically convincing, continues that the national 'intranet' could also provide a much higher level of re-calibration for offering local contents to different age groups, and more importantly content creation in Farsi, (which faces similar and greater risks in being globally sidelined, as Arabic (cf. The Economist, 2014c)) and coherent web based creative businesses and eco-systems, for example for cultural and educational activities. On a related hardware note, over the last decade, the hosting for most, if not all of official websites of Iranian government and banks has been transferred to domestic servers, in effect improving the local access, security and control issues.

Returning to the ININ initiative, global practice suggest that the success and sustainability of any such schemes is not determined by national policy alone but also by a combination of the joint and continuing motivation of users and groups of content creators, endeavouring to match their online requirements.

As an indepth Financial Times analysis (2014), looking at internet access issues in Iran, as well as in Turkey, Russia and China, recently highlighted, the verdict on such scheme is yet to be decided. In discussions with technical experts, it asserted that

> "… "the [economic] value of connectivity is so huge that no one… cuts themselves off the internet entirely"[…] Iran is pushing ahead with the launch, 18 months from now, of a "clean internet" [referring to ININ] that provides a filtered view of the global medium. Yet many analysts believe that the launch is increasingly unlikely given a young, educated population – 70 per cent are under the age of 35, many of them with university degrees – that has come to see the internet as an important window on the world and a way of pushing back against strict rules governing social interaction in daily life."

And summarising for the entire report on efforts to balkanise the digital world and the other three countries examined, concludes by stating

> "In an increasingly fractious world, the dreams of a borderless medium capable of connecting humanity in a frictionless way are on the retreat. But it is still far too early to declare the era of open internet over." (Financial Times, 2014)

Internet and social media, and satellite television in Iran along with their effects have been studied in some detail and continue to be examined (as part of media monitoring) regularly, based on external research funds linked to supporting geo-political plans and geo-strategic intentions.

The position with mobile phones and related services (e.g. 2G or 2.5G, such as SMS based activities) however has received modest research attention. Iran has had operational mobile phone services and networks for over twenty years, and as such has made numerous efforts to work innovatively within the 2G and 2.5G constraint: the core case studies of this research, described in detail later, in Mobile-Service (m-Services) and Mobile Banking (m-banking) are all supported by 2G backbone structures. Based on their enhanced security and the infrastructure investments by the firms and customers, much of those systems are unlikely to alter too rapidly. Amongst all value-added services, SMS and SMS based mobile banking VAS have had the most uptake (Business Monitor International, 2012, pp. 30–31 & 45).

Iranian telecoms regulator has however in the recent years (since September 2014) managed to coordinate its policy and practices sufficiently coherently so as to start to offer faster-internet (mobile broadband) based services (i.e. via 3G and 4G/LTE, in time) via mobile phones and smart handsets (Donya-e-Eqtesad, 2014b, 2014c; IRIB TV1, 2014; Tejarate Farda, 2014b). As a senior official recently revealed publicly however, Iranian ICT industry is about a decade behind the leading international curve (Jahangard, 2014b), particularly on commercialisation of products.

As far as the statistics (conservative estimates and pre-3G launch) for 2014 reveal, Iran's mobile market has about 83.2 millions mobile subscription base (largest in the Middle East), translating to about a 110% (projected to rise to 140% by 2017-18) active mobile penetration rate, disregarding the estimated 'network churn'. The estimate smart phone users are about 8 millions and rising significantly, and the current (platform-agnostic) internet rate is about 55%. Social media and both foreign and local mobile apps are also widely used and on the increase, with the increase in the numbers of mobile web users (via emerging nationwide 3G & 4G services).

A key point of policy contention on the newly expanding mobile cyberspace horizon is the identification, promotion and local generation of appropriate content which are 'culturally congruent', as well as the use of apps which are originated from foreign mobile apps companies, based on a perception of security and privacy (or lack thereof) concerns.

The generation of content is not only a dilemma for Iran but also other surrounding states and thus practical steps are taken to promote innovation in home-grown mobile apps (Croucher, 2013; Iran Mobile App Festival, 2013; Mehr News, 2014). This is part and parcel of the Iranian government new promotion of the cyberspace, and more recently the mobile cyberspace via attractive and creative mobile apps, as a platform for entrepreneurial digital activities. The introduction of 3G and 4G/LTE services are heralded with much economic promise by a number of government ministries, provided the eco-systems are nurtured appropriately and in time, to develop a mobile eco-system economy (GSMA Intelligence and ATKearney, 2013), such as that promoted in South Korea, as part of a *Creative Economy* vision.

Forecasting the Iranian market developments, a specialist sectoral briefing outlined that

> "The greatest untapped potential for data appears to be Iran – despite having mobile penetration of 139.5%, [without the 'churn' factors] the region's most populous country has less than 1% of its connections on mobile broadband networks. [...] With 3G and 4G deployments increasing across the region, operators must ensure that they can effectively monetise their network investments in the face of competition from both their rivals and from the OTT [over-the-top content, using the internet] messaging services whose popularity will inevitably grow as smartphone penetration increases." (GSMA Intelligence, 2013)

The graph below [3.2.A], illustrates a comparative snapshot of the Iranian telecoms position (with a dominant non-mobile broadband services) and the surrounding regional states.

The next section further focuses on the operating environment of Tehran for the innovating firms. It does so not only by considering Florida's 3T model (*talent, technology and tolerance*) (Florida, 2002; Florida et al., 2008) considered as essential elements for a creative sector to flourish, but also reviews the most recent set of indexes, for competitiveness in Iran. It should be highlighted that whilst Tehran is the capital of Iran, for statistical purposes much of the international bodies essentially draw their lion's share of their sampling from Tehran (World Bank and IFC, 2014).

Figure 11 [3.2]: Total mobile penetration and mobile broadband share, selected Middle Eastern countries – data based on Second Quarter (Q2) 2013
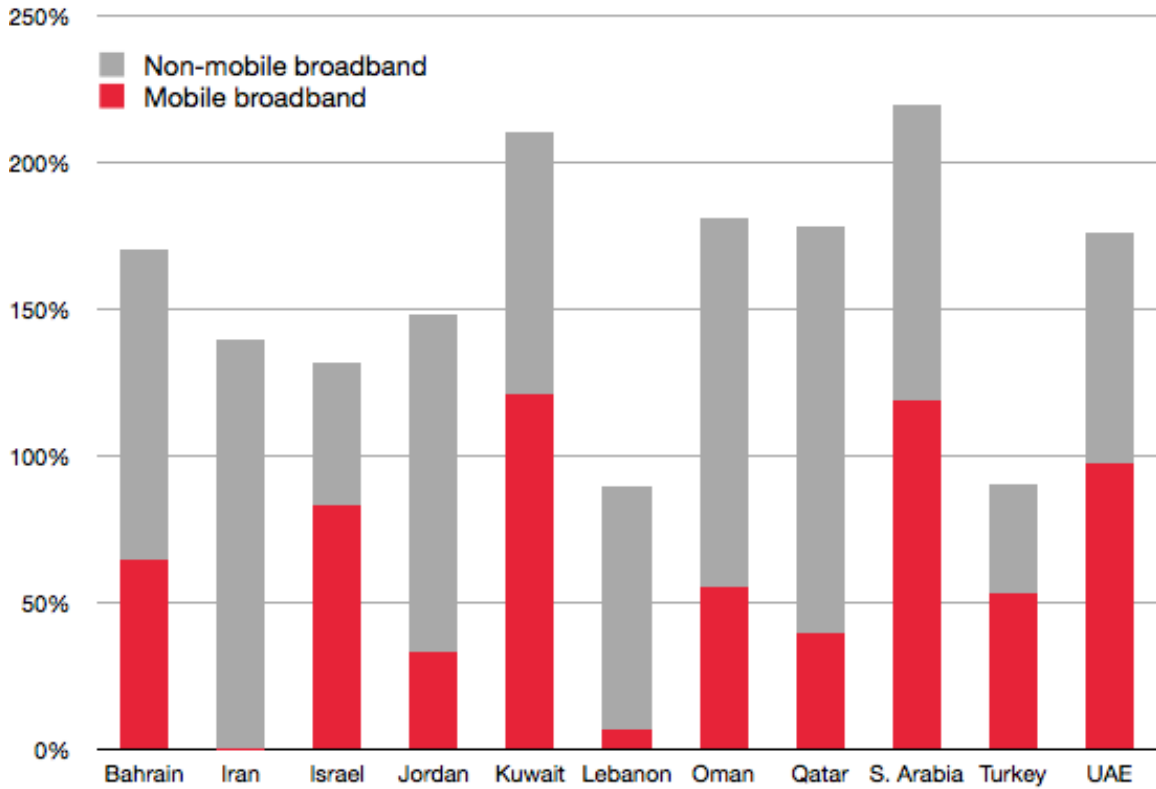
Source: (GSMA Intelligence, 2013)

Note that GSMA Intelligence uses a broad definition of mobile broadband including the following technologies: CDMA2000 1xEV-DO, Rev. A, Rev. B, WCDMA HSPA, TD-SCDMA, LTE, TD-LTE, AXGP, LTE Advanced, TD-LTE Advanced, WiMAX and WiMAX 2.

3.2.1 Framing Tehran as a hybridised site and operating environment for innovating firms

Innovating firms, especially small innovative firms, have to live in the same operating environment as the larger and better resourced larger private and public firms. So that the challenge of unequal competition does not over-power them, they have to remain agile and develop the ability to retain a sustainable competitive advantage through innovation activities.

In providing a most up-to-date business view on the operating environment, it is worth reviewing data held in rankings such as the Word Bank's Doing Business report (consulted in earlier sections, which provides a macro and a regulatory picture of the economy) and WEF's GCI study (which offers more meso and micro indicators), outlined below. Based on composite measures, Global Competitiveness Index (GCI) study and report, produced by the World Economic Forum (WEF), attempts to describe, measure and offer an annual ranking. In 2014-2015, Iran ranked 83 among 144 countries in the Global Competitiveness Index (GCI) released in September 2014 (Schwab and Sala-i-Martin, 2014).

It is worth highlighting that Iran had ranked 82nd out of 148 countries in the GCI 2013-2014, whilst a year before then, the country's score stood at 66th place among 144 countries (2012-2013 rankings). More recently in 2016-17, Iran ranked 76th out of 138 and in 2017-18 climbed to the ranking of 69th out of 137 countries surveyed.

World Economic Forum (WEF), commonly known for its annual Davos economic meeting, attended by various policy stakeholders, contributors, and commentators as well as private sector leaders, benchmarks countries against 12 factors. These include infrastructure, education and training, labour market efficiency, technological readiness and innovation. Iran achieved an overall score of 4 in a scale of 1-7 (with 7 as best). In the 12 pillars or sub-criteria for the assessment and ranking, Iran scored the highest in health and primary education (6) and market size (5.1); whilst scoring the lowest in labour market efficiency (3), financial market development (3) and technological readiness (3).

The World Economic Forum at Davos in 2014 was attended by a number of Iranian representatives including the 7th President, and a number of others from the Iranian policy circles (Rachman, 2014; Salehi-Isfahani, 2014), making the case for a fresh perspective on the country.

The 2014 WEF report accurately highlighted that Iran's economy was expected to stabilise after two 'difficult' years, mainly driven by external developments, such as the more stringent implementation of tighter sanctions.

Figure 12 [3.2.1.A]: A detailed explanation of the 12 pillars utilised in WEF's GCI

Institutions

Concepts related to protection of property rights, efficiency and transparency of public administration, independence of the judiciary, physical security, business ethics and corporate governance
- Public institutions
- Private institutions

Innovation

Capacity for, and commitment to technological innovation

Business sophistication

Efficiency and sophistication of business processes in the country

Market size

Size of the domestic and export markets
- Domestic market size
- Foreign market size

Infrastructure

Quality and availability of transport, electricity and communication infrastructures
- Transport infrastructure
- Electricity & telephony infrastructure

Technological readiness

Adoption of the technologies by individuals and businesses.
- Technological adoption
- ICT use

Financial market development

Efficiency, stability and trustworthiness of the financial and banking system
- Efficiency
- Trustworthiness and confidence

Macroeconomic environment

Fiscal and monetary indicators, savings rate and sovereign debt rating

Health & primary education

State of public health, quality and quantity of basic education
- Health
- Primary education

Higher education & training

Quality and quantity of higher education, and quality and availability of on-the-job training
- Quantity of education
- Quality of education
- On-the-job training

Goods market efficiency

Factors that drive the intensity of domestic and foreign competition, and demand conditions
- Competition
- Quality of demand conditions

Labour market efficiency

Labour market efficiency and flexibility, meritocracy and gender parity in the workplace
- Flexibility
- Efficient use of talent

The report suggested that a more steady economic context, together with more outward-facing policies provides an important opportunity for enhancing competitiveness, building on the country's improved macroeconomic positioning, its significant market size, and its well educated population. Other significant factors mentioned are improvements to its institutional framework and measures to heighten the efficiency of its goods, labour and financial markets.

As outlined below, it may be interesting to note that in considering *'the most problematic factors for doing business'* in Iran, the study had outlined 'access to financing' (16.9%), 'policy

instability' (13%) and 'inflation' (13%). As stated earlier, issues around 'access to financing' are usually on top of the small firms priorities, in various global surveys and other countries, and this has held equally true for Iran's large and small (private and public) firms.

Figure 13 [3.2.1.B]: WEF's Global Competitiveness Index summary for Iran (2014-2015)

Global Competitiveness Index

	Rank (out of 144)	Score (1–7)
GCI 2014–2015	83	4.0
GCI 2013–2014 (out of 148)	82	4.1
GCI 2012–2013 (out of 144)	66	4.2
GCI 2011–2012 (out of 142)	62	4.3
Basic requirements (41.8%)	71	4.6
Institutions	108	3.4
Infrastructure	69	4.1
Macroeconomic environment	62	4.8
Health and primary education	52	6.0
Efficiency enhancers (48.6%)	98	3.7
Higher education and training	78	4.2
Goods market efficiency	120	3.9
Labor market efficiency	142	3.0
Financial market development	128	3.0
Technological readiness	107	3.0
Market size	21	5.1
Innovation and sophistication factors (9.5%)	102	3.3
Business sophistication	110	3.5
Innovation	86	3.1

Stage of development

1	Transition 1–2	2	Transition 2–3	3
Factor driven		Efficiency driven		Innovation driven

—O— Iran, Islamic Rep.   —O— Middle East, North Africa, and Pakistan

The most problematic factors for doing business

Access to financing	16.9
Policy instability	13.0
Inflation	13.0
Inefficient government bureaucracy	11.5
Inadequate supply of infrastructure	10.6
Corruption	7.9
Foreign currency regulations	7.3
Restrictive labor regulations	5.6
Poor work ethic in national labor force	4.0
Inadequately educated workforce	3.5
Tax rates	2.0
Tax regulations	1.8
Insufficient capacity to innovate	1.5
Crime and theft	0.7
Government instability/coups	0.5
Poor public health	0.2

Percent of responses

Note: From the list of factors above, respondents were asked to select the five most problematic for doing business in their country and to rank them between 1 (most problematic) and 5. The bars in the figure show the responses weighted according to their rankings.

A further unpacking of the 12th pillar, i.e. innovation, along with two other related pillars (7th and 5th) may be worthwhile based on the focus of this study. These are outlined in the table below.

Table 1 [3.2.1.C]: WEF's GCI Breakdown 3 Sub-Categories (Pillars) for Iran (2014-2015)

WEF GCI 2014-15: **12th pillar** on **innovation**	Value (/7)	Rank (/144)
12.01 Capacity for innovation	3.5	94
12.02 Quality of scientific research institutions	**4.1**	**45**
12.03 Company spending on R&D	2.7	110
12.04 University-industry collaboration in R&D	3.2	102
12.05 Government procurement of advanced technology products	3.2	91
12.06 Availability of scientists and engineers	**4.4**	**46**
12.07 PCT patents, applications/million population	0.1	105
WEF GCI 2014-15: **7th pillar** on **labor market efficiency**		
7.07 Reliance on professional management	3.1	132
7.08 Country capacity to retain talent	**2.5**	**125**
7.09 Country capacity to attract talent	**1.8**	**140**
WEF GCI 2014-15: **5th pillar** on **higher education and training**		
5.02 Tertiary education enrollment, gross %	**55.2**	**50**
5.04 Quality of math and science education	**4.5**	**44**
5.08 Extent of staff training	3.0	135

A further examination of the above scores, from the three sub-categories (pillar 12 on innovation, pillar 7 on labour market efficiency and pillar 5 on higher education and training) confirms the Iranian firms' difficulties in implementing Florida's *3T model (talent, technology and tolerance)* as a sustainable mechanism.

In the analysis and descriptions outlined in previous sections, it has clearly been indicated that the current state of the technology and social/societal tolerance are mediated by the policy ambivalence.

The issue of talent, which is generally seen as a strength factor by various accounts in the literature, is further unpacked here: as the above scores indicate, whilst the Iranian higher education, especially those in scientific and technology related courses, train many scientist and engineers, within a reasonable quality range, it is not easy to see how the brightest talents could be retained in or attracted into the country. Historically, discussions of 'brain-drain' in Iran, and possible causes and remedies for it, have been highly contested. This provides a further challenge both for smaller firms and for new emerging sectors such as the creative sector, to retain and develop their skill sets and sectoral expertise.

3.3 Concluding remarks: Tehran's fledgling Creative ICT enabled Sector

With a current population of over 10.2 millions in the city (and 15.8 millions in the metro area), Tehran is a buzzing city, as the largest such entity in the West Asia region, with many of Iran's instruments and institutions of government, as well as national top universities, contemporary art, science and technology hubs, placed in it. Without a significant sectoral cluster structure, the ICT sector is dispersed (Dadashpoor and Allan, 2007) and even more so is the emerging creative sectors.

There is no 'Tehran Valley' in Tehran, as a geographical areas or clustering such as Silicon Valley, California and Route 128 around Boston in Massachusetts, or new media and technology hubs in big city districts such as Hollywood, Los Angeles; Silicon Alley, New York City; and in East Asia. 'Teheran Valley' (an older version/German-spelling of the city's name) is the colloquial name for the area around 'Teheran Boulevard' in Gangnam district of Seoul, South Korea (테헤란로 – 'Teheran-ro') which is generally viewed as South Korea's equivalent to 'Silicon Valley' and 'Silicon Alley' combined. The name originates from 1976, when the Seoul Metropolitan Government suggested that the city of Seoul, South Korea and Tehran, Iran exchange the name of two streets, as a sign of friendship and 'sister city' agreement, on the occasion of an official visit by Mayor of Tehran to Korea. Conversely, there still exists a prominent street, now seen primarily as an uptown residential area of north Tehran, called 'Seoul Street'.

The lack of a clear cluster, an Iranian Gangnam district type for example, is insufficient proof however to deny the existence and rapid emergence of the sector, although not geographically clustered. It is in this sociological and network space that small firms step into, to carve out a niche area for themselves and in so doing, make a living by learning to innovate.

This chapter, building on and further fine-tuning the focus of chapter 2, has outlined a number of themes related to the contextual settings of the research. Whilst circumscribed in its coverage, in line with thematic and episodic themes described, the chapter has attempted to provide a narrow and in-depth review and analysis on selected themes, to outline the context of the study.

The thesis will now move on to more conceptual issues around learning and innovation, and methods and methodologies, before returning to the context of the research. The issue of clustering, and prima facie evidence (or lack thereof) will also be returned to in the concluding chapter.

Chapter Four: Perspectives on innovation in firms

Building on the contextual account of Iran described in the previous two chapters, the aim of the next two chapters is to offer a focused view on the key debates around the role of innovation and learning, and with it the associated skill enhancement, in pursuit of business development and sustainable competitive advantage. These will be outlined, where possible, with particular reference to actual practices in small enterprises, particularly new technology-based firms, leading to developing the analytical means of capturing some of the significant factors within, and emerging out, of the study.

This and the next chapter, namely chapters four and five, in conjunction with the previous contextual and operating environment settings, provide the theoretical material which the last section in chapter five will draw upon in moving towards constructing an analytical framework. Chapter six will subsequently move the argument on, by initially dealing with methodological issues, followed by describing and examining the empirical inquiry.

It is thus important at this stage in the thesis to take a considered look at selected debates about innovation as a key factor of business development that has occurred predominantly in the North American literature and by extension, the British (and in parallel, continental European) literature, over the last three to four decades.

This is necessary in the context of this study as these ideas, as well as being highly influential in the Western academic literature, policies and firms' operations have also widely infiltrated to the thinking and practices of developing and emerging economies, with transitional market conditions, such as those of today's practices in Iran.

Additionally, the underlying rationale of these ideas, whether from management, economics, organisations and innovation studies, and economic geography, have in the past been, and continue to be, heavily drawn upon by Iranian scholars, practitioners, policy makers and planners.

The chapter is structured as follows: an introductory synopsis (4.1) opens the discussion before attention is turned to different perspectives on innovation in the firm (4.2), where I have offered a highly circumscribed review, considering Schumpeter's classic work on the macro level before

moving to subsequent theorisations on the importance and challenges of knowledge mobilisation on the level of the firm. I next consider strategies to 'mobilise' knowledge and skills (4.3) by means knowledge brokerage and 'bridging and bonding'. The last part of the chapter (4.4) considers collaboration in aid of innovation in a distributed mode, specifically utilising the concepts of knowledge brokerage and 'skill webs', as a way to familiarise the reader with the accumulative themes of the literature, appearing in the text.

By the end of this chapter and in preparation for the next chapter and the detailed discussion on advances in learning[59] in and across projects, the multi-faceted concept of innovation, operationalised at different levels, is unpacked.

Schumpeter's seminal contributions are highlighted whilst providing a circumscribed overview of the literature and a selective look at other scholars' work that have either continued the trajectory of his thoughts or varied it in some way is outlined.

The concluding section of the present chapter will endeavour to pull together different strands, as a bridge to the next chapter which considers the significance and characteristics of workplace learning, collaboratively and in a distributed mode.

This should then pave the way for forming and justifying the conceptually derived analytical framework outlined at the end of chapter five and the appropriate methods for provoking an empirical inquiry, outlined in chapter six.

4.1   Key strands

Two broad streams have emerged from the business and management literature which are of direct relevance to the theme of this thesis: these are the issues of innovation and learning with associated skill enhancement, bounded by the firm's business strategy in pursuit of sustainable competitive advantage, and at a more specific level, innovation and learning in small and medium enterprises (SMEs, including new technology based firms) engaged in collaborative relationships, facilitated by technology-oriented projects.

As a comprehensive overview of themes is clearly beyond the scope and the requirements of this text, a cross selection of core concepts and studies are presented on the basis of their appropriateness and relationship with the remit of this work. An initial key observation about a discussion on these strands is that they have traditionally been dealt with separately in the Western literature, as dictated by the respective cross-disciplinary scholar and practitioner communities, although increasingly within that literature, as well as in practice, the power of the ideas is only realised and released when they are used in combination.

The concept of innovation has changed and evolved significantly over the last fifty years, as up to the 1950s, it was broadly viewed as a discrete development brought about by experiments and studies undertaken by isolated researchers, and insulated scientific and engineering research (R&D) units. In our current era, innovation is generally viewed as a process, requiring joint activity, often in a distributed and networked mode of operation.

The innovation literature is vast and fragmented, an issue which is expanded upon in later sections. I have thus chosen to confine my coverage to a circumscribed view of pertinent themes, congruent with the context and the content of the study. These strands include learning issues enhanced by project interactions in technological innovation, where possible, specifically within the practice of distributed global software development and the internationalisation of the creative sector.

There are various and wide-ranging definitions for technological innovation. As this study examines technological innovation in the form of product innovations[60] intended for the professional and consumer markets, I have anchored my discussions around a broad definition, outlined as successful implementation of a technical idea that is novel for the developers and users of the innovation (cf. Branscomb, 2001, p. 15498).

Technological innovations have significant and long-lasting effects on the macro level of governments and public policy usage of technology, and the more micro levels of firms and personal usage. On a macro level, in most developed and emerging economies, a significant sum of public funds are devoted to areas of science, technology and research and development (R&D), on a local, regional, national and supra-national (e.g. EU, OECD) level. This is due to these activities being viewed as core factors of medium to long-term economic competitiveness and

growth (OECD, 2011, 2010a, 2010b, 2004, 2000b, 1996; OECD and Eurostat, 2005; Toner, 2011) and entrepreneurial activities and (somewhat disputably) job creation (Pianta, 2005).

Equally, on the micro level of the firm, achieving technological innovation is viewed as a core activity to many firms as the introduction of innovative products and services increases demand for, or service experience of, their products and services offering the potential for sustainable competitive advantage (Cohen and Levinthal, 1994; Hamel and Prahalad, 1994; Kim and Mauborgne, 2005a, 2005b; OECD and Eurostat, 2005; Porter, 1991, 1990, 1985).

Such is the importance attached to, and the growth of the interest in technological innovation, that during the last four decades, the topic has been widely examined by multiple disciplinary lenses, inter alia, engineering, economics, management studies and sociology (of technology). In the emerging intersections, the research undertaken from a primarily social science perspective on innovation is broadly labelled as innovation studies. This domain has grown rapidly and significantly creating its own terminology and frameworks, textbooks and scholarly journals, consultancy firms, research centres and regional hubs (and in some countries, even named government department units).

Beyond the hype and aspirations to examine the 'magical role' attributed to innovation in economic and social change, after decades of work, innovation studies lack internal coherence even on basic concepts and is more accurately described as a mosaic of approaches rather than a cohesive research field of inquiry (cf. Fagerberg, 2005; Fagerberg and Verspagen, 2009).

Whilst this lack of coherence in innovation studies is comprehendible and may be somewhat justified, based on the nature and relative youth of the field, it situates the researcher in a complicated maze. The complexity and speed of change of the research subject (i.e. current practice of innovation in firms) commonly acts as a moving target and as a result, the innovation research is often somewhat behind the emerging trends.

Whilst the importance of cross-disciplinary dialogue is widely emphasised and recognised in innovation studies (Fagerberg, 2005, p. 21), the domain has gained internal self-sufficiency, and as such, broadly obeys by newly created disciplinary norms and boundaries, avoiding serious engagement in cross-disciplinary dialogue. In short, it pays scant attention to developments in other disciplines and operational fields.

To add to the present weaknesses of cross-disciplinary dialogue, innovation studies is hampered by the asynchronous development of theoretical elaborations, often based on single empirical observations or in some cases, mathematical/computer simulations.

A prime example of such state is the concept of learning at the level of the firm in innovation studies which has attracted some theoretical attention, and a few replication studies, but without recently updated nuanced empirical and/or practice-based foundations.

My approach in this study therefore reaches across a number of themes and domains, in an effort to answer the call for a genuine cross-disciplinary dialogue, at least in the modest undertaking of this research, whilst realising, but not succumbing to 'analysis-paralysis' condition brought on by, the scale and scope of the challenges.

Viewing innovation as a process, a strand of research has conceptualised technological innovation in firms as a problem-solving process (Dosi, 1982) and has highlighted that the learning and knowledge base of technology is embedded within the social context and content of that technology (Tornatzky and Fleischer, 1990, pp. 11–18). The work of Tornatzky and Fleischer (ibid) reviewing significant trends in a number of studies up to two decades ago, additionally highlight the nonlinearity characteristics of the process, as well as the research challenge of identifying an appropriate level of analysis (who, what and where under which circumstances) in innovation research, mindful of the fact that:

> "Each… categories of units [of analysis] has its own innovation literature, and each can tell us something about the process. There is no uniquely "correct" level of concentration" (Tornatzky and Fleischer, 1990, p. 33) [while immediately afterwards offering a cautionary lesson in an endnote that states that despite their earlier assertion] "relationships… may appear attenuated if one uses an inappropriate level of analysis." (Tornatzky and Fleischer, 1990, p. 50 - Endnote 3)

Initiating, carrying out and maintaining innovation is an inherently unpredictable endeavour. The required multi-level learning and feedback, as well as assimilation and generation of new solutions and a prediction of the success rates, are tasks with exceedingly high levels of uncertainty (Pavitt, 2005a, p. 88) and these are further compounded in catching-up and emerging economies (Bell and Pavitt, 1993). As the innovation journey (Van de Ven et al., 1999, pp. 170–172) is uncertain and nonlinear, and the fundamental features of value proposition and strategy

are shifting in the emerging knowledge-based economies (Kim and Mauborgne, 2009, 1999), it may be more appropriate to conceptualise the innovation processes in terms of 'episodes'.

My contention, based on a theoretical literature and the empirical elements of this study, is that 'episodes' rather than 'stages' in the practice and process of innovation, and more specifically 'learning episodes' in a distributed mode of operation, offer a unique and worthwhile lens for investigation, concurrently as a theoretical concept and an empirical unit of analysis.

Whilst I may have refined and re-interpreted the concept, the use of 'episodes' to refer to a unit of analysis for learning is not new in the innovation literature[61] especially in distributed project activities, where the 'performative' nature of learning (Säljö, 2010) provides the firm with the stabilisers to compete in a changing market.

4.1.1 An emerging 'small world' pattern

Within the process and practice of innovation in firms, I propose that learning is increasingly viewed[62] as enhancing skills for 'connectivity and interactivity' often enhanced digitally, with an emphasis on the importance of horizontal structures, and moving from 'presumed authority to collective credibility'. This also reinforces the need for lifelong learning in interprofessional interactions, such as when problem-solving, forming opinions and making professional judgements.

Based on the empirical aspects of this study, it was soon apparent that a 'learning cycle' vacillates between the exploration and exploitation phases of projects (March, 1991). This further identified and thus highlighted the 'learning episodes' as a unit of analysis, utilising knowledge brokers to enable knowledge 'creation'/'translation' mechanisms, together with networking opportunities (Boden and Avram, 2009; 2003, 2002; Hargadon and Sutton, 1997; Pittaway et al., 2004; Thorpe et al., 2005), as well as cross-border knowledge sourcing strategies (Huggins et al., 2010), which are particularly important to micro new technology-based firms (NTBFs)[63] in technical and non-technical challenges.

It was also noted early on that new technology-based firms in developing economies, such as Iran, when endowed with skilled, technology savvy and connected teams, in other words with a

high level of social capital and absorptive capacity, tend to mimic MNC/TNCs' 'skill webs' and associated brokerage processes, in order to survive and prosper.

In interprofessional problem framing and problem solving, such as innovating, 'connectedness'[64] is paramount. New technology, especially the evolving generations of the World Wide Web applications and its convergence with mobile devices, is enabling an unprecedented number and variety of individuals to contribute information, knowledge/s and expertise, by authoring and analysing content and data individually or collaboratively and by helping one another directly via online means (Adamic et al., 2010). This is where and why knowledge brokerage and sourcing, in various applied forms has become an emergent and promising subject for studying innovation.

Networked team and group learning processes at work, recently labelled as 'teaming' by Edmondson and colleagues (Edmondson, 2012a, 2011, 2008, 2002; Edmondson et al., 2009; Edmondson and Nembhard, 2009), are amongst such developments.

It is a move towards the [re-]development of a process view of innovation in firms and the required synthesis, which takes us to the next section of the chapter.

4.2 Firms as a site of innovation

This section continues to take a circumscribed view[65] of the previous core literature by starting with the seminal contribution of Schumpeter (4.2.1) and the mainstream literature on innovation. At the end of the section on Schumpeter's work, a number of issues loosely around three inter-connected points as a critique to Schumpeter's legacy are raised, and selected other authors are introduced who have attempted to move the argument on.

In order to front-load my argument, it is worth mentioning that with specific reference to this thesis, my three-fold critique of Schumpeter's work (and the trajectory of his conceptual legacy), is briefly as follows. Firstly, Schumpeter's work took technology and technological development for granted, and thus, underplayed the 'process orientation' of innovating, which meant that, secondly, he skated over the role of learning that enables and facilitates innovation. Third and finally, although there are strong historical traces and insights in his work, he could not have anticipated the extent to which globalisation would lead to organisations working ever more closely with one another and/or becoming networked with one another, as part of growing global value-chains and joint market-, and product- and service-activities.

Building on the cumulative discussions, the end of this section will then return to pay particular attention to the role of knowledge and skills, and their mobilisation and transfer, as a core process in innovating.

4.2.1 Schumpeter on innovation and entrepreneurship: a brief overview

On a theoretical level, the social scientific study of change has shaped an important part of social sciences, and our understanding about the relationship between technology and the economy. The role of innovation in macro-economic change was the focus of the early studies[66], at the dawn of both market and Marxist economic thoughts. As this thesis is not about the historical roots of the concept of innovation, it does not examine these factors in any depth: it does however attempt to use a number of ideas about the current debates on innovation, to assist in unpacking and then tackling the underlying questions.

The macro-economic conception of innovation and business cycles were expanded in the work of Schumpeter and Kondratiev, in the early parts of twentieth century. Schumpeter (1883-1950), an Austrian-American economist with previous work and professional experience of business and policy in Europe before migrating to the United States, observed that economic development occurs as a result of drastic external and internal changes to existing routines and is primarily caused by innovation.

Innovation[67] is viewed as a disruption consciously driven by organisations and individuals, which is characterised by new combinations of economic resources. Additionally, he was one of the first scholars to provide a fuller definition of innovation and it was Schumpeter who first drew links between 'the market' development and the role of, while emphasising the position of entrepreneur, initially as an individual and later as a specialised function (such as in R&D teams) (1950, 1943, 1939, 1928, 1926, 1911).

In his early definition and review, Schumpeter did not explicitly refer to technology or services, whilst clearly these could well be a feature of innovation in terms of new product and methods of production; new sources of supply; new markets; and/or assisting firms in organising in a productive manner.

Conceptualising within the economic and institutional environment of the first half of the 20th century, Schumpeter explicitly highlighted 'innovation' as "keeping the capitalist engine in motion"[68]. Schumpeter suggested innovations to be imperative for economic growth, commercial profit, and thus, public wealth. Schumpeter's theory has subsequently been developed by neo-Schumpeterian economists[69] as well as contributions from diverse disciplines have complemented and refined the modern theory of innovation.

During the course of the development of the theory of innovation, scholars with different approaches including the classical economists, the Marxists, the neo-classical theorists, the Schumpeterians, post-Keynesians, and post-Schumpeterians have made significant contributions.

Nevertheless, two characters in the history of innovation emerge[70]; Adam Smith by laying the foundations of the classical understanding of technical change and economic growth and Joseph Schumpeter by challenging Smith's views with a dynamic theory of economics based on cycles

of innovation. It is worth recalling that Smith (1776) was essentially the first classical economist to study technical change and its impact on economic growth, believing that economic development is a gradual, self-perpetuating process. He built his theory on the eighteenth-century doctrine of natural law and asserted that, within the control of the natural legal system, each member of the society is free to pursue his self-interest, resulting in a harmonious, beneficial economic order. Thus according to this line of thinking, development has a tendency to become cumulative, which results in an increase in saved capital, described as 'Capital Accumulation', which is a fundamental element in economic development and an increase in the extent of the market, eventually resulting in an increase in national income and growth in population (Smith, 1776; cf. Meier and Baldwin, 1957). Smith's classical theory mentions developments resulting in 'improvements in art' which in turn, lead to further specialisation and productivity gains (Meier and Baldwin, 1957).

Schumpeterian analysis, on the other hand, brings a different perspective to Smith's classical theory, providing a comprehensive and provocative analysis since Marx of the economic development and social transformation of industrialising capitalism (Elliott, 1985). In essence, Schumpeter, as an influential theorist on innovation, broadly rejects the classical and neo-classical explanation of economic development as a gradual, harmonious process. Instead of a gradual and smooth manner, Schumpeter suggests that development occurs, if and when there is a high degree of risk and uncertainty[71] in an economic environment (Meier and Baldwin, 1957).

Schumpeter explains an 'equilibrium state' in an economic environment with the 'circular flow' principle (Schumpeter, 1954; Hospers, 2005). According to 'circular flow', there is a static equilibrium represented by a constantly repeating circular flow of money and goods. The only events in this economic environment are routine changes to which producers and consumers can easily adapt themselves. Schumpeter's dynamic theory outlines a disturbance of equilibrium of 'the circular flow' in a constantly growing, static economy by 'clusters of innovations'.

Schumpeter believes that, there is little possibility of profiting in the equilibrium state and innovations are essential to make profit. Accordingly, innovations increase the economic activity by activating other innovators and in Schumpeter's definition, 'entrepreneurs'. This economic activity reaches a mature state and alleviates itself, and hence economy returns to the state of equilibrium. Thus, Schumpeter believes that innovations lead to the development and growth of the economy, and eventually to prosperity and wealth.

According to Schumpeter (Schumpeter, 1943, p. 83), innovations are the driving forces leading a capitalist economy run. He (ibid) poses

> "the fundamental impulse that sets and keeps the capitalist engine in motion comes from new consumer goods, the new methods of production or transportation, the new markets, the new forms of industrial organization that capitalist enterprise creates".

In Schumpeter's 'theory of economic development', innovations stimulate and potentially create a new wave of other innovations (constituting 'clusters of innovations'), hence opening new profitable opportunities, obtaining profit and growth in the economy, and finally resulting with an enhancement in the public's standard of life. Schumpeter (1943, p. 68) suggests that each cluster of innovation, subsequently appearing, act as

> "…an avalanche of consumers' goods that permanently deepens and widens the stream of real income".

Examining the avalanches of consumers' goods, it is possible to identify that each of them consists of articles of mass consumption and increases the purchasing power. In other words, the argument suggests that the capitalist process, not by coincidence but by virtue of its mechanism, progressively raises the standard of life of the masses.

The question of economic development and key contributing factors within it, namely innovation and entrepreneurship, is central to Schumpeter's contribution. In his two seminal publications of *Theorie der Wirtschaftlichen Entwicklung* (1926)[72] and *Capitalism, Socialism and Democracy* (1943), he addresses these issues.

Reflecting the climate of the era, Schumpeter attempts to question the viability of capitalism and whether such system can survive the rapid onset and uptake of socialism (ibid). At a historical juncture, when capitalistic democracy in the West were seriously challenged and threatened by economic crisis and alternative socio-economic governance models, Schumpeter argued that capitalism will in time, inevitably disappear. This was based on what is now a seemingly erroneous assumption that capitalism will not evolve or renew itself in the way that it has.

Paradoxically, it was the robustness and significance of entrepreneurship, examined, explored and advocated in his own work that came to ultimately derail his theoretical trajectory on the future of

capitalism. It is also worth noting that whilst Schumpeter's conceptualisation on innovation is still widely used and to a large extent, underpins contemporary theorising and policy-making, his work is not, nor could it expect to be, in tune with the currently emerging knowledge- and learning-based economy realities.

Two important points are worth drawing out with reference to Schumpeter's work. Firstly, Schumpeter shifts his position with reference to innovation and entrepreneur (and by extension, individual entrepreneurship). Whilst in 1926, he defines entrepreneurship as a critical and key function of innovation, in 1943, that is no longer the case. In his earlier writing, an entrepreneur is a person who brings about new combinations and yet no one is considered to be an entrepreneur, by profession, as it is not seen as a permanent state. Hence a person, who continues to re-formulate new combinations in a routine manner, is not an entrepreneur (Schumpeter, 1926, p. 116).

In his 1943 text however, contrary to his 1926 assertion, the entrepreneur is no longer viewed as a key component of innovation as by then, the entrepreneurial function is seen to be performed by a team of specialists such as in corporate R&D settings.

The second point deriving out of above is that whilst Schumpeter may have swung the proverbial pendulum too far, by foregrounding the role of corporate R&D in favour of an 'entrepreneurial mind-set' at both the individual and group level of the firm, he does raise an important distinction and a shift in his model. The shift is one of 'undertaking' and is as follows: innovation remains a process of making new combinations albeit now by a team of specialists, due to the complexity of the processes, rather than individual entrepreneurs and therefore becomes a social process.

With reference to this thesis, this is a significant transition: whilst not explicitly labelled as such, as early as 1940s, innovation is viewed as a partially planned[73] social process and the chasm between invention and innovation becomes increasingly apparent. Furthermore, as the entrepreneurial function is performed by a team of multidisciplinary specialists, the role and process of interaction takes centre stage in developing and harnessing the 'knowledgeability' required for innovation.

In sum, Schumpeter was the first economist to place innovation at the centre of economic theory. As he observed, innovation is itself an act of creative destruction and the introduction of new

economic artefacts and the generation of new knowledge that underpins them, destroys or invalidates pre-existing knowledge bases[74]. In Schumpeterian thinking, the benefits of innovation (creative destruction) are due to its firm-specific nature and its ability to exclude others from those benefits.

Schumpeter also explored the link between innovation and the cyclical pattern of macro-economic development and growth (which was introduced much earlier by Kondratiev), asserting that each cycle is closely associated to a key invention and its subsequent innovation. Scholars who adhere to this line of thinking (Perez, 1985, 1983) maintain that the Western economies are now in the fifth Kondratiev cycle, based upon the new information and communications technologies.

While macro-economic concept of innovation was the focus of the nineteenth century and early part of twentieth century's studies, the trends shifted in the latter half of the twentieth century and the first decade of 21st century. This has resulted in a greater emphasis upon meso- and micro-economic implications of innovation and entrepreneurship, together with a broadening of its disciplinary foundation to include and encompass different perspectives. An enduring question has been to examine the relationship between the macro, meso and the micro, by means of exploring the impact of the macro-economic framework upon the micro-level behaviour of individual firms. A stream of key studies here has been those concerning the links between the competitive environment and the priority for firms to innovate in order to gain and retain competitive advantage (Porter, 1985), leveraged on technological progress (Gomulka, 1990).

Turning to some of the subsequent work, it is worth to briefly highlight the contributions of Solow, Romer, Nelson and Winter, and Lundvall.

It was Solow (1956, 1957) who first acknowledged the technological dimension of innovation and who propagated the idea of technological change as the single most important contemporary component of long–term economic growth and development. He further specifically suggested that a steady state rate of growth depends on the rate of technological progress and the rate of investment in technology. In pure economic terms, Solow argued, innovation comprises of the ability to extract greater economic value from advances in science and technology.

Romer (1990) along with others (e.g. Grossman and Helpman, 1991) extended Solow's analysis by introducing and exploring the 'endogenous' views of innovation. The core argument in the 'endogenous' approach propagates the view that the acquisition of technology on its own is not sufficient to explain why economies, industries and sectors grow at different rates. Thus, the endogenous view of innovation proposes that institutional intermediation, i.e. acts by institutions such as governments, agencies, universities and research centres, as well as firms, make significant contributions in the process of technological change. These could include policies on investment in education and training, work-based learning and development, and subsidies and incentives to encourage research and development (R&D) in the public and private sector.

Technological progress and the resultant effect on innovation are thus viewed as not only an economic issue, but also as a social and societal phenomenon. Therefore, the endogenous view accentuates the importance of the role of human capital in the production process of new technologies.

Seminal work by Nelson and Winter (1982, 1977) also supported and extended the endogenous theory of innovation, as they emphasize the key role of institutions such as governments in delivering the necessary resources (and creating the operating environment) for innovation to occur, and more importantly, succeed.

In a parallel and yet associated development, systems of innovation literature, started to appear and be taken-up more seriously from this point (i.e. early 1980s) onwards, leveraged on earlier work on systems at RAND and OECD, and mainly propagated especially at early stages, by Lundvall (1985, 1988; cf. Godin, 2009; Gault, 2010).

Finally, as a review of the innovation corpus (Storey and Salaman, 2005) accurately observe, there are numerous, often overlapping literatures that may be relevant to the analysis of innovation, as well as an absence of an easily definable shape to the literature.

The position with the core role of knowledge is however clearer (Storey and Salaman, 2005, p. 16), as:

> "many analysts regard innovation as application of knowledge […] not only does innovation derive from the application of knowledge but new knowledge can also be created during the process of innovating. It follows that learning - by individuals, teams and

organisations - is also highly relevant.[…] the study of the management of innovation invites us to explore the interplay between many of the most lively and enticing current issues - and allows us to draw upon some enduring classical works and insights."

Remaining conscious of, and operating within a knowledge-based approach to the firm, 'networking' activities to assist and aid collaboration for innovation have been significantly examined in recent decades (cf. Powell et al., 2005, 1996). In offering an overview, Pyka (2007, p. 370) summarises the position, with three major implications as follows:

> "First, [innovation networks and networking, are] … an important co-ordination device, enabling and supporting inter-firm learning by accelerating and supporting the diffusion of new technological know-how. Second, within innovation networks, the exploitation of complementarities becomes possible, which is a crucial prerequisite to master modern technological solutions characterized by complexity and a multitude of involved knowledge fields. Third, innovation networks constitute an organizational setting which opens the possibility of the exploration of synergies by the amalgamation of different technological competencies."

This is clearly in line with earlier seminal studies (Nonaka, 1994; Teece, 1986) that have highlighted the challenges of the innovation processes, and the robust collaborative means and structures required built within the processes, in large as well as smaller firms. In essence, these early studies highlight that successful innovating require complex forms of business organisations which do not thrive in isolation, but must formulate and sustain generative linkages to others, upstream and downstream, laterally and horizontally.

4.2.2 Learning, knowledge and skills as core resources

Having outlined the trajectory of ideas on innovation in a circumscribed manner, I will now return to examine some of the issues around my three-fold critique of Schumpeter, and by extension, some of the subsequent theorisation. This is of relevance to this thesis and worth some in-depth exploration, so as to highlight a key point on the collective nature of innovation and entrepreneurship, and the role of learning processes within that.

Learning in firms, building upon and utilising the knowledge and enhancing skills in firms' activities, is viewed as an essential factor to increase capacity for innovation. The resulting innovation in turn, is considered as one of the current key issues in sustainable competitive

advantage and with it, business development strategy. In other words, leveraging on the knowledge and skills embedded in firms' activities and resources, innovation is viewed as the creative affordance and commercial embodiment of learning.

Thus my starting position, supported and expanded upon later in the text, is that *innovating* is a complex, socially-mediated and context-specific activity and one that ultimately, within the business environment of small new technology-based firms, needs to provide rapid solutions and results. To substantiate this claim, I initially discuss some broad themes about innovation, building on previous discussions before turning to selected authors who are widely deemed to have made major contributions to the scholarly analysis of innovation.

Based on my focus and definition of innovation, I am not turning to the mainstream literature on innovation, either from a theoretical or practice-based orientation. Instead, I mobilise ideas from scholars who have looked at the relationship between innovation and learning, specifically within the context of the emerging knowledge-based economy. This mode of engagement allows me to actively retain the issue of learning within innovation literature and to keep the argument iteratively grounded.

Thus, Guile's (2010b, 2006, 2005) examination of learning and knowledge and its 'new' role in the economy, as well as the emergence of 'joint learning ventures' (Guile and Fonda, 1999; Fonda and Guile, 1999), as a model outlining 'new learning for new work' moving away from a 'command and control' metaphor towards a 'joint venture', acts as an initial point of departure for considering the issues around innovation and learning.

I retain the notion of inquiry from Schön and Dewey (expanded upon further in the next chapter on learning). This is however, by and large, an inquiry within a professional or domain-specific field: the importance of learning to inquire and framing appropriate questions. In addition to Schön and Dewey's contributions on inquiry, I utilise Guile's more recent and contextual work, as a set of guiding principles. Whist Guile (2010a, 2010b, 2006, 2005) draws on social scientists, including prominent management and social theorists to outline a set of principles in dealing with the learning challenges of the knowledge economy, my intention is to explore those further within the specific context of innovation and skill enhancement[75]. In my effort to explore the implication of these, I later draw upon a set of other authors who have written about and formulated concepts and ideas, specifically on innovation in firms.

Writing on the role of tacit knowledge in new product and service development, Guile (2010) offers a nuanced analysis on pertinent theories of the firms' position as "sites for knowledge production". His study draws on management and organisational development literature and mobilises Lundvall's concept of *learning economy* (1996; 1994) whilst drawing on other key contributors to the debate (Gibbons et al., 1994; Nonaka, 1994; Nonaka and Takeuchi, 1995; Nowotny et al., 2001; Zuboff, 1988; Zuboff and Maxmin, 2003; Zuboff, 2010).

In such context[76], Guile (2010b, p. 33) refers to innovation as;

> "a process of problem identification and problem-solving that occurs inside firms and this constitutes a major basis of firms' knowledge-producing activities."

Additionally, writing about the distinctiveness of the knowledge economy, and specifically the epistemological dimension of firms' activities, Guile (2006, p. 357) further reveals that

> "The idea that firms constitute sites for innovation is not an entirely new proposition. Writers in management science such as Drucker (1969), Penrose (1959) and Nelson and Winter (1982) first pointed out in 1960s that firms were repositories of quite specific types of knowledge which they to a greater or lesser extent were able to exploit successfully."

As previously indicated, there now exists an enormous, and ever increasing, amount of literature on innovation. Within innovation studies, the proliferation and fragmentation in the literature is highlighted by the field's scholars in handbooks, such as Fagerberg (2005, p. 1, 3 and 4) when stating:

> "Research on the role of innovation in economic and social change has proliferated in recent years, particularly within the social sciences, and with a bent towards cross-disciplinarity. […] Hence, to get a comprehensive overview, it is necessary to combine insights from several disciplines. […] Today, the literature on innovation is so large and diverse that even keeping up-to-date with one specific field of research is very challenging."

In defining innovation in this thesis, two pertinent factors emerge regularly. These are *novelty* and *utility*: referring firstly to the fact that there often is an element of (relative, if not absolute) newness in the application of the innovative idea and secondly, it is utilised (actualised and/or utilisable) and taken-up in practice.

It is in fact the essence of the latter point that broadly distinguishes an *invention* from an *innovation*, and the strong and ever-present commercial relationship between novelty and utility, required in a successful implementation of an innovation that distinguishes it from discussions about *creativity* in firms.

In order to grasp and streamline the complexity of the innovation literature, scholars engaged in reviewing the organisation and management studies corpus (e.g. Osborne and Brown, 2005, p. 117) have clustered a number of themes which address the sub-topics of innovation as related to:

1. the nature of innovation: theoretical background and approaches to defining and classifying; plus issues of agency, structure and outcome (*innovators, innovating and innovation*)

2. the characteristics of innovation: design attributes of innovation and the management of innovation processes

3. the attributes of innovative organisations: structure, internal culture and management/leadership, and relationships with external environment

4. and lastly and recently of intense interest in policy circles, attempts at creating unified theories of innovation, such as *systems of innovation* (often categorised around international, national, regional and sectoral level), first introduced by Freeman in mid 1980s as a conceptual framework which identifies and examines a variety of factors (including learning) influencing innovation (Freeman, 1987; Lundvall, 1988, 1992; Edquist, 2005).

Whilst this study's exposition draws to some extent on all four streams highlighted above, it is mainly factors around the second strand, i.e. innovation processes and design attributes, at a firm level, that are dealt with in depth.

This focus is further supplemented by the key insights of established scholars within the field (e.g. Dodgson et al., 2005; Tidd and Bessant, 2009) who clearly point to the importance of 'context' in understanding innovation and innovation management processes. As Dodgson et al (2005, p. 27) cogently argue, for innovation, as an outcome and/or process, to be understood, a series of three interconnecting principles must be recognised,

"that
1. innovation has to be located in a historical context
2. innovation is not a discrete event or activity, but results from, and contributes to, a range of systemic relationships and interdependencies;
3. innovation is socially mediated and results from organizational, managerial and individual practices and decisions."

Before concluding this section, it should be pointed out that the historical and contextual elements were also evident in Schumpeter's original insights, but these were gradually faded in subsequent work and repositioning (cf. Jones and Wadhwani, 2006).

Schumpeter's great insight, even though it potentially has a high cost for individuals, communities and societies, is the cyclical notion of creative destruction; which pulls apart structures, systems and processes (as well as markets and the required skills and knowledge to compete in those markets), which were once in place. Schumpeter did not have a remit, or an opportunity to look at meso or micro level issues on how learning processes occur as a result of creative destruction. His work and the subsequent reading-off of his work in economics and innovation studies had till recently, for many decades, played down the processes involved, particularly those around learning.

4.3 Strategies to develop and mobilise knowledge: brokerage by bridging and bonding

In this section, we will direct our attention to exploring some of the ways and means utilised in firms to develop and mobilise the required knowledge and skills, broadly via learning, for innovation.

As outlined previously, my three-fold critique of Schumpeter's work, and the subsequent trajectory of his conceptual legacy is that, firstly, his work took technology and technological development for granted, and thus, underplayed the 'process orientation' of innovating. This lead to, secondly, his theorisation underplayed the role of learning that enables and facilitates innovation. Finally, he could not have anticipated the extent to which globalisation would lead to organisations working ever more closely with one another and/or becoming networked with one another, as part of growing global value-chains. Whilst remaining cognisant of all three of these factors, I will retain my focus on the issue of learning in the remaining sections, further expanded in the next chapter.

Later in this chapter, I will draw out issues around knowledge brokerage, as an umbrella term for a range of performative-learning activities undertaken in firms to aid innovation. An additional reference to the 'small world' network structures is also briefly outlined.

It is important to recall that whilst learning is a common research subject within the innovation literature, the concept of learning, at times, has taken on multiple meanings and it has developed, primarily out of the economics literature, without close connections to the conventional theories of learning traditionally derived from psychology and education (itself drawing on experimental and socio-cultural psychology, underpinned by philosophy and increasingly sociology). The systems approach developed by evolutionary economists (e.g. Lundvall and Johnson, 1994; Lundvall, 1998, 1988) is a prime example of advocating the research on learning in innovation. A number of international policy organisations (e.g. OECD and EC) and an array of publications[77] and reviews since early 1990s, have been concerned with the emergence of a knowledge-based economy (with an important, yet embedded role for learning), defined broadly as the use of knowledge to facilitate economic growth, as a key trend in Western countries and innovation

concepts. Evolutionary economists, such as Lundvall, have elaborated on this policy declaration by arguing that a knowledge-based economy would be better understood as a learning economy.

'Knowledge' is however a highly problematic term within the literature (cf. Guile, 2010b) and it is only partially available as a tradable commodity, such as in patent, copyrights and codified data on ICTs and 'knowledge management/expert' systems[78]. It is increasingly apparent that knowledge/s are acquired through social learning processes, such as in the course of know-how trading among professional colleagues (Archibugi and Lundvall, 2001, pp. 4–5), and joint activities of communities of cross-disciplinary inquiry.

There is also a shortage of tenable theories and concrete empirical studies on learning processes (Miettinen, 2002, p. 45) which becomes problematic within the policy-oriented economic research on learning. As such, maverick organisational theorists, such as Engeström, argue that any theory of learning must answer at least the basic questions of who the subjects of learning are, why they learn, what they learn and what the key processes of learning entail (Engeström, 2001, p. 133). The policy-oriented economists themselves, such as Lundvall (2004a) broadly accept and admit that the research is only now beginning to raise these questions. Additionally, Miettinen (2002, p. 45) makes a significant point that there is still some doubt on whether learning processes will be adequately analysable at all with the traditional data and methods used in economics.

Notwithstanding the key concern raised by Miettinen (ibid), the concepts of *learning by doing, using and interacting*[79], as elaborated in policy-oriented economic research may hold some promise. Learning by using was expanded by Lundvall initially in late 1980s to cover producer-user interaction. *Learning by interacting* refers to the reciprocal interaction that occurs between producers and users of a new technology during initially product, and now expanded to include, service development. The producers monitor the competence and learning potential of the users in order to estimate their capability to adopt new products and services, whereas the users gain information about how the use-value characteristics of new products relate to their specific needs (Lundvall, 1988, p. 352, 1985, pp. 13–14).

As Lundvall (2004a, 2004b) highlights, the concepts of learning by doing, using and interacting (DUI) regard learning as an unintended outcome of processes that have a different aim than learning or increasing competence. Learning is thus seen a *by-product* of processes of design and

delivery, production and use, marketing and/or innovation in 'tangible' products and 'intangible' services.

Whist the plurality of perspectives in workplace learning, at the micro and meso level (Elkjaer, 2009; Unwin, 2008; Tynjälä, 2008; Raelin, 2008; Elkjaer, 2004; Edmondson, 2002; Leadbeater, 2001; Engeström, 1999; Schön and Wiggins, 1992) are welcomed in capturing the localised and variegated nature of learning at work, a cautionary tale may be in order. I note that while the plurality in perspectives of learning, of use to innovation studies, has continued to increase from disparate disciplines, the 'mainstream' innovation studies research has built self-sufficiency in theoretical elaborations. This may be a result of the relative youth of the subject and manifested by its 'confidence' and hence the absence of a meaningful dialogue with psychological and educational theories of learning.

As a point of observation, it could also be as a result of the balkanisation of learning concepts and theorisation in psychology and education by focusing on either individual or collective units of analysis (Sfard, 1998; Säljö, 2009): an issue that recent research in pragmatism has tried to address tangentially (Elkjaer, 2009, 2004; Elkjaer and Simpson, 2011).

In the next sub-section, I proceed to offer a circumscribed overview on the pertinent ideas of networks and networking for collaboration and learning in firms, and in so doing, briefly expand upon the 'small world' networks. The last section will then conclude by linking the perspectives as resources to reinterpret and expand the remit of 'skill webs' primarily as a potent analytical (and at times, descriptive) concept.

4.3.1 Collaborating for innovation in networks

Increased intensity and velocity of international competition as well as rapid technological change are the core factors that are often mentioned as primary motives for firms to collaborate for innovation in networks (Jackson, 2008; Todeva, 2006; Yli-Renko et al., 2001; Tsai and Ghoshal, 1998). Traditionally within the organisational management and strategy sphere, one way of facilitating innovation is to engage in alliances for the exploration of new capabilities and at the same time retaining other (and at times, different) alliances for the exploitation of the existing knowledge base (March, 1991). Alliances in firms are also generally seen as increasingly important instruments for learning (Kale et al., 2000; Khanna et al., 1998). The actual process of learning in alliances basically boils down to the exchange of specialist and technological knowledge, skills and capabilities.

In order to reformulate a more refined view on learning modes within the management and organisational studies literature, I make use of March's seminal study and distinction between exploitative and explorative learning[80]. I thus lay the foundation for the next sections and chapters in which important differences between the two modes of learning (and undertaking inquiries) are highlighted, which considerably affect the way in which firms make use of their internal and external networks.

As suggested above, exploration and exploitation strategies are not just internal to the firm. Alliance networks are often used to support these strategies. In spite of the large extant literature on strategic technology alliances, authors have only recently started to focus on the use of networks for exploitative or explorative learning (Ahuja, 2000a, 2000b; Narula and Hagedoorn, 1999; Rowley et al., 2000). Most studies till recently however, have not had much interest in taking a longitudinal view on strategic change by means of networking as proposed by Freeman (1991). In addition, there has been little attention to the question of whether and how firms might be able to transform their network from one focused on exploitation processes towards a focus on exploration activities.

Seminal contributors have argued that firms pursuing a strategy of exploration for product development are most likely to establish alliances that are characterised by 'weak ties' (Granovetter, 1973, 1983, 1985). 'Weak ties' in this context imply that firms exhibit low

commitment to their alliances and can potentially team-up with non-familiar partners. When exploring a particular new technology, firms may not wish to enter into inflexible forms of alliances, as they cannot know whether the technology will, in time, prove to be useful to them. In that case, they value the opportunity to abandon the alliance, as and when necessary and without penalties. Exploration alliances are generally used when R&D efforts are aimed at the creation of radically new technologies and new procedures.

Strong ties, characterized by intimate, recurrent and trustful relationships, on the other hand are generally considered to be useful when firms aim at an exploitation strategy (Krackhardt and Hanson, 1993). In order to exploit knowledge and to make the most of established technologies and products, trustworthy and intensive relationships with partners are a prerequisite. Exploitation requires intensive knowledge exchange and the creation of economies of scale. These can be achieved in strong ties to a much greater extent than in weak ties, because only strong ties accommodate and promote the requisite intensity and reciprocity.

Hence, exploration strategies require 'lower-commitment' R&D alliances in new technological capabilities, since the focus is on learning new ideas from new partners. Exploitation strategies on the other hand will benefit from high-commitment alliances in existing technological capabilities (Koza and Lewin, 1998). In the literature, there exists some scattered empirical evidence on this matter. Some authors (Afuah, 2003; Hansen, 1999; Rowley et al., 2000) cite strong evidence that the value of strong and weak ties depends on the type of learning required at, and the external environment of, the firm; Rowley et al. for example, indicate that strong ties are particularly effective for exploitation purposes and less effective for exploration.

Elsewhere, the need for weak ties has been shown to be particularly high under conditions of rapid technological change where the need for explorative learning is predominant.

Empirically, exploration networks clearly differ from exploitation networks in two observable ways.

Firstly, exploration networks will make use of flexible legal organisational structures, whereas exploitation alliances are associated with legal structures that enable long-term collaboration. In spite of their stability and the advantages associated with higher levels of commitments in equity agreements, those ventures seem to be less well equipped to deal with strategies of exploration. In

terms of exploration, the flexibility, speed and learning opportunities associated with non-equity agreements by far outweigh the benefits associated with stability and improved commitment.

Exploration networks therefore have a preference for non-equity alliances, whereas exploitation networks can be expected to exhibit a larger proportion of equity alliances (Koza and Lewin, 1998). Joint development agreements and joint research pacts are non-equity agreements with lower levels of commitment. Agreements with a high level of commitment are equity-based relations like joint ventures. As a tangential point of observation, a measure for the extent to which a network shifts towards an exploration strategy is obtained by counting these alliance types across different time periods.

Related to above, in exploration networks partner turnover will be higher than in exploitation alliances. A number of studies (Ahuja, 2000a, 2000b, Burt, 2000, 1997; Hansen, 1999) have suggested that different contingencies require different network structures. Companies pursuing exploration strategies will change their partners more often. Exploration requires access to a diversity of knowledge and a continuous scanning of new technological opportunities. As these opportunities often arise outside existing partners, partner turnover will be high.

Exploitation requires intense collaboration. This takes time to build up and benefits will accrue only after long-term collaboration. Consequently, exploitation networks will have a higher proportion of the same partners over time than exploration networks.

Secondly, exploitation and exploration strategies differ based on the partner/s capabilities. In exploration networks, firms tend to look for partners with capabilities outside their own existing business. In exploitation networks firms tend to look for other firms with similar technological knowledge. Exploration strategies should lead to an innovation network consisting of partners in new technological areas. Exploitation strategies on the other hand may be expected to lead to an innovation network of partners in similar technological areas. From an exploration perspective similarity among alliance partners decreases potential learning effects. The literature emphasises that too much focus on local search might aid exploitation but can lead firms to develop 'core rigidities' (Leonard-Barton, 1995) and this can pave the way for firms to fall into competency traps that decrease the amount of explorative learning (Levitt and March, 1988).

Whilst the debate on exploration and exploitation has continued for over two decades, with a large volume of secondary literature, increasingly many investigators now suggest looking towards 'ambidexterity'[81] as a potential way forward. The idea of 'ambidexterity' in firm has emerged as a new research paradigm and is broadly about finding intricate and yet realistic solutions to balance the exploration and exploitation objectives, based on practical means and supportive structures.

It is worth stating that several fundamental issues to the ambidexterity debate remain controversial however: these include decisions about achieving ambidexterity through differentiation or integration; retaining the balance at the individual or organisational level; employing a static, dynamic or a cyclical perspective on ambidexterity and whether ambidexterity can arise internally, or do firms have to externalise some processes.

4.3.2 Collaborating for innovation by networking

Whilst the answers to the above questions remain outside the immediate scope of this research, the practicality of balancing exploration and exploitation in Iranian small new technology-based firms, with limited resources, weak global horizontal structure and operating under severe geo-political restriction as the case for this research, points to finding creative and at times, pragmatic solutions, to circumvent the barriers.

This is an occasion when and where the small firm may have to act 'laterally', by developing and leveraging upon knowledge brokerage processes, in order to undertake and implement innovative solutions, to sustain its competitive advantage.

As briefly outlined in the first chapter, from an organisational perspective, with our interest primarily focused on learning and knowledge flows leading to enhanced skills for innovation (OECD, 2011; Toner, 2011; Tether et al., 2005), studies and theorising about 'brokerage' appear to vacillate between 'structural' and 'connective' perspectives.

The structural perspective views brokers' role as bridging structural holes, to enhance social capital[82] (Adler and Kwon, 2002), including a 'vision advantage', in order to better reformulate

and reframe problems. The connective approach, views the connections amongst parties, interdisciplinary and inter-professional in our cases, as key, in enhancing coordination and collaboration, leading to joining-up previously unconnected activities and unified 'visions'. Thus, the conceptual plurality of 'bridging and bonding' (Woolcock and Narayan, 2000), augmented to 'bridging, bonding and linking', assists in our analytical conceptualisation and empirical endeavour.

In the glocal practices of the creative and cultural sector, where connection to, and connectedness with other sources of expertise has become paramount, knowledge brokerage and sourcing, in various applied forms, demonstrates an emerging 'small world' pattern. This has become a promising subject for studying innovation[83].

Whilst the 'small world' hypothesis is still at an early stage of empirical investigations in different scientific domains, including innovation studies, and there are emerging debates, questions and critiques, it offers a powerful metaphor for investigating learning and innovation, and a useful, albeit an under-researched, analytical lens in exploring the challenges of inter-professional networked learning, embedded at work in our current 'connected' era.

It is worth recalling that much of recent social network theorisation in innovation studies (deriving out of network theory, whether based on graph theory and mathematics, or psychology, sociology and economics) is still, by and large, struggling to explain or account for the flows in knowledge, learning, and skill development[84]. Whilst network theory excels at representing links, and at times, the strength of the links between people, it struggles to explain or account for what connects those particular people and what happens between them.

By now, having provided a circumscribed summary on collaborating for innovation *in networks* and *by networking*, I return to the subtitle of this section as 'brokerage by bridging and bonding' in order to outline the conceptual foundations of 'bridging, bonding and linking' (see recent usage in Guile, 2010a, p. 386). This is further utilised and built-upon in the latter parts of the next chapter.

We have already outlined and discussed March's conceptualisation of exploration and exploitation, and have offered a brief discussion on ambidexterity. Within the context of this study, I now briefly reinterpret and re-frame *exploration as an active collaborative capability to*

deviate from the routine, and *exploitation as the ability to coordinate, control and operate within the structural constraints*.

In earlier sections, we saw that the spirit of Schumpeterian creative destruction will mean that new exploration activities will in, a matter of time, firmly cannibalises exploitation processes and activities. In the actual practice of the firms, we also note that learning is the bridge between working and innovating, and where specialist corporate knowledge, at times appears 'leaky' or 'sticky' (Brown and Duguid, 2001, 1991) based on context.

So far however, our concepts do not offer us a clear way of operationalising, exploring and 'mapping' the activities and processes, undertaken in the firm and on projects.

With this in mind, I have mobilised the concepts of 'bridging, linking and bonding' that arose from the field of social capital (Stone, 2003) and defined as

> "the norms and social relations embedded in the social structures of societies that enable people to co-ordinate action to achieve desired goals" (OECD, 2000a, p. 43 and note 7, p. 63; cf. Grootaert, 1998).

The concept of *bonding* broadly refers to interactions within the boundaries of a specific community, characterised by 'strong ties' and high levels of trust. On the other side of the continuum, interactions that traverses across the boundaries of different communities is viewed as *bridging*, which is associated with 'weak ties' and lower levels of trust. *Linking*, as outlined in this study, lies somewhere in the middle of continuum of the two states of *bridging* and *bonding* as an intermediate level in which time, effort and developing trust will play a critical role in establishing its future movement and status.

In the light of the current circumstances and tight sanctions, practices of small firms in Iran, such as Iranian new technology-based firms, predominantly seek knowledge brokerage and sourcing via informal networks. This actualises in two main routes or combinations thereof: firstly, visits to global technology fairs and workshops, and secondly, exposures to and participation in global/glocal professional/R&D networks (being in on- or offline mode, as appropriate), nurtured via academia and professional associations (including engagement by the professional diasporas and expatriate community (cf. Gillespie et al., 1999; Kapur, 2001; The Economist, 2011)).

It is in those contexts that the firm, and by extension the project teams, and individuals within it, look for *bridging and linking,* perhaps in time turned into *bonding* situations. At the *bonding* stages, the firm and projects are more enabled to draw on other firms and other associated individuals' skill webs.

The next section briefly reviews some of issues in intermediation and brokerage studies in aid of learning in firms. Whilst the brokerage interdisciplinary literature has recently grown significantly in the last two decades, as it will be revealed, very few studies explore the intricate mechanism involved in the actual learning. That said, and notwithstanding the generic concepts used, the field is relatively young (and in the case of informal links, very sparse) so the insights derived from the studies are useful.

4.3.3 Firm as a site of innovation: brokerage and intermediation as core resources in learning

As outlined in the previous sections in this chapter, operating in *networks* and by *networking* provides the opportunities for firms and project teams to enhance their complementary. The literature broadly supports the importance of connecting heterogeneous groups of people and professionals, so as to explore and exploit *weak* and *strong ties* and *structural holes* (2007, 2004, 2000, 1985, 1983, 1973).

With the remit of this study in mind, some of the challenges also relate to what is described in conceptual terms as *distance* and *proximity*. Despite the hyped-up claims of the *death of distance* at the height of the *dot.com* inspired knowledge economy era, we now know in a more nuanced way, and recent synopsis of research supports that, distance still matters, albeit in different manners. This is particularly the case for when we go beyond information exchange mediated by technology, towards the more complex exchanges along the co-construction of knowledge and skills continuum.

As a recent OECD flagship report on *SMEs, Entrepreneurship and Innovation* highlights, whilst:

> "New and small firms can benefit substantially from knowledge spillovers… [as] due to limited assets and resources SMEs invest less than large companies in R&D, in both absolute and relative terms, and are more prone to innovate by drawing on collaboration." (OECD, 2010c, p. 145)

in practice, *knowledge spillovers decay with distance* (OECD, 2010c, p. 144), and thus expanding on the issue as follows, which I quote at length for clarity:

> "Unlike information that can be easily exchanged through the Internet, the knowledge that drives long-term growth is technical, detailed and context-specific (Auerswald, 2007). Most economically useful knowledge is tacit, which means that it cannot be codified in blueprints or transmitted over long distance but rather needs close, local interaction to be exchanged. Tacit knowledge is not just created a priori through investments in education and training or the attraction and retention of qualified labour, but is also generated by the very interaction process between customers and suppliers or between users and producers, which explains why proximity is so important for knowledge spillovers to happen. Geographical proximity is crucial, but cognitive and institutional proximities also matter. Cognitive proximity implies that the two parts involved in the interaction need to have a common technical background and understanding. Institutional proximity involves shared

norms and values that also enhance the exchange of tacit knowledge […]. Both strengthen the importance of geography for knowledge spillovers." (ibid)

In order to achieve complementarity in aid of innovation, therefore, a balance in distance and proximity needs to be achieved and maintained. This is where intermediation and brokerage facilitates this balance and by extension, enhances innovation processes.

The use of intermediaries has grown due to the complexities of knowledge and the distances between innovation actors as they, be it as organised intermediation agents or individuals acting informally, offer the opportunity to enable other actors to innovate, and diffuse and transfer technology (Cillo, 2005; Hargadon, 2002; Hargadon and Bechky, 2006; Hargadon and Sutton, 1997; Howells, 2006; Winch and Courtney, 2007), while acting on different levels of operations such as international, national, regional and local levels and sectors. A point to bear in mind is that the concept of technology brokerage, soon evolved into and became associated with the broader notion of knowledge brokerage: these are seen as intermediaries between otherwise disconnected people with ideas and practical know-how.

A synopsis of selected core studies of recent years is presented in table 4.3.3 below.

Table 2 [4.3.3]: Summary of select recent studies on intermediation and brokerage

Study	Findings
Winch and Courtney (2007)	Innovation brokers essentially undertake an intermediary role, rather than performing that role as a by-product of their [other] principal activities. The key role played by innovation brokers in the innovation process is the independent validation of new ideas, thereby facilitating diffusion. In order to carry out this task objectively, innovation brokers are organised [in most countries] on a not-for-profit basis, typically as a public-private partnership.
Howells (2006)	Intermediaries provide a wider, varied and holistic role for their clients in the innovation process than has generally been acknowledged. Innovation intermediaries may have systemic value in policy terms in an innovation system; not only in improving connectedness within a system, through bridging ties, but also in its 'animateur' role of creating new systemic possibilities and dynamism.
Cillo (2005)	Based on data from four firms facing the challenge of continuous innovation in different industrial settings; - Firms rely on the use of internal knowledge brokers to absorb market knowledge, and promote sharing, - Brokers roles include: information broker, knowledge coder, integrated knowledge broker, and pure knowledge broker - The type of internal broker needed depends on some key variables, such as the complexity of the task or the frequency of interaction between the broker and the actors within the innovation process

As it is apparent from the previous discussion and summaries, a large number of functions, whether actual or perceived, are attributed to brokerage. In his extensive review, Howells (2006) for example suggested a long list of functions, including; foresight and diagnostics; scanning and information processing; knowledge processing and combination/recombination; gate-keeping and brokering; testing and accreditation; validation and regulation; protection of the results; commercialisation; and eventual evaluation of outcomes.

In an earlier study, van Lente and colleagues (2003), provide a concise working definition, attributing three basic functions to brokers. These are around *demand articulation*, *network composition* and *innovation process management*.

Firstly, demand articulation refers to the diagnosis and analysis of a problem, including re-framing and the articulation of the needs of the firm.

Secondly, network composition involves recruiting, retaining and expanding external relations to and for a firm by scanning, scoping, filtering and matchmaking of sources of complementary assets such as technical knowledge, material and funding.

Third and lastly, innovation process management relates to activities for enhancing communication, learning and other forms of interaction, and the alignment of these among partners, to make it happen, and which can also later smoothen and facilitate the attribution of intellectual property rights and the commercialisation of innovation outcomes. Innovation process management also involves the process of creating an atmosphere that stimulates knowledge sharing and learning, enabling a fair distribution of the costs and benefits between innovation team (and network) members and anticipating and resolving any potential conflicts between the members.

Finally, in his study, Carlile (2004) conceptualised the broker's role as essentially that of an interlocutor: to help other actors *transfer, translate or transform* the meanings encountered during their joint activities and innovation journey. A broker thus is seen as 'translating' the knowledge created in one group into the 'language of another' so that the new group can grasp and integrate it, and overcome information/knowledge asymmetry.

Before closing this section, two contextual points are worth bearing in mind about the application of the theory as a resource to the empirical site. Firstly, whilst technology transfer and the associated brokerage is well-established in Tehran and the regional market, knowledge brokerage, especially at the small firm level, in its all intricate details and ecologies, is a new adventure. The challenge amplifies around building trust and developing the capacity to operationalise, and then protect the commercial know-how, based on limited resources of a small firm.

Secondly and directly related to above, due to the weak representation of Iran's innovation eco-systems and public bodies (or public-private partnerships, or via universities and their *triple-* or *quadruple-helix* systems) (UNCTAD, 2006) engaging with or offering an active knowledge brokerage service, the 'brokerage role' becomes internalised to the firm and by default, the project team members. This is why the informal networks, facilitating the construction of (albeit temporary or transient) skill webs, with expansive and contractive qualities based on their purpose and nature, are worth a close examination. This task will be taken up further in the next chapters.

4.4 Conclusion: Collaborating for innovation via knowledge brokerage and skill webs

The contention of this chapter was that innovation occurs in practice, within a localised (and in the empirical elements of this study, a hybridised) business-climate and -ecology context and as a collaborative enterprise, involving problem framing and recontextualisation.

As such, the route to innovation is through conducting an inquiry and framing and reframing problems in indeterminate zones of practice. In balancing the learning activities and strategies of firms, and in pursuit of an inquiry to address the innovation problem, I have turned to the concepts of *exploration and exploitation*, and *bridging, linking and bonding* as means of intermediation and brokerage, which has been extensively examined and expanded-upon in cross-disciplinary literature.

I turn further towards the perspectives of learning and innovation (later utilising the concept of 'skill webs') in firms in the next chapter, and re-visit aspects related to learning, on an individual and collective basis, to formulate and articulate an analytical framework. This is then to better allow me to unpack the significant factors of learning and brokerage in the empirical elements of this work.

By the start of chapter six, I will also shift the focus and register from a theoretical principles and themes within the literature, initially to a more methodological and later into an analytical lens on a micro and meso level. This refocusing and 'translation' is with the aim of developing resources and fine-tuning the analytical tools for capturing firm- and project-level practices, particularly within the context of the study.

Chapter Five: Perspectives on learning and innovation in firms

This chapter builds on the previous discussions on innovation in firms: it focuses however on the perspectives on learning in practice by drawing on circumscribed manner on the ideas of selected authors. In conjunction with the previous contextual and conceptual chapters, it sheds light on the learning aspects drawn from the extant literature, as applied to *NTBF'*s projects, and assists in constructing the conceptual framework and analytical model.

5.1   Introduction and key strands

The concise text of this is structured as follows: an introductory synopsis opens the discussion (5.1) before attention is turned to aspects of learning (5.2), with specific reference to select authors. The last section (5.3) concludes by outlining my synthesis of selected literature, which then acts as a foundation for the formulation of the analytical model.

5.2   Perspectives on learning and innovation

Following the previous discussions on innovation, this section advances the argument to the importance of learning in firms and the role it plays in the development of the firm, by selectively reviewing literature pertaining to learning in and at the level of the firms.

As a point of departure, it is worth highlighting that my definition of individual and collective learning, e.g. at project and firm level, in this work is much more curtailed and focused than learning theory per se. As the actual process of learning in the projects within firms, studied as part of the empirical element of this work, is highly context specific, I have drawn on elements of workplace learning definition and description offered in a concise format by Unwin (2008).

At the heart of my observations of learning on new technology-based firms' projects, I note that the learning is acquired in the midst of action and is highly linked (even to the point of 'just in time') to the task/problem in hand; and is a simultaneously individual and collective activity which is real-time yet continual, self-directed and reflective in nature. Additionally, the learning

processes and activities, utilising knowledge and skill brokers, are often 'stealth'[85], and combined with uncertainty and experimentation.

With that description in mind, the introductory part of this section orients the reader by providing a brief broader view of the literature, and the embedded theoretical fractures and methodological challenges. Attention is soon refocused however to two specific authors, namely Schön, on problem identification/inquiry and problem framing, and Elkjaer, on the importance of resources mobilisation as a *'third way' in organisational learning* (Elkjaer 2004). Features of both ideas, as well as recent articulation of 'teaming' activities by Edmondson, are then integrated into the conceptual framework and analytical model framework in the next chapter.

Schön and Elkjaer are both heavily influenced by Dewey: this is part of my rationale for looking at, and linking their work together. Furthermore, the idea of inquiry in their work (one of the core aspects of Dewey's work) links them to elements of Edmondson and her work, particularly around teams and group.

Similar to the literature on innovation in firms, there now exists an enormous, and ever increasing, amount of literature on learning in firms[86], and somewhat mirroring the state of innovation studies corpus, with clear signs of proliferation and fragmentation in that literature (Boreham and Morgan, 2004).

Examining numerous authors, Elkjaer (2004, 2003, 1999) makes a parallel point when introducing her own review of the organisational learning, although in that specific case, with a focus on social learning theory within organisational learning literature.

In the process, she reiterates a revealing remark by Weick and Westley (1996, p. 440) stating that:

> "… there appears to be more reviews of organizational learning than there is substance to review".

Moving from organisational learning to workplace learning, the position is somewhat similar. Conducting a State of Science review (foresight report) of the literature for the UK government's Office of Science, Unwin (2008, p. 2) offers a broad and interesting perspective, outlining some of the underlying reasons, in brief:

> "Research interest in learning at work has been accelerating over the past 20 or so years, for three main reasons: first, new forms of work organisation have been viewed as potential catalysts for learning; second, the workplace is firmly recognised as a site for learning; and third, governmental concern to increase workforce skills and capacity for innovation to compete in the global marketplace and the so-called 'knowledge economy'… The study of learning at work now engages researchers across the fields of work psychology, labour economics, labour process, organisational studies, human resource development/management (HRD/HRM), and, more broadly, education and sociology. Much of the research remains, however, in strict disciplinary silos with limited cross-referral. There is also a methodological divide between qualitative, case-study based and quantitative surveys… Some collaboration is taking place, but more needs to be done to ensure greater articulation between research findings, and to build interdisciplinary and methodological capacity."

She concludes her review by stating the importance of professional 'horizontal' structures for learning and outlines future research need, close to the focus of this study, that

> "new theories reflecting the relationship between knowledge creation and innovation in the contemporary workplace are required (for a detailed review, see Guile, 2003)." (Unwin, 2008, p. 6)

Before leaving this brief overview, it is worth stating that the study of learning and innovation is not a new phenomenon.

Theodore Wright (1936, pp. 124–125), working as an aeronautical engineer, described a learning curve phenomenon: as the workers gained more experience, less time was required for aircraft assembly operations. The phenomenon was later conceptualised and expanded as *learning by doing* by Kenneth Arrow (also see 1994, 1962, p. 156), as an economist, suggesting that technical change in general can be ascribed to the accumulation of experience gained over time in problem-solving activities of production.

Nathan Rosenberg (1982, pp. 120–140), writing as an economic historian, expanded this concept by introducing the concept of *learning by using*. This concept focuses on the use of complex technologies and refers to the performance increase gained in the prolonged use of a new technology. Rosenberg argues that learning by using is evident in many industries and explains various aspects of productivity improvement in high-tech industries.

As previously referred to, learning by using was expanded by Bengt-Åke Lundvall, as a development and innovation economist, to cover producer-user interaction. Working with

Christopher Freeman, he coined the phrase *learning by interacting* in 1980s which refers to the reciprocal interaction that occurs between producers and users of a new technology during product development. The producers monitor the competence and learning potential of the users in order to estimate their capability to adopt new products, whereas the users gain information about how the use-value characteristics of new products relate to their specific needs. Other researchers, prominent amongst which is Eric von Hippel (2010, 2005, 1988, 1987), have also looked at similar issues of users influence on innovation - but at different levels of analysis and in different disciplinary domains.

5.2.1 Schön and the turn to practice

I now proceed to outline Schön's contribution before moving to Elkjaer's work on the *'third way'* in organisational learning (Elkjaer 2004), where she mobilises, the two metaphors of acquisition and participation for learning (Sfard, 1998), re-applied to aspects of learning in firms, as well as Dewey's notion of inquiry and reflective thinking.

Donald Alan Schön (1930-1997), was by his own account, a *displaced* philosopher working in (among other places) a management consulting firm, a governmental agency, a non-profit centre for social development, and finally a university department of urban planning. A prolific author on a wide range of topics, he was Ford Professor Emeritus on Urban Studies and Education, and Senior Lecturer in the Department of Urban Studies and Planning, and Architecture, at the Massachusetts Institute of Technology, the institution he joined in the early 1970's, until he passed away in 1997.

Partly due to the popular uptake and success of his later publications, on professional practice, i.e. *The Reflective Practitioner* (1983) and *Educating the Reflective Practitioner* (1987), as well as his long collaboration with Chris Argyris at Harvard University, on organizational learning issues, the full depth and relevance of his work remains unexplored. In line with the themes of this research, and as previously highlighted, the text therefore highlights aspects of his work and publications (generally chronologically earlier) which refers to his practical and theoretical insights on learning while innovating and collaborating, combining these with some of the insights from later work.

It is commonly believed that he spoke *from* philosophy *to* professional practice, conceiving design to be its unifying core, and projecting a new model for learning and teaching in the professions and higher education, be it a *teaching* or a *research university* institution.

He received his B.A. from Yale University, and an M.A. and a Ph.D. from Harvard University (the latter entitled '*Rationality in the Practical Decision-Process*' – Unpublished Ph.D. thesis, 1954, University of Harvard), all of them in philosophy, and had studied in the Sorbonne after his B.A. and before starting his studies at Harvard. While at the Sorbonne he also studied performance music (clarinet and piano) at the Paris Conservatory (*Conservatory Nationale de Music*), and was awarded the Premier Prix in clarinet. He continued to perform, and perhaps draw on his varied experiences, throughout his life, in some account to great philosophical advantage.

The first major influence on his thought seems to have been John Dewey's theory of inquiry, with which he struggled as he initially found Dewey "muddy and unintelligible" (Schön, 1992, p. 123) which later became the subject of his doctoral dissertation.

He also raises a cautious note that we should "beware of accepting [Dewey's work] precisely as he left it to us"[87] (Schön, 1992, p. 122).

He had seemingly accepted Dewey's concept of thinking in 'problematic situations' as a starting point, but sought to 'rethink and reconnect' Dewey's work. He aspired to illuminate the process of practical inquiry by combining conceptual analyses with empirical studies of expert practitioners.

Additionally, the Deweyan notion that all knowledge derives from practice remained at the heart of his formulation of the epistemological foundation of effective practice. Schön's formulation was far from a rehash of Dewey's argument as he went beyond Dewey in developing a theory of learning, which he argued required reflection-in and on-action and mobilised notions of (and discrepancy between) 'espoused theory' and 'theory-in-use' in problem solving action, as well as the limitations of technical rationality[88].

Schön also worked at the Arthur D. Little consulting firm in Cambridge Massachusetts, where he formed the New Products Group and consulted with many industrial firms on product design and technical innovation. In 1963, he joined the department of commerce in the Kennedy

administration and directed a new Institute for Applied Technology in the Bureau of Standards. In 1966 he left government service to return again to Cambridge where he founded the Organization for Social and Technological Innovation, which engaged in research and practical interventions in a range of public policy domains such as housing, health, education and other social services.

From his long excursion into technological innovation, design, and applied research, he had learnt a number of lessons which contributed to his insight. Two of these, of direct relevance to this research are outlined as follows.

Firstly, he explored the effects of the increased rate of technological change and how that could throw people in a constantly changing and destabilised world that threatened the individual and social identities, against which identity-conserving reactions are formulated.

Some of these insights were explored in *Technology and Change: The New Heraclitus* (Schön, 1967) which related to his exposures as an organisational consultant. In 1970, he delivered the Reith Lectures on the BBC (Schön, 1970). *Beyond the Stable State* (Schön, 1971a, for issues on "implementation", also see 1971b) grew out of those lectures, capturing his consulting practice and early research in the area of learning in firms.

Secondly, he paid attention to generative metaphors and how these permit people to 'construct meaning' in their perpetually changing circumstances and providing continuity between older experiences and new situations by pointing at similarities or 'family resemblances' between them.

As professionals constantly find themselves in disorienting situations requiring conceptual 're-framing', they engage in 'frame-experiments' to work up a conceptual framework for the new situation. Without the re-framing, it would be hard to determine what the relevant facts are, or what evaluative criteria apply.

Metaphors, according to him, have the power to bring

> "the familiar to bear in the unfamiliar in such a way as to yield new concepts while at the same time retaining as much as possible of the old" (Schön, 1963a, p. ix).

This idea was explored in his first book, the *Displacement of Concepts* (1963) and was amplified in subsequent book chapters. Schön argued that technological innovators, social planners, and other professional practitioners primarily engaged in such 'frame-reflections.'

Schön extended his interest in software design, the role of computers in designing, and the uses of design games to expand designing capabilities during his last years of life[89].

In concluding this section, I return to Schön's early (and late) work on innovation and the importance of *product champions* (Schön, 1963b) as well as change and transformation of organising and organisations (1971) for collaboration. Writing about resistance to invention and innovation, in military and corporate organisations, he outlines the difficulties of supporting and nurturing processes to promote innovating in firms.

Published in Harvard Business Review, the article on product champions is an early example within the professional literature that starts to explore innovating processes with the action of individuals and groups bearing important consequences, and firm-wide dynamics and responses, be it supportive or non-supportive, to the innovation effort.

Schön (1963b, p. 82) also refers to a 'necessary and justified ambivalence' within the innovating firm, as follows:

> "Resistance to change is not only normal but in some ways even desirable. An organization totally devoid of resistance to change would fly apart at the seams. It must be ambivalent about radical technical innovation. It must both seek it out and resist it. Because of commitments to existing technology and to forms of social organization associated with it, management must act against the eager acceptance of new technical ideas, even good ones. Otherwise, the technical organization would be perpetually and fruitlessly shifting gears. This is true in the military and also in almost all walks of private industry."

What lies at the heart of that argument has come to be known as 'ambidexterity' in firm's activities, with exploration and exploitation, as its key features: a topic covered earlier and one that I turn to in formulating the analytical model.

Furthermore, in *Beyond the Stable State* (1971), Schön argued that we had to understand the shift from being a reasonably stable society to one which was (and will continue to be) fundamentally unstable due to the accelerating pace of change facing industrial societies. This required a new

way of thinking for both individuals and society as a whole. He demonstrated how the old command and control models would become increasingly inappropriate and that 'network' type organisational designs would in time replace hierarchical models.

> "Social systems must learn to become capable of transforming themselves without intolerable disruption. But they will not cease to be dynamically conservative - not if dynamic conservatism is the process through which social systems keep from flying apart at the seams. A learning system, then, must be one in which dynamic conservatism operates at such a level and in such a way as to permit change of state without intolerable threat to the essential functions the system fulfils for the self. Our systems need to maintain their identity, and their ability to support the self-identity of those who belong to them, but they must at the same time be capable of frequently transforming themselves." (Schön, 1971a, p. 60).

Additionally, he discerned the emergence of new modes of diffusion, in business firms and social movements where centre-periphery models were replaced by forms of complex networks and human beings were no longer simply defined by the organisational membership, but as members of complex network patterns. In such conditions:

> "The principal problem of design shifts from the design of a product or technique to the design of a network…and the pattern of social learning shifts from successive 'sweeps' of limited innovations from a centre throughout a periphery, to the formation of self-transforming networks." (Schön, 1971a, p. 115)

Thus, for a firm to become a learning system, both the social system of agencies and the theory of implementation need to alter.

Before bringing this section to an end, it is worth recalling a core and insightful critique of the corpus of his work (with reference to the focus of this study) too, as articulated by a departmental colleague (Bish Sanyal, who was at the time, the Chair of the Department of Urban Studies and Planning, at MIT), in 'a tribute' volume of recollections and papers.

> "We must however, acknowledge one shortcoming in Don's intellectual approach if we are to build on his ideas: Don was silent about the uneven distributions of political/economic power and how this affects learning and innovation. This omission did not reflect ideological posturing… […] It was the result of his work experience…[as part of which, he] rarely had to confront issues of political economy of the kind which influence urban problems. And, since Don only wrote about issues which emerged directly out of his work experience, he had very little to say about the effects of asymmetrical political and economic relationships in the public domain. The closest Don came to addressing the issue of politics was in his relatively recent book, Frame

Reflection, co-authored with Martin Rein [...][focusing on] what they labeled as "unsolvable problems"… that some problems are unsolvable because different social groups contest the framing of those problems." (Sanyal, 1998, pp. 6–7)

I turn next to Elkjaer (2004) and her conceptual mapping of the literature by introducing a metaphor of the *third way* in learning in organisations. While her work engages and scans the literature on the (macro) level of principles, I will in the next chapter draw on this in the construction of my analytical model, to offer me a handle on the (meso and micro) levels of practice, when viewing the learning episodes in firms' projects. In so doing, I will draw on cycle of exploration and exploitation activities in the firm, and learning as individuals and in collectives, to formulate and articulate the model.

5.2.2 Individual and collective learning

I thus draw on the work of Elkjaer focusing primarily around her 2004 publication in which she develops an argument for a 'third way' in organisational learning (OL) utilising the two metaphors for learning, namely acquisition and participation (Sfard 1998), which are widely cited in education studies. She cogently argues that the two metaphors can be applied in the underlying learning theories utilised in organisational learning, and by extension learning in firms.

The 'first way' is identified as individuals' skills and knowledge acquisition in organisations as systems, while the 'second way' refers to learning as participation in communities of practice and inquiry. Elkjaer defines the 'third way' as the development of experience and knowledge by inquiry (or reflective thinking) in social worlds held together by commitment.

She explains (Elkjaer, 2004, p. 420) the essence of the synthesis as follows:

> "The basic idea behind this synthesis of what is here called the 'first' and 'second way' of OL is to acknowledge that *thinking* is instrumental in learning as participation and that learning takes place as a *social* process."

As previously mentioned, whist there are many reviews, classifications and taxonomies of learning concepts and theories in organisations, it is the 'third way' in her work with a link to Dewey's notion of inquiry that I have found congruent with, and helpful to the remits of this research on learning to innovate. I have therefore primarily concentrated on the Deweyan link on inquiry which naturally connects this section to the last, on reviewing Schön's contribution.

Elkjaer states that in her search for a better analytical frame for exploring learning theory in organisational learning, she was lead to the work of John Dewey. Specifically, it was her unease with the 'disappearance'[90] of the notions of the *'how'* and the *'what'* of learning within the broader concept of 'learning as participation' that had triggered the search.

Similar to Schön , she draws heavily on the work of the American pragmatist and educationalist John Dewey (1859–1952) (Dewey, 1896[1972], 1917[1980], 1925[1981]; Dewey and Bentley, 1949[1991], cited in Elkjaer 2004) and his concepts of 'inquiry' or 'reflective thinking' (the two

are identical in Dewey's writing) and 'experience', which she identifies as having a role in what actually takes place in the 'participation' elements of learning in firms.

On the notion of inquiry she (2004, pp. 424–425) expands her argument as follows:

> "In Dewey's conceptual world there are no pre-given cognitive structures or mental models shaping human experience. For Dewey, knowledge always refers directly to individual and collective human experience (the process and the result). This does not, however, imply that pragmatism rejects thinking and reflection, let alone acquisition. Rather, a pragmatic theory of learning regards thinking as an *instrument* – as a way to play or experiment in the mind with different solutions to problems – in the learning process in which inquiry of the uncertain situation is the prerequisite for knowledge acquisition. One can also say that the condition for learning is the engagement in inquiry and the application of thinking and reflection as *tools* in that endeavour. This is why Dewey also terms inquiry 'reflective' and 'critical thinking' (Dewey, 1933[1986]). Thus, there is not only action or practice, but also acting *and* thinking in the pragmatic inquiry. To quote:
>> (...) thinking is a process of inquiry, of looking into things, of investigating. *Ac*quiring is always secondary, and instrumental to the act of *in*quiring. It is seeking, a quest, for something that is not at hand. (Dewey, 1916[1980]: 155)".

The importance of the notion of inquiry is also raised elsewhere. Hickman[91] (2001, p. 28), explains the core proposition of the notion of the inquiry as

> "For Dewey... one of the most important concerns of philosophy was not so much epistemology, or the attempt to deal with the [post-Cartesian] problem of skepticism, but logic [considered as]... the theory of inquiry... as a matter of [social] experimentation."

Elkjaer (2004, p. 425) further expands on Dewey's notion of inquiry by stating that she views it as being as "attached to the actual process of 'becoming knowledgeable' – of having experiences." She adds, somewhat similar to the thrust of some of Schön's arguments that

> "Inquiry is a process that starts with a sense that something is wrong. Intuitively, the inquirer(s) suspects there is a problem. The suspicion does not necessarily arise from an intellectual wit. It is not until the inquirer(s) begins to define and formulate the problem that inquiry moves into an intellectual field by using the human ability to reason and think verbally."

And in concluding she states (Elkjaer, 2004, p. 426) that, when meeting with uncertain situations:

> "The method is inquiry or reflective thinking as thinking is required to define problems, and reflecting to move the learning outcome into the verbal and conscious field."

Table 3 [5.2.2]: Three ways of [viewing] organizational learning

	The 'first way'	The 'second way'	The 'third way'
Learning content	To be skilled and knowledgeable about organizations	To become a skilful practitioner in organizations	To develop experience as part of a continuous transaction between individuals and organization
Learning method	Acquisition of skills and knowledge	Participation in communities of practice	Individual and joint inquiry or reflective thinking – begins with body, emotion and intuition
Relation between individual and organization	Traits and possible to separate in analysis and practice	Individuals as part of communities of practice	Transactional – mutual formation of individuals and organization
Organization	System	Communities of practice	Social worlds

Source: (Elkjaer, 2004, p. 430)

In thinking about my use and utilisation of concepts highlighted by Elkjaer and Schön, I am mindful of the fact that within the selective texts I have drawn upon, these authors were essentially scanning the field and literature on the (macro) level of principles.

It therefore becomes my prime task to re-work their concepts within text as potent resources that can assist me in creating high fidelity, more on a micro and meso level, in my analytical model so as to ensure rigour in my analysis.

It is with this primary objective in mind that I turn to conclude this section. The key elements that I take from Schön to my analytical framework are his cautionary tale that problems are not given and hence, need to be 'made'. I find Schön's attention to, and articulation on making, and the nature of the 'inquiry', and the process of framing, re-framing and the impact of frame-making on 'problem' situations highly valuable. As he states (Schön, 1983, p. 165)

> "As [inquirers] frame the problem of the situation, they determine the features to which they will attend, the order they will attempt to impose on the situation, the directions in which they will try to change it. In this process, they identify both the ends to be sought and the means to be employed."

I would also point out that based on his writings' success elsewhere, Schön's contribution on innovation, technology and learning has been largely neglected in the current era, as the literature has run with aspects of his articulation on reflective practice.

Whilst acknowledging the strengths of his thinking, it is also appropriate to express that his theorisation, while arguably some way ahead of his time, was still a product of his era. Had he lived longer, he may well have undoubtedly further develop and refine his thinking[92] especially in light of the exponential advancement and application of new technology in society.

My main concern as a limitation with his work is that, on inquiry, reflection and reframing, his level of analysis and engagement was essentially (although not exclusively) pitched at the level of individuals and not the collective. Issues around collaboration and collective effort, which he poignantly addressed in early to late 1960s, did not continue to develop in his articulation as he moved to different projects and challenges, and academic and publication partnerships.

Similar to Schön's, I have found insightful elements congruent to the current project in Elkjaer's work who writes and researches across the education, management and organisational studies disciplinary divide. These have provided a platform and where needed an anchor back to the 'safety' and shelter of a disciplinary shore. In formulating my analytical model, I draw on Elkjaer (2004) for the last time in this section, in her astute articulation on the delicacy of the movement and inter-linkage between ontology, epistemology (of practice) and methodology, in an effort to capture the projects' inter-connected unit of analysis across longitudinal data and shifting parameters. This I draw upon, in particular with my utilisation of 'learning episodes' as a unit of analysis.

As she (Elkjaer, 2004, p. 427) expands

> "When individuals and environments are related to each other on the basis of a transactional understanding hereof, *time* and *space* are inseparable. Time and space - history and context - are in the transactional understanding of the relation between individual and environment aspects of an integrated unity. …In a transactional understanding of the relation between individuals and organizations, the unit of analysis is

not either the individual or the organization but a problematic situation or an organizational event. The situation or event is contextual and unfolds over time, and it is a unity of intertwined and complex phenomena whose parts are mutually penetrating and inseparable. Thus, a problematic situation or event can only be studied as a united whole. One cannot first tear it apart and then study its elements to understand the whole; as the whole cannot be reduced to the sum of its parts."

Therefore for my case studies, the 'learning episodes' acts as the 'problematic situation or event' unpacked with the use of the analytical model, as part of the vignettes in chapter seven.

I turn now to briefly highlight selected aspects of collaborative innovation based on inquiry, drawing on recent work of Amy C. Edmondson on 'teaming' processes at a micro (i.e. project) level of operation (2012a, 2012b, 2003; Edmondson et al., 2009; Edmondson and Nembhard, 2009) before closing the chapter. Based on its currency, this is used as supplementary material to enhance my analytical model.

5.2.3 Learning based on inquiry in projects: a brief glance at 'teaming'

Amy C. Edmondson, a management scholar based at University of Harvard, with a background in engineering and psychology, has been exploring team dynamics for about two decades. In her most recent work, spanned across the last decade, she has highlighted the tensions in interprofessional teams and projects in the current era and in various sectors, with particular attention to 'teaming' attributes and activities, such as brokerage, rather than the traditional conceptions of team work. (2012a, 2012b; Edmondson and Nembhard, 2009)

Edmondson describes 'teaming' (viewed as a verb) as 'informal collaboration on steroids' as well as 'teamwork on the fly'. Exchanging information and accommodating workplace 'knowledge spectrum' and skill sharing is high on her conceptualisation. Of interest to this work, she also highlights the importance of 'purpose' in sustainable and successful project work. Her observation point to as a dynamic activity rather than a traditional, bounded group structure. That said many of its purposes and benefits are grounded in basic principles of teams and teamwork. Primary amongst which is the ability to integrate diverse expertise as needed to accomplish large and complex tasks.

In the conclusion of her recent paper, she outline the core argument as follows

> "Projects increasingly require information and process sophistication from many fields. And managers are dependent on all kinds of specialists to make decisions and get work done. To excel in a complex and uncertain business environment, people need to work together in new and unpredictable ways. That's why successful teaming starts with an embrace of the unknown and a commitment to learning that drives employees to absorb, and sometimes create, new knowledge while executing." (Edmondson, 2012b, p. 80)

Whilst this is a concise representation, other aspects of her recent conceptualisation is outlined in the below figure.

Table 4 [5.2.3]: The rewards and challenges of 'teaming'

Multiple functions must work together	People are geographically dispersed	Relationships are temporary	No two projects are alike	The work can be uncertain and chaotic
CHALLENGES				
Conflict can arise among people with differing values, norms, jargon, and expertise.	Time zone differences and electronic communication present logistical hurdles.	People may not have time to build trust and mutual understanding.	Individuals must get up to speed on brand-new topics quickly, again and again.	Fluid situations require constant communication and coordination.
BENEFITS				
ORGANIZATIONAL Innovation from combining skills and perspectives Ability to solve cross-disciplinary problems INDIVIDUAL Boundary-spanning skills Understanding of other disciplines Broader perspective on the business	ORGANIZATIONAL Greater alignment across divisions Better diffusion of the company's culture INDIVIDUAL Familiarity with people in different locations Deeper understanding of different cultures and of the organization's operations	ORGANIZATIONAL More shared experience among colleagues Greater camaraderie across the company INDIVIDUAL Interpersonal skills Extensive network of collaborators	ORGANIZATIONAL Ability to meet changing customer needs INDIVIDUAL Flexibility and agility Ability to import ideas from one context to another	ORGANIZATIONAL Ability to manage unexpected events INDIVIDUAL Project management skills Experimentation skills

Source: (Edmondson, 2012b, p. 76)

Whilst the development of Edmondson's concept of teaming was after I had undertaken my empirical case studies, I have reflected upon her practical ideas and have taken account of it so as to build elements of these in my conceptual framework and analytical model.

5.3   Conclusion

I have outlined and discussed a number of related factors on learning and innovation in firms in the previous sections.

Drawing out the selected literature (and outlined in table 5.3 overleaf), I have articulated three interconnecting core processes which I have identified as essential for learning and innovation in NTBF's creative projects. These processes, I have labelled as *resource agility*, *search and responsiveness* and *unified design and prototyping*.

This synthesis is used in the next chapter to strengthen the study's contextual and processes framework. This then leads to better articulation between different levels of the study and the analytical model, formulated later in the next chapter.

The table below draws a circumscribed summary based on the core literature examined in innovation processes (Kanter, 1988a, 1988b; Leonard-Barton, 1995; Nonaka, 1994; Nonaka et al., 2008; Nonaka and Konno, 1998; Nonaka and Takeuchi, 1995; Roberts and Fusfeld, 1981; Schön, 1963b), and condenses and streamlines their 'insights' into the three processes used in this study.

Table 5 [5.3]: A synthesis based on previous studies of the innovation processes

Current Synthesis (Processes)	Schön (1963)	Roberts & Fusfeld (1981)	Kanter (1988)	Leonard-Barton (1995)	Nonaka & Takeuchi / et al. (1994/95/98 SECI/Ba)	Nonaka et al. (2008)
Resource Agility	'championing'* the new practice: coalition building	pre-project, project possibilities and initiation [1]	ideas generation and coalition building [1]	experimenting and prototyping [1]	sharing tacit knowledge and creating concepts [1, 2]	'managing flow' as enhanced SECI model: sharing 'frames of reference'
Search and Responsiveness	ideas generation and testing, deeply rooted in practice	Project execution, outcome and transfer [2, 3]	idea realisation [2]	Implementations and integrations of new tools and processes [2]	justifying concepts [3]	dialogue as synthesis of thought: practice as synthesis of action
Unified Design and Prototyping	'champions' pursues idea, as an 'inquiry', (beyond job roles)		diffusion and transfer [3]	'import' knowledge [3]	building prototype/archetype cross-levelling knowledge [4, 5]	conceptual reconstruction in practice (kata), exercising phronesis

The numbers in square brackets [ ] refer to the approximate sequential stages within the models, as outlined in the original text. * On 'change champions', Stjernberg and Philips (1993) **refer to the term 'souls of fire', from the Swedish '*eldsjälar*' meaning 'driven by burning enthusiasm'.**

Chapter Six: Framing and analysis of the case study vignettes

Building on the conceptual and contextual accounts provided in the previous chapters, the aim of this chapter is to outline the methodological choices and decisions undertaken to conduct and interpret the empirical part of the study. The next chapter, namely chapter 7 then offer a commentary and discussion on the case study data, analysis and subsequently in chapter 8, based on these, expand on the conclusions including implications and future directions.

I start this section in part one of the chapter, with initial observations about the nature of research. These include issues around dealing with 'learning as an object of investigation' at the level of the firm; the symbiotic relationships between 'context, content and processes'; and factors within and around 'investigating processes', particularly within a longitudinal qualitative research design and the ensuing analysis. In part two of the chapter (6.2 onward), I provide details and analysis of the case vignettes.

6.1   Part One: Framing and structuring a prolonged empirical inquiry

The core challenge of the methodological aspect of the empirical elements of the thesis is thus to construct tools and models, with high fidelity, to examine the way the skill webs and knowledge brokerage (for example by *bridging, linking and bonding*) unfolded over time. I have therefore devised and articulated a methodology to do so, from the tradition in philosophy broadly referred to as pragmatism and have also drawn, when necessary, on mixed-methods.

The overall aims of the methodology is thus to

i. capture how things change, and practices unfold over time;

ii. be able to examine unfolding practices over time, and thus, take connected 'slices of reality', referred to as 'waves' of data collection in method's lexicon, at different points in time;

iii. be able to interpret the ensuing data that were derived out of the above activities.

One of the core ideas that have influenced the thinking behind the earlier parts of the thesis is my interpretation (and operationalisation) of Dewey's notion of inquiry.

In order to develop a methodology which is consistent with this tradition of thought, it is important to explain, in ideal-typical terms, some of the key tenets of pragmatism, in order to identify and use them as the methodological strategy which I have pursued. This is covered later in sub-section of the chapter.

My continuous endeavour is to offer a methodology that is consistent with the use of Dewey's notion of inquiry, in the conceptual and theoretical parts of the thesis, and thus, closely connect the thesis along ontology and epistemology, with methodology.

An important motivation behind my pursuit of the principles of the pragmatism, is my endeavour to avoid division of singular levels (e.g. individual or group; group/team or firm**;** firm and the sector; and sector and society). Furthermore, guided by previous empirical and theoretical contributions (cf. Newell et al., 2009, pp. 194–196; Sole and Edmondson, 2002; Tyre and Orlikowski, 1996), I strive to utilise 'episodes' as an appropriate units of analysis, so as to provide a coherent approach between this and other previously relevant studies.

I have come to understand that by working with Dewey (and with Schön's ideas, on 'problem reframing') I am working within a 'pragmatic-type' tradition. In doing so, and bearing in mind that my theoretical perspective has firmly influenced the framing of the methodological issues, I have sought a dialogue between my theoretical (and by extension, conceptual) and methodological perspectives. It has thus been important to clarify the movement from my study's empirical 'purpose' (which is also labelled as 'object of inquiry' by other researchers in the related literature) and unit of analysis (Säljö 2009)**,** to and from a methodology that allows me to explore that unit of analysis, in a way that is logically consistent and congruent with the position that I have adopted.

It is clearly not my intention, nor within the remit of this study or my intellectual project, to form or offer a theoretical commentary or critique, upon pragmatism per se, so I have instead drawn insights from it, in an interdisciplinary manner, primarily from the notion of 'inquiry'[93] in Dewey's work. This includes drawing on other workplace learning scholars who have cogently advocated such line of argument, explicitly (Elkjaer, 2004, 2000, pp. 94–96; Elkjaer and

Simpson, 2011), or implicitly and indirectly, by drawing inspiration and insights from the tradition (Edmondson, 2012a; Edmondson and Zuzul, 2014; 2009, 2008).

As a consequence, I have tried to think about my methodology, through a 'pragmatic inspired' set of lenses, rather than what has till recently been seen in the social sciences as debates between quantitative and qualitative approaches.

6.1.1 Learning episodes as the unit of analysis

Investigating episodes as the unit of analysis entails a temporal perspective: *time* and *place* matters, and so do the *connection between places* across *time*, in investigation of the process of learning to innovate, and learning from innovating. The innovation process in new technology-based firms is firmly linked with what has previously been learned by teams of staff and users (e.g. partners and customers/consumers feedback). The understanding of the innovative processes, such as the reason for a particular choice, pronouncement and later, technical and non-technical intermediation and brokerage and procurement, becomes highly impoverished without considering the *historicity* of the individuals and firms' decision.

Therefore, the 'untangling' of such processes are better operationalised by the adoption of a longitudinal perspective rather than transversal and singular observations undertaken by one-off single snapshot methods.

As previously mentioned, episodes, refined specifically within the course of the study as *learning episodes*, are taken as the primary unit of analysis and feed into my model-making. Learning episodes in firms and teams have previously been defined as

> "an occasion in which a [project] team learned something significant that advanced the project" (Sole and Edmondson, 2002, p. S20).

Whilst I have utilised and mobilised this definition as a starting point, I have had to refine it to suit my research circumstances. For example, within the episodes, attention was directed at identifying circumstances when and where project team members utilise and scaffold upon their skill webs in order to better formulate a professional 'distributed-judgement', keeping the inquiry moving, reaching a 'break-through' (and/or a 'cul-de-sac'), falling within the spheres of explorative or exploitative learning spheres. This has led me to explore and reflect upon the notion of interprofessional judgement (Guile, 2011) in practice, as an important element, enabling the core team members to better grasp, frame and re-frame problems.

I will expand more on learning episodes within skill webs (be it in an expansive, contractive or fragmented manner), as appropriate, in the later parts of the thesis, while outlining and discussing the case vignettes.

Longitudinal design, in which the researchers attempts to return to the same site and people in a number of waves, embedded within a case study framework, together with qualitative encoding and clustering of themes, to build up a model provides the basis of the identification of stages for, and triggering sources of learning. This can then better inform the study's understanding of the dynamic relations between innovation, skill webs and learning.

A number of intermediate processes were undertaken to analytically and thematically condense, make interpretative sense of, and lead to an integrative model as outlined later. In grounding the notion of abduction, and untangling the processes that lead to innovating and innovation as part of my empirical study, I have made use of the overarching concepts of *analysis* and *interpretation*, leading to *integration*, as applied to the innovation processes (Lester and Piore, 2004). In their astute study, Lester and Piore (ibid) concluded that firms tend to *over-analyse* and *under-interpret* their innovating and innovations and thus to reach *integration*, a rebalancing in favour of *interpretation* should be sought after.

It is in that integration stage that inter-sectoral exploration can lead to exploitation, facilitated initially by *brokerage and linking*, and later once both the inter-group trust and relevant knowledge develop, lead to successful *bonding* of interprofessional skills.

6.1.2 Researching learning episodes with an abductive approach

In this and the following sections, I wish to further expand on the ideas and mark-out a methodology based on the concept of abduction. To do so, I draw on Morgan's (2007) methodological typology. I firstly, outline his potent methodological argument and secondly, to illustrate how his typology is different from other commonly used approaches in social sciences.

In practical terms, a core point in Morgan's typology is the notion of abduction. The notion of abduction is not widely utilised or understood as it is highly abstract and possibly viewed even as esoteric. What I have undertaken in operationalising it is to try to provide the notion of abduction with higher specificity. The concept of abduction originates in the work of Pierce (Weiss et al., 1931) (who had greatly influenced Dewey in his re-formation of his theory of logic) and other contributors (1965, 1958; Schön, 1959),. While the details and debates of the argument (cf. Paavola, 2006; Paavola and Hakkarainen, 2005) about abduction falls outside the remit and focus of this work, I have taken an useful insight as follows. The work of Charles S. Peirce and his followers, as well as his influence on aspect of Dewey's work, have paved the way for arguing and maintaining that, as well as deduction and induction, there exists a third mode of inference, namely abduction, which looks at the way new ideas are generated. My methodological contention, in line with the work of Morgan (2007) is that abduction is a useful and promising departure point for conceptualising the processes involved in discovery for, and as part of innovation processes.

In his cogent article entitled *paradigms lost and pragmatism regained: methodological implications of combining qualitative and quantitative methods*, David L. Morgan (2007) has unpacked the developments in social sciences methodology, since, and as a result of the seminal contribution of Thomas Kuhn's seminal work (cf. Hacking, 2012; 1977, 1970).

Morgan describes the perceived dichotomies between the *inductive-subjective-contextual* approach and the *deductive-objective-generalising* approach and calls for an effort to integrate these methodologies, to better suit the nature of our inquiries. He outlines that the integrative methodology is consonant with the worldview of pragmatism which has acted as a leading theoretical foundation for mixed method research. The focus therefore is on the problem in its

social and historical context rather than on the method, and multiple relevant forms of data collection which can be mobilised to untangle and answer the research question(s). A pragmatic orientation further addresses how our values and ethics, our politics and epistemologies, and our worldviews as researchers directly influence our actions and our methodologies.

Thus taken together, the *abduction-intersubjectivity-transferability* approach (Morgan, 2007) in which reasoning moves back and forth between induction/deduction and subjectivity/objectivity, just as researchers would have to do so in practice. With regard to transferability, we ask how knowledge created through action and reflection can be used in a new setting and examine our evidentiary warrant for doing so.

Of specific interest to this section of my work is Morgan's view *on new opportunities offered by the pragmatic approach* where he states (p.71) that

> "The pragmatic approach is to rely on a version of *abductive* reasoning that moves back and forth between induction and deduction – first converting observations into theory and then assessing those theories through action."

The pragmatic approach[94] therefore provides a position from which to defend an array of methods, based on appropriateness and purpose, and that are the best that can be imagined and implemented, under the circumstances. The pragmatic method itself parallels the scientific method as an iterative process of reflection on experiential evidence, hypothesis, experiential experiment/test, evaluation, add to evidence, and then reiteration of the cycle.

Drawing on the above debates and discussion, I came to create the DEAL (Design, Execute, Adjust and Learn cycles) model, outlined in detail later, as a way to facilitate an ongoing dialogue[95] between analysis and interpretation stages of inquiry, along exploration and exploitation, whilst undertaking individualised or collective manners. The different processes of DEAL clearly have a constitutive relationship with one another, particularly when reaching-up to a unified stage of integration (for example, leading to a break-through in the project).

In sum, pragmatic ontology and epistemology, leveraged on Dewey's work on inquiry, can embrace an absolute or essential truth as a fallible instrument, but functionally would view absolute truth as an absurdity for a finite mind to know or proclaim. It believes that humans learn through reflection and inquiry (note that these two terms are used interchangeably in Dewey's

work) on their limited individual and collective experiences and that leads to propositions and hypotheses that are tested by ongoing experiences and trial and error in ongoing iterative processes of inquiries.

Additionally, it asserts that humans can learn through the experience of others but all hypotheses must still be tested by personal and community experience. Dewey distinguishes educative experience as particularly important to the process. Educative experiences require reflection on the logic and evidence of the conclusions and judgments arising from the experience; experience as per Dewey in terms of the interaction (as "action between entities"), and transaction (as "action across entities") - (Elkjaer and Simpson, 2011, p. 69) between the person and the concrete/external world, and openness to change if conclusions are not effective or if they are in conflict with experience.

Within this study therefore, I have found my views ontologically and epistemologically aligned with this view and therefore have approached my data and analysis through this orientation. My epistemological assumption is that I arrive at what I perceive to know through the abductive process[96]; both consciously through knowing in action and inquiry-based thinking, and tacitly and implicitly through empirical thinking and modelling.

In summarising this section, it is worth revisiting some of the differences between a pragmatic approach, to other mainstream quantitative and qualitative approaches in social science research, as highlighted by Morgan (2007).

Table 6 [6.1.2]: Pragmatic alternative to the key issues in Social Science research methodology – Summary of Methodological Approaches

	Pragmatic Approach	Qualitative Approach	Quantitative Approach
Connection of theory and data	Abduction	Induction	Deduction
Relationship to research process	Intersubjectivity	Subjectivity	Objectivity
Inference from data	Transferability[97] [Generalisability]	Context	Generality

Source: (Morgan, 2007, p. 71)

In describing the table above as a simple summary of his framework, Morgan explains that the columns represent the main comparative distinction in the table, contrasting a pragmatic approach with two most common social sciences methodological stance; while the rows make the comparison in terms of three central choices that researchers make, both to purposes being pursued and the kind of procedures being followed.

His insights further illustrates the point that as experienced researchers, we know that the actual process of moving between theory and data hardly ever operates in a one way direction. Whilst in the midst of the actual design, collection and analysis of data, it is impossible to operate exclusively in a data-driven or theoretical mode. So 'intersubjectivity' in the table above, aims to capture the duality that as a researcher, one has to work back and forth in various frames of reference.

By 'transferability', by which he essentially is highlighting 'generalisability', he is asserting that we cannot make the assumption that our research is either context-bound or universally generalizable, and instead need to ask how much and how far, our existing knowledge might be usable in a new set of circumstances and be clear about what justifies our warrant for such claims.

He also places methodology at the centre of the debate between epistemology (and as extended in my study, to ontology) and methods, and posits (ibid, p.68)

> "We need to use our study of methodology to connect issues in epistemology with issues in research design, rather than separating our thoughts about the nature of knowledge from our efforts to produce it."

In the climax of his paper on a potential paradigm shift in methodology, Morgan (2007, p. 71) summaries his argument as follows:

> "From a pragmatic point of view, however, the only way to assess those inferences is through action. Hence, one of the most common uses of abduction in pragmatic reasoning is to further a process of inquiry that evaluates the results of prior inductions through their ability to predict the workability of future lines of behavior."

Having considered the specific issues around a pragmatic approach to methodology, we now turn our attention to the analytical framework of the study. Before doing so, it is worth highlighting

that my brokerage and DEAL model thus have the explanatory potential to help to make explicit what was implicit in the firm's social practices: this is of a generative nature not only in the firm under study but also potentially in other similar contexts and sectoral settings.

6.1.3 Abductive approach: capturing data in long and short waves

In line with the pragmatic orientation utilised, methodological choices made around the unit of analysis and the longitudinal design intends to permit a deeper and more nuanced understanding of learning and innovation in the context of a firm operating in an emerging/transitional economy and sector. The interdisciplinary approach utilised further develops a rich tapestry of the macro- and meso-level factors, while paying close attention to the micro level practices, which breaks away from a one-dimensional and cross-sectional snap-shot analysis. As a researcher, I was intensely conscious, from early in the research cycle and waves, of exploring methods that 'fit' the situation and thus viewed primarily cross-sectional means as insufficient and impoverished for my research purposes.

Organisational ethnographic techniques, involving observations and project shadowing project outcome analysis and meeting and talking with project members and teams about, and after 'learning episodes' were employed, to grasp the work processes and practices. These were set within a pragmatist orientation, inspired by an abductive approach whilst undertaking and at later reviewing of the vignettes.

A note on my utilisation of observational methods, and later analysis thereof, is worth highlighting. My position is similar to Bakker et al. (2006, pp. 347–348) when they clarify that,

> "while we describe our observational methodology as ethnographic, we [are] careful to state that we do not attempt the kind of engagement which is typical of ethnography amongst professional anthropologists, … over periods of months or years [of immersion in the field]."

Additionally in my analysis, similar to recent workplace learning analysis (ibid), I have by and large refrained from coding "individual 'chunks' of data, such as individual interview responses", as my understanding of how learning leads to innovation in practice draws on the processes of thematic clustering and analysis, and has built upon a synthesis of different viewpoints and data sources, enhanced by triangulation means. I have therefore made use of thematic clustering and analysis (Boyatzis, 1998; Braun and Clarke, 2006; DeSantis and Ugarriza, 2000; Harvard GSE, 2008; for technical notes, cf. Saldaña, 2013, pp. 175–181) that has been derived from the overall state of the empirical analysis, based on multiple sources of the longitudinal field data at my

disposal. The themes, themselves built upon 'segmenting and re-assembling' the data along the spiral of analysis and the application of constant comparison (Boeije, 2010, pp. 76–90, cf. constant comparison as a method, 2002) and theoretical sensitivity on the literature. This is enhanced by drawing on summary and synthesis of previous work, which have then shaped the additional theoretical foundations for the creation and development of the DEAL model and skill webs analytics.

Whilst an experienced proponent of the constant comparison method, referring to the actual analysis in constant comparison method as iteratively investigating qualitative data, till reaching a 'saturation point' where no further insights are gained, Boeije (2010, p. 84) highlights a key insight, outlining that

> "Constant comparison of data does not automatically lead to adequate descriptions of the field or to theory. The data do not 'speak for themselves' but the researcher plays an active role […] combining the different elements…"

She advances her argument by citing Wester (1995), as a Dutch researcher that she draws upon, who has developed constant comparison from a qualitative method into a qualitative strategy. He has created and advocates a potential analytical framework and model (which I have labelled ESRI iteration) based around the procedural logic of constant comparison that has four [ideal-typical] phases as follows (cited in Boeije (2010, p.84)):

> "1.   Exploration: the discovery of concepts
> 2.   Specification: development of concepts
> 3.   Reduction: determining the core concepts
> 4.   Integration: developing the final theory"

Whilst acknowledging that both Boeije and Wester draw on grounded theory principles and procedures in their work, I have found their evolved approach, built around the core idea of constant comparison, to allow sufficient flexibility to be utilised in my empirical data compression, management and interpretation. I have thus taken this insight, as well as the four-phased model above, and have used it to guide my interrogation of the quantitative longitudinal data corpus, primarily on the theme level.

Whilst the core research ethical principles, i.e. informed consent on a voluntary basis; privacy; and confidentiality and anonymity (BERA, 2011) were designed into the study and observed from

the start, enhanced by the departmental ethical committee procedures, some contingency planning related to the longitudinal nature of the research, as creating additional operational challenges, were envisaged. As an example, one of the challenges which I initially envisaged, which may have needed to be regularly managed, was the maintenance of 'ongoing motivational factors' of the participants to retain their interest in continuing to engage with the study, and avoiding significant attrition rates in different waves of the study. My contingency plan was to pay due attention to factors that could retain the motivation of participants, as well as being open to explain the current stages of the work, and how different parts will ultimately fit in together, as well as a continued re-assurance on the voluntary nature of participating and privacy as well as continued confidentiality and anonymity safeguards. In the event, during all the waves, there were no significant difficulties encountered in this respect: the natural attrition rates due to the firm's staff turn-over, especially of the few of the protagonist team members, did not create major difficulties as over the years, certain 'project anchoring' individuals had remained with the vignette projects and the firm and retained the institutional memory of the research. This position has changed since, as in 2013 a number of protagonists left the firm.

Before concluding, a key point in this section is to highlight the need for a careful consideration in creating congruence in unit of analysis (UoA) and the focus of the empirical inquiry. This tension has recently seen some poignant discussions and debates, both within the learning literature as well as the broader management literature, encompassing learning and innovation (Edmondson and McManus, 2007; Miettinen, 2002, 1993).

Discussions on the appropriate unit of analysis to utilise for learning have been greatly enriched by recent contributions from Roger Säljö, as a socio-cultural scholar (2009, cf. 2007). Säljö has paid careful and insightful attention to the often implicit incongruence at the level of unit of analysis. He argues for a stronger interconnection between the purpose of an empirical inquiry and the unit of analysis utilised, describing unit of analysis as the conceptualisation of a phenomenon "that corresponds to a theoretical perspective or framework" (Säljö, 2009, p. 206). He also outlines the importance of what is conceptualised and, in the classical sense of a unit of analysis, what is observed in terms of changes across time and situations, but highlighting that these will depend on the questions being addressed and the theoretical perspective being adopted (ibid).

In further justifying my methodological approach, it is worth highlighting thematic analysis, while utilising the *ESRI* cycle: the four [ideal-typical] phases (cited in Boeije (2010, p.84)) of Exploration - the discovery of concepts; Specification - development of concepts; Reduction - determining the core concepts; and Integration: developing the final theory.

6.1.4 Skills webs and work processes: context and the DEAL model

As stated in the earlier chapters on Iran and Tehran's business operating environment, the new technology-based firms have had limited options in enhancing their innovation capacity and capabilities. As the conventional and formal routes, such as contractual means of technology transfer and international joint ventures (IJVs), have been problematic, informal brokerage has gained the implicit centre stage. We thus need to bear that in mind whilst considering the enhanced role played by learning episodes facilitated by brokerage and skill webs.

As the learning episodes occur within the flux of work processes, and by extension, the flux of work involves diverse skills, I have borrowed and build upon the notion of skill webs and applying it at a micro level so as to help us to make visible the range of interprofessional skills that surface in the learning episodes.

So in order to develop the analytical framework and the subsequent model, we need to briefly revisit some of the earlier theoretical and conceptual conclusions about learning and innovation. As stated previously, the concept of 'skill web' was initially constructed and introduced within a macro level framework (2010, 2009). Building on earlier discussions, it is my contention that 'skill webs' is not only apparent and operational on the macro level, primarily as a form of 'arbitrage' arrangement for sourcing, but also on the meso and micro levels, as a form of brokerage and informally intermediated sourcing. The *skill webs*[98] is an evocative concept: I have taken the spirit and the kernel of the idea and have used that to help us think about the connections and the actual processes involved in firm-based brokerage, in aid of learning for innovation.

Building on the previous work, my intention therefore is to use the principles of pragmatism to help us think about the operationalisation of 'skill webs', particularly in small technology firms' projects.

My departure point is to revisit and review an interesting attempt to look at skill in relation to work process, undertaken by Guile (2002b) while reviewing aspects of skill and work experience in the European knowledge economy, and later supplemented by Guile's work on *workflow*

pedagogic processes (2008, p. 259) and later on interprofessional working and learning (IPWL) (2011, 2010b). Guile's original typology was constructed in an effort to theorise the relationship between the individual and the collective skill in relation to the work process.

My aim is to retain the idea that lay behind the typology (ibid) of looking at skill in relation to work processes but the work processes that I have identified, and wish to explore further in 'skill webs', are the processes of brokering and informal sourcing. While I have retained the 'individual' and 'collective' continuum, as well as 'symbolic analytical' and 'intrapreneurial' activities within the 'individual' sector; and 'boundary spanning' and 'polycontextual' activities within the 'collective' sector, as used in his model, I have chosen to evolve the descriptors[99] in his model, to reflect the pragmatic orientation and principles, more congruent with this study.

I have therefore attempted to evolve the model to take account of my focus on brokerage and sourcing as intermediation; be it at the level of knowledge or practical skill. This is a way to frame what the 'skill web' may look like in the actual processes pan out in practice: the task of the DEAL model and skill webs (be it with e*xpansive or c*o*ntractive features* or *fragmented*) are to fulfil that need for conceptual and processual clarity.

In his original model, Guile (2002) defined and utilised terms such as 'symbolic analytical' and 'intrapreneurial' activities, and 'boundary spanning' and 'polycontextual' activities, as generic skills. These definition are fine for my concern, as they capture the nature of activities undertaken to learn and innovate, and are also broadly in line with recent research (OECD, 2013a, 2011; Toner, 2011; for innovation in developing economies, cf. World Bank, 2010, pp. 167–169). Guile (2011, 2002b) has further distinguished in the work processes, the symbiotic relations between individual and collective activities, particularly in interprofessional learning and working spheres and I have chosen to follow-up this line of inquiry as it is congruent with the nature of activities and processes within my case studies. On the basis of this reformulation of the criteria for the typology, I have devised a number of descriptors based on Morgan's characterisation of pragmatic methodology.

Within the episodes, certain activities and processes accommodating the project breakthroughs were highly apparent. These are outlined in the table below.

Table 7 [6.1.4T]: Features of conceptions/activities in skill webs

Focus	Nature of work processes	
Individualised skills	- Symbolic analytical (ability to infer between different, and apply specific form of knowledge) - Intrapreneurial (ability to work effectively in face-to-face and distributed work context)	Co-ordination and Control [prominently 'interactive' features, described in the Deweyan lexicon as 'action between entities']
Collective skills	- Boundary spanning (ability to broker and conduct inquiries effectively in, and bridge across different contexts) - Polycontextual (ability to infer and judge between different forms of professional / technical knowledge)	Collaboration [prominently 'transactive' features, described in the Deweyan lexicon as 'action across entities']

(constructed by author, partly based on (Elkjaer and Simpson, 2011, p. 69; Guile, 2011, 2002b, p. 266))

Having discussed the skill webs, we now move on to the Deal Model. As stated before, the critical issue for the small firms is how to use the skill webs to facilitate the processes of learning and innovation. We recall from previous chapters, particularly discussions in chapters four and five that the DEAL model draws on a number of conceptual distinctions which has already been highlighted in the thesis: these include exploration and exploitation, and learning at individual and collective levels.

We recall that exploitation refers to the firm's refinement and development of existing knowledge with predictable outcomes, whereas exploration refers to the pursuit of new knowledge with uncertain outcomes. We further note that the nature of learning is in the form of generative interactions between individual and collective inquiries, and as means of performative nature of learning, deriving out of exploring metaphors of mediated problem setting and [re-]framing in order to innovate. These are placed on the horizontal and vertical axis of the model's schematic respectively, outlined in the figure 6.1.4.B below.

In the centre of the figure 6.1.4.B, drawing on the learning episodes, we noted the zone of 'collaboration' and 'coordination and control' activities within projects, as articulated and facilitated by the cycles of Scrums (and Sprints), which were first discussed in chapter one.

Collaborative efforts bring together experts from different domains or firms, to solve a specific problem or to provide a strategic advantage over single discipline or single firm offerings. Professional 'collaboration', including projects, often starts by involving entities that possess different expertise. In sum, we collaborate to tackle problems which are deemed too large for a single individual or team (or a firm) and to leverage multiple expertise[100]. 'Coordination and Control' on the other hand, within the literature, broadly refers to management of processes to enable effective work as well as *'managing dependencies between activities'*[101]

At the heart of the activities however, I noted a range of processes which I labelled as DEAL, as an acronym that stands for the cycle of Design[102], Execute, Adjust and Learn.

Within the DEAL model, various activities were enhanced via formal and informal knowledge brokering and knowledge sourcing, via, in and between firms[103]. A sample series of questions, relating to each problem or inquiry, which are tackled at these stage include:

- **D**esign: What is desirable and viable, and how feasible is it?
- **E**xecute: What is the expected outcome and impact of the process/artefact?
- **A**djust: What worked and what did not, and why? What further 'mutual adjustments' are needed?
- **L**earn: What is the core problem and cause? How can we frame and reframe?

The cycle continues with alternative framing and reframing of the new problem and inquiry, which then leads to a new design imperative, transforming prototype to archetype, till an adequate solution is formulated.

Brokerages and sourcing may occur initially via formal means (e.g. contractual domains) but are mainly conducted informally, with trust gradually gained in time, by

1. Visits to technology fairs and workshops
2. Exposure to global/glocal professionals or R&D networks, and
3. Participation in online developers' space on specific technical problems.

Figure 14 [6.1.4F]: DEAL Model: learning and innovation processes in creative projects
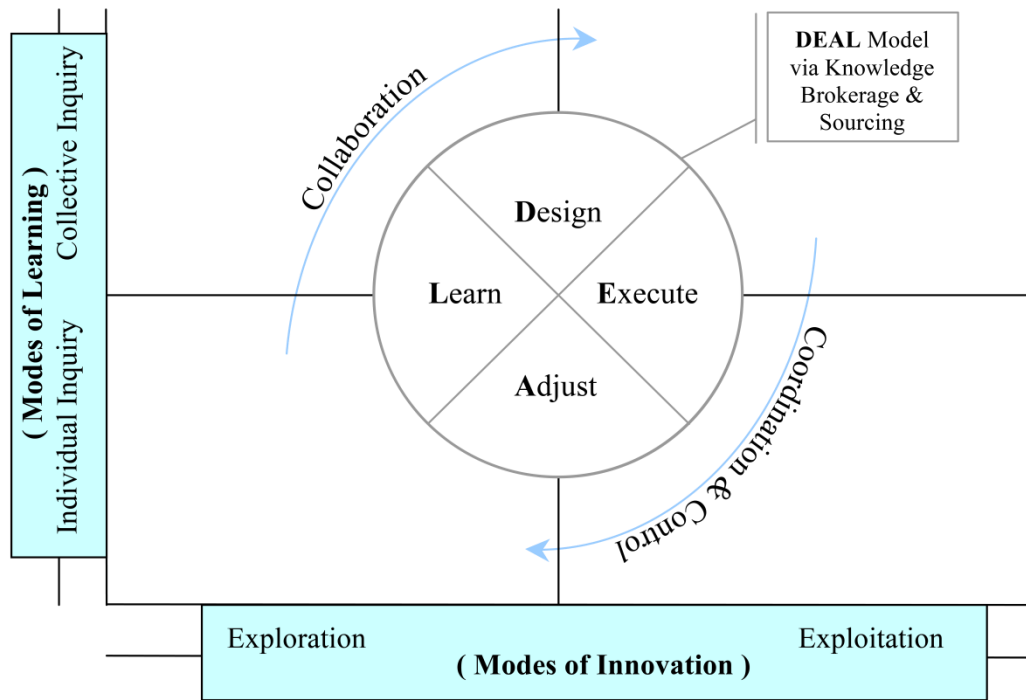
Highlighting the operationalisation of the 'skill webs' concept, in actual interactions, the action of project members in practice, in pursuit of 'performative' learning, be they the supervisory managers, software application analysts and developers, or marketing, finance and support staff, fell into different types of brokerage processes. Whilst all forms of brokerage were detected to some extent, the learning episodes leading to 'break-through' primarily involved "gatekeeping", "representing" and "liaison" brokerage type,.

Equally, examining the timeline of the creative projects, some of the more intricate connective features of the skill webs play an important role in the success of learning episodes. In ideal-typical terms, the two types of skill webs, which I have labelled as 'Expansive Skill Webs' (ESW) involving bridging and linking activities and 'Contractive Skill Webs' (CSW) involving bonding activities, both have the potential to lead to project break-throughs. A third type, labelled as 'Fragmented Skill Webs' (FSW), which is an unsustainable form of skill webs, ultimately does not get to the stage of performative-learning as it breaks down or metaphorically 'evaporates'

mid-stream of projects, before reaching performative collaboration, thus leading to project cul-de-sacs. These are outlined in the table below.

Table 8 [6.1.4.C]: Dominant features of brokerage in skill webs

Brokerage Feature	Activities
expansive skill webs (ESW)	bridging and linking
contractive skill webs (CSW)	bonding
fragmented (non-functioning) skill webs (FSW)	singular/unsustainable bridging and linking occasions

(constructed by author, drawing upon and extending (Guile, 2010a))

In formulating the analytical framework, derived from the literature and the data, I thus attempted to ground my observations and theorisation. As no single strand of literature provided the necessary theory, I brought together arguments of several theories and soon traced patterns of cyclical exploitation and exploration, within inquiry-based activities.

As the title of this section suggested, we have outlined a number of issues to consider whilst structuring a prolonged empirical inquiry, within a pragmatic approach. We will return to a number of discussed concepts, in the next chapter, primarily to discuss implications of the case study vignettes. For now however, we will move to part two of the chapter to outline and expand on the case study vignettes.

6.2   Part Two: Analysis of the case study vignettes

Building on the conceptual foundations provided in the last chapter, this section starts to analyse the case study vignettes and the next chapter provides a further conceptual commentary on the case vignettes, before discussing the potential implications of the findings within the case study.

It is worth clarifying that I am using the term case vignette[104] as a way to present the interactions within the learning episodes which I have chosen to discuss: the term therefore ensures that the context of the episodes is presented and not taken for granted.

In addressing the research propositions, my aim has been to develop fidelity in the analytical model so as to enhance rigour in the analysis, whilst addressing the dynamic and 'performative' nature of learning in the firm's operations and the extended temporal aspects of the study.

This section opens with an introduction, and the core part of the part two of this chapter outlines two case vignettes: m-Services on national TV and m-Banking enhancing multi-channel services delivery. I then provide some glances of the practical challenges and interactions such as segments from meetings and interviews, team discussions and validation meetings, supplemented at places by my observations on the context and background. The last section draws out some of the implications of vignettes in brief, so as to provide a natural bridge to a concise, yet more detailed and specific discussion in chapter 7 of brokerage and intermediation, via skill webs and informal professional networking, shedding light on work processes.

The vignettes therefore exposes the problem of relations between workplace practices and the resources available to individuals and teams, as described in the earlier chapters, within the 'business climate' they inhibit and operate, as well as the resources they try to mobilise to undertake inquiries and solve problems. In doing so, it refers to a number of issues which were highlighted in chapters 2 and 3.

At times, this leads us to being confronted by, and coming to terms with the firm's moment-to-moment and tactical interactions and project priorities to achieve a significant level of distributed- and joint-work, in aid of solving its problems. At other times, the longer term objective of tasks and projects are more present and pronounced. This *bifocal* switching of methods and the

'accommodating' action of project focus required to continually move from short term to medium-to-long term, is captured by the cycles of exploration and exploitation, embedded in the DEAL model. It should also be highlighted that the *bifocality* within this context, is intrinsically driven primarily by project purpose/s and subsequently by processes and outcomes, and re-constituted by distributed interactions. Similar to many processes in firms, when all goes well (such as making a project 'break-through'), the 'switching' becomes a largely transparent canvass for the successful completion of project tasks. Conversely, when things do not go so well (such as ending up in a project task's 'cul-de-sac'), this transparency disappears, and a myriad of issues demand analytical attention. 'Unpacking and untangling the learning episodes thus in both cases of reaching a break-through and/or a cul-de-sac is deeply embedded with the performative nature of the learning in the projects and firms.

The brokerage and DEAL model thus have the explanatory potential to help to make explicit what was implicit in the firm's social practices: this is of a generative nature not only in the firm under study but also potentially in other similar contexts and sectoral settings.

The two case vignettes within the study are outlined here and expanded in detail later. The first case concerned the introduction and use of mobile services on a popular sports programme of the Iranian national television channel 3.

It followed the development of the business and applications case over a number of years examining how the creative executives and controllers of the television programme were persuaded to explore and exploit means of live competition and voting (similar to the methods used originally in talent shows in the EU, such as the *Big Brother* and *the X Factor* series and *Eurovision Song Contest's* televoting system), while on air, as a unique and highly responsive mean to create 'live' bridges to the audience concerns and feedback. AlphaCo's projects initially introduced, and provides the technological platform and consulting to make this happen.

The second case concerned the introduction and use of mobile banking services, enabled via SMS: it falls within the mobile banking application and solutions, later rolled out for a number of large Iranian banks. In 2004-2005, it was clear that a move towards 'internet banking' in Iran would be slow. Mobile banking (m-banking) as a source of multiple 'service channel' concept and tool (cf. OECD, 2005b) was thus introduced and promoted by AlphaCo as projects, while exploring innovative service design. It was built around SMS, and where needed secure and

encrypted SMS were utilised, to allow customers to check accounts and transfer, and later pay via SMS into specified accounts - e.g. utilities bills. It is important to note that the solution did not require the use of 3G facilities of online banking via smart phones connected to the internet. The firm and developers draw on their project partners in London, in "framing" the problem and then ways to re-think/re-frame the solution given the local context and constraints.

In both vignettes, the service developers faced major issues in creating 'generative metaphors' in problem-setting, to make the relevant teams of staff, of different backgrounds to 'restructure, reposition and re-contextualise' (Guile 2010) the issues. A break-through in both vignettes was through an initial inquiry, in the form of a presentation 'pitch', brokered via the firm's executives assisted by their 'insider contacts', leading to an agreement to allow a prototyping phase. As the skill webs and interprofessional relations developed, the prototypes slowly moved to become archetype, and new industry norms were set and while evolving, the solutions are still (as of late 2017) in operation, as viable service-channel options.

The figure below outlines the timeline of the empirical study. Detailed commentary on the methods and analysis was provided before and will be supplemented by the last section in this chapter and discussed further in the next chapter.

Figure 15 [6.2]: Longitudinal data collection and waves/exposure points
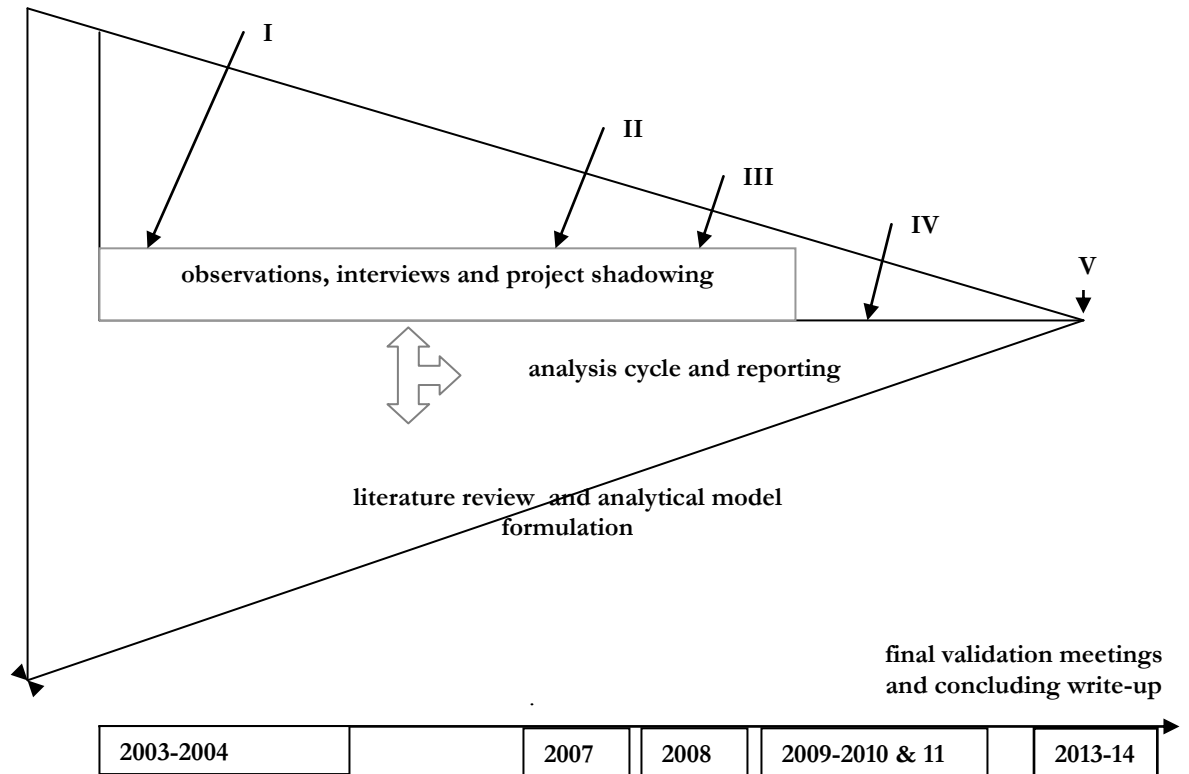
As an exploratory study, within the Tehran based firm's context, this account attempts to capture a connected slices of time and place, via the filter of the firm's activity on technical projects. The arrows at the top of the upper triangle indicate the organisational ethnographic immersion periods, at the firm and/or attached to related project meetings:

I.   Four weeks (December 2003- January 2004) in firm in Tehran (acting as a pilot stage)

II.   Two weeks (June 2007) in firm in Tehran

III.   One week (June 2008) in firm in Tehran

IV.   Various days accumulating to two weeks (between July and September 2009) in Tehran and one week in accumulated days, between June and September 2010, as case follow-up in London, as well as continued ad-hoc virtual contacts and project-issues' tracing and tracking in Summer and Autumn 2011, accumulating to one week.

V.   Various days accumulating to two weeks (between May and September 2013) in final project (*break-throughs* and *cul-de-sacs*) follow-ups, meetings and attendance at *Iran Telecom Fair 2013* (*the 14th International Exhibition of Telecommunications, Information Technology and Networking* held in late September 2013 at Tehran's Permanent International Exhibition Centre, in north Tehran) with the firm.

Lastly, there were also three occasions of ad-hoc follow-up e-mail, telephone calls and in-person meetings with selected individual *protagonists* (team leaders, who were still with the firm and traced via *LinkedIn* professional networking system when they had left the firm) in spring and summer 2014.

The empirical elements, derived from the five waves, investigated sharing of problem-reframing/-setting and problem-solving expertise on the issues that emerge out of daily business challenges in projects, which is both of a technical (software) and a commercial (business model and service design) nature.

The primary-sourced data within the firms[105] is of a longitudinal nature and comprises of two group interview meetings, initially 18 semi-structured interviews and ongoing organisational ethnographic observations across 2004 to 2013, plus ad-hoc London and Tehran-based meetings, 'issues-tracing' and 'feedback and validation' meetings.

The longitudinal research design involved five waves of (one pilot and four actual) data collection, broadly in line with a 'panel design', where as far as possible the same people are contacted, observed and/or contacted and interacted with more than once (Ritchie and Lewis, 2003, p. 76), with the orientation and focal thematic questions mirroring previous research (Sole and Edmondson, 2002; cf. Waterson et al., 1997, pp. 100–101).

Despite the potential attrition rate, this design strengthens the shortcomings of a single case study (Yin, 2009b) and is of particular value when time-critical processes such as learning are observed.

6.2.1 Justifying the methodological timeline and waves

Before outlining the vignettes, this section aims to provide two insights as a way of further justification for the methodological approach undertaken. These insights, in brief, are as follows:

A. the importance of time gaps between the waves of the empirical elements of the research, facilitating, as well as requiring a flexible emergent design

B. the relevance and appropriate utilisation of longitudinal data collected across a protracted time period.

Initially commencing as an exploratory study to consider learning in firms in pursuit of innovation, the different phases of the research were associated with a gradual tightening-up of the research focus. Having started by looking at strategic management; 'knowledge management' cycles and methods; and the firm's strategy and/on learning; as well as organisational learning within the context of the firms, and after iteratively reviewing the literature related to the rapidly changing business context of the firms, it was found that these initial themes were unlikely to lead to a workable, and more importantly, a timely and contextually relevant approach for the thesis. In short, some of the debates had run their course and some of those core-reviewed topics had moved on and branched in different and unexpectedly nebulous ways. Added to this, as time along the research and empirical elements had passed, other core themes had slowly begun to emerge as more central to the firms' priorities, around survival and continuous development. This gradual 'grounding' then lead to a significant reduction of 'noise' factors and refocusing of the core interdisciplinary literature, on the role of brokerage and intermediation, in learning and innovation.

The need to re-focus, as a result of the relationship between the researched and grounded realities of the practice was recently highlighted by Boeije (2010, p. 26)

> "In proceeding from a problem to more specific issues and questions defined by information collected in the field, the researcher may realize that the initial question is somehow inappropriate; that it just does not make sense in terms of the realities of everyday life. Or the researcher may discover that many important issues in need of study were not anticipated at the onset of the project. If the research project were to continue as planned, it would yield less interesting results than if adjustments were made now. Researchers may also discover that they do not get access to their preferred field of

research, forcing them to reformulate the research question in such a way that they are able to get access."

A similar point echoing the above was also well captured in earlier studies by Walford (2001, p. 5) when he outlined that:

"Fundamentally, doing research is a profoundly pragmatic and down-to-earth activity… Where textbook on research methods usually give normative advice on how research should proceed in an 'ideal' environment, the real world of research is one of constraint and compromise. The nature of the various compromises to be made vary with the research project and may well change in importance as the research progresses."

So returning to point A. made above, the time gaps and multiple waves have played a highly significant role in shaping and refocusing the research and with it the empirical lens applied, based on the actual unfolding context of the firm.

Figure 16 [6.2.1]: Data collection waves and abductive iterations
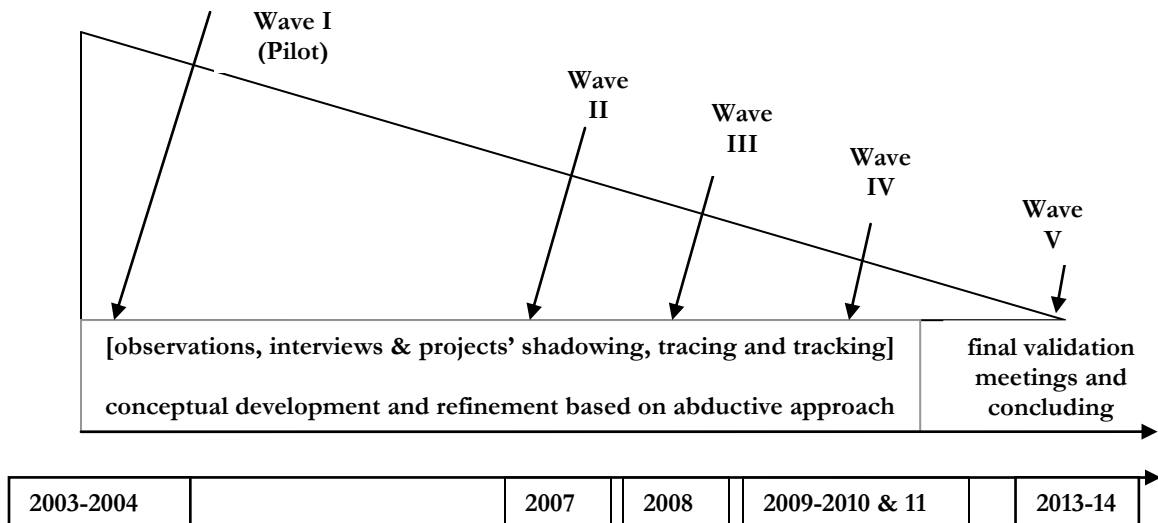
The figure above outlines the dates in the longitudinal approach (horizontal line) and the case-study's immersion periods as cross-sections (vertical waves). This way the study attempts to capture connected slices of the firm's activity on the shadowed technical projects. The arrows at the top of the triangle indicate the organisational ethnographic immersion periods, at the firm

and/or attached to related project meetings (in London or Tehran). The list of questions used and issues raised at Wave II onward is presented in appendix one.

Overall, in its first five years of operation by 2008, approximately matched to the research cycle, the firm had survived and gradually prospered. However, once passed the 5 year mark, it started to significantly (and in some short periods, near exponentially) develop new and fine-tuned existing strategies for its continued prosperity and successful operations. Had the thesis not been able to configure ways to leave the 'analytical window' open for longer than the fledgling formative years (of the first five years), we would have clearly ended-up with quite a 'different take' on their interactions, intermediation and learning-to-innovate strategies and efforts.

The research therefore had to be re-oriented, which included 'back-grounding' (and at times, abandoning) a number of themes and related literature, and taking on new reviews in line with the refocused position in order to 'fore-ground' new lines of analysis. As the research waves had made use of organisational ethnography, including observational data, individual and group interviews, and validation discussions/meetings, as well as document analysis, the issues around learning episodes within the three categories of the skill webs, operating within the DEAL model processes were then primarily focused upon and probed. This subsequently led to a much desired reduction of 'noise' in the large data volume and the emergence of the interconnections between the different parts of the thesis related to theory, practice and policy.

As to the point B. above, the relevance and appropriate utilisation of longitudinal data collected across the time period had become an important consideration for the analysis, both theoretically and practically. It is in fact by wanting to address this issue, from the outset, that elevated thematic clustering and analysis as the preferred choice of analytical means.

6.2.2 Outline of innovation case vignettes: m-Services on national TV and m-Banking enhancing multi-channel services delivery

The firm under study and the partner firms involved are all SMEs: all 'young' in that they were founded within the last decade and despite the ICT industry links, essentially operate within the nexus of the digitalised creative sector in Tehran and London. Based on the longitudinal nature of the study, the number of staff has changed over the years: the primary firm, AlphaCo, has in late 2013 settled with around 60 FTE (full-time equivalent) members, which includes use of occasional yet regular (short term) project assistance, particularly on software solutions, coding and debugging (on multiple platforms) tasks. The London based partner firm has over the years become so lean that now operates with only a couple of FTE members: the primary function of the London partner has evolved over the last decade into sourcing and brokering technical and business expertise. The episodes described later are therefore primarily 'located' in AlphaCo, in Tehran.

m-Services on national TV

The first of the two case vignettes within the study are thus outlined here: the case concerns the introduction and use of mobile services on a popular sports programme (focusing on football) of the Iranian national television channel 3. It followed the development of the business and applications case over a number of years examining how the creative executives and controllers of the television programme were persuaded to explore and exploit means of live competition and voting (similar to the methods used originally in talent shows in the EU, such as the UK's *Big Brother*, *the X Factor* and *Eurovision Song Contest*'s televoting system), while on air, as a unique and highly responsive mean to create 'live' bridges to the audience concerns and feedback. AlphaCo's projects initially introduced, and provides the technological platform and consulting to make this happen. The period of the firm's engagement commenced in 2004 and the project was essentially considered satisfactory (in a *Beta* format) in about 12 to 18 months and highly 'stable', fully evolved and considered a local industry standard leader by 2010.

As will be reiterated later, the evolved versions of the business model and software solutions for both vignettes were still, as of late 2013 and (when the last 'validation meetings' were conducted - and then a final project follow-up in mid-2014, and re-checked in 2017), in full operation and active usage.

The "Programme 90" (locally known as *"Barnameh Varzeshi Navad"*[106] in Farsi) is a highly popular programme broadcast on Iranian national television channel 3 (IRIB[107]: Islamic Republic of Iran Broadcasting), chaired by a talented anchor[108], who is also the founder and the producer of the programme, who is competent in English as well as Farsi language, usually late every Monday night extended to early hours of the Tuesday morning, live for about 180 minutes. The programme carries both national premier league match segments, highlights and analysis, interviews and commentaries, as well as EU/International (such as Asian and Latin American) matches under national licence broadcast agreement.

Initially established and on air in 1999, by early 2000s, in order to maintain and improve its rating, the programme needed a much better audience participation mechanism to vote on issues (e.g. favourite goal; favourite team manager or striker this week/month,... primarily a binary or nominal question e.g. choice of 1 or 2 or choice of 1 to X, as nominated numbers to be SMS'ed back to a specified number) similar to other televoting systems although with somewhat cheaper SMS charges as the use of 'premium numbers' were and are not generally used, nor allowed in Iran. The programme with its live feed remains one of the most popular (with significant numbers in Iranian TV audience participation rates of recent years), and occasionally controversial, as hard questions are put to the managers and national team's performance, in Iran.

Both at the start of the firm's engagement with the TV programmes in Winter 2003 to Spring 2004 as well as its continued relationship to date, some elements of the design remain 'under the radar', brokered by AlphaCo in the background. An important break-through back in Winter 2003 was in the form of a brokered contact, from the AlphaCo's senior managers with the programme anchor, to discuss potential means to enhance audience participation, and a technical demonstration of the potential capabilities of a suggested system solution. This led to a provisional agreement to start working on a software solution prototype, overseen jointly by the firm and the programme production team (which initially started at about 10 and through the decade has grown to over 60 technical, production and sport journalism staff) to see if it receives attention and 'buy-in' from the audience.

The TV production team initially had serious reservations and concerns about the potential stability of any software solution system that would be relied upon, during a live broadcast. As the prototyping was progressing, the firm suggested finding a corporate sponsor to provide gifts to the winners of the weekly competition whose numbers were chosen at random by the weekly guest, live on the programme. The 'gifts' offered evolved over a number of months and years, and finally settled to being electronic equipment, such as mobile phones and in some exceptional cases included digital TVs and large screens (sponsored by the Iranian partner of a large South Korean conglomerate), and was and continues to be viewed as an implicit 'product placement' form of advertising. As the system became more robust, on some evening managing to handle over 2.5 to 3 million SMS load, and as more gifts were won by different people in different cities and towns of the country, as part of the competition incentives, the viability of the audience service-channel was consolidated over a period of about 18-24 months (to mid 2005-early 2006).

The application has been modified over a number of years and whilst the technical solution and the business model has been 'copied' by a number of other programmes, it is still an active and integral success part of the "Programme 90" which is still utilising an evolved version of the original solution, continuously administrated, managed and updated by AlphaCo.

m-banking enhancing multi-channel services

I will next outline the second vignette and then in the following sections proceed to offer a sample of actual encounters and description, on the task and team level interactions and transactions.

The second case vignette concerns the introduction and use of mobile banking services, enabled via SMS: it falls within the mobile banking application and solutions, later rolled out for a number of large Iranian state and privately owned banks. In 2004-2005, it was clear that a move towards a PC based internet banking in Iran would be gradual and slow.

Mobile banking (m-banking) as a source of multiple 'service channel' concept and tool (cf. OECD, 2005b) was thus introduced and promoted by AlphaCo as potential *market-creating*

service innovation (Berry et al., 2006) projects, while exploring innovative service design. It was built around SMS, and where needed secure and encrypted SMS were utilised, to allow customers to check accounts and transfer, and later pay via SMS into specified accounts - e.g. utilities bills. It is important to note that the solution did not require the use of 3G facilities of online banking via smart phones connected to the internet and the technology started as, and has remained essentially SMS based. The firm and developers draw on their project partners in London, in "framing" the problem and then ways to re-think/re-frame the solution given the local context and constraints.

This was partly undertaken by exploring service design using mobile phones, as well as by exploiting the use of SMS interfaces in Farsi (Persian) to make the content more user-friendly for all, and cryptography for mobile communications - encrypted SMS - and ultimately "bringing everything to the lowest common denominator" so that any customer with almost any "relatively new mobile phone models" [as in 2006-2007] and subscription contracts can still use the higher most level of service offering. In short, AlphaCo created a new and viable 'service channel' via SMS-enabled banking, for the bank's customers.

The service developers faced significant issues in creating 'generative metaphors' in problem-setting, to make the banking staff, of either a technical and/or financial audit background reframes their inquiries and practices within the remits of the project.

A break-through was in the form of an initial inquiry leading to an agreement to allow a prototyping phase, of a mobile solution overseen by a single bank's ICT department, to go ahead. Once the prototyping was a success (cutting customer queuing time from an average of 15 minutes at branch during peak business hours, to conducting most transfers in 2-4 minutes on a mobile handset), it was quickly taken as a serious and viable service-channel option and 'soft-launched', tested and re-launched over an initial period of 12 to 18 months, till early 2006. The application has been modified and where necessary fine-tuned (with bespoke elements for different banks as customers) over a number of years and has rolled out successfully with many Iranian national and private banks, most of which are still using an evolved version of the original solution.

Within both vignettes and in the above collaborative iterations across the firm, their project partners and clients, enhanced via formal and informal knowledge brokering and knowledge

sourcing (e.g. from London based project partners), a series of stages of queries were detected. These were grouped thematically, which I have labelled as processes within the *DEAL* model.

The inquiries would conventionally start around a team of business analysts and application programmers, starting an inter-professional dialogue, mediated (and at times, punctuated) by scrum and sprint project management heuristics. The focus of the iterative cycles would revolve around the DEAL (*Design; Execute; Adjust* and *Learn*) processes: these are described in further detail, after a commentary note on research access issues.

6.2.3 Research access

Before proceeding to the next section, a note about research access may be helpful in further outlining the context. The challenges in obtaining and maintaining research access in firms, especially new technology-based forms under longitudinal project circumstances are well-documented: being observed, questioned and at times, implicitly scrutinised can make most project teams under time pressure, uneasy and potentially defensive and uncooperative. The nature of some projects and project stages were seen as too sensitive, or financially costly to AlphaCo, to allow external individuals and other personnel to 'tamper with' too much.

There were various occasions for example that discussions were asked to be held 'outside the records', in 'brackets' and my digital audio recording equipment (and mobile phone) left on a table, with batteries/power supply, visibly detached, or left outside the room. On other occasions, such as tea breaks and meals (and in 'smoking areas') afterwards, or in formal larger meetings, it was inappropriate to produce or even introduce audio-recording or other 'means' or 'tools' that would change the balance of the interactions, and would easily damage a delicate fledgling trust equation.

Whilst mindful of such potentially serious obstacles and conscious of keeping the relationship on an even keel for a significant period of time, I had to draw not only on my former experience as a business consultant, but also on a network of existing contacts (such as mutual business acquaintances and reputable/research-based local universities) to sustain the 'buy-in' form the firm's senior management, who could 'legitimise' my stay and 'inquiry' within the firm. I soon discovered that opportunistic 'cold-calling' of project members hardly ever worked and even when it did, it produced highly impoverished data.

What proved to be helpful was stating (and at times, repeating and reinforcing) that my remit was primarily to explore learning and innovation issues, and sought to assure all parties of firm-wide and individual confidentiality and anonymity (as well as 'firewall' procedures from one project and client to another, as necessary and requested by the firm). Offering feedback at a later stage (in 'validation meetings') and sharing my view and understanding of 'good practice' (for example on "multi-channel service delivery strategies" both by firms and public sector, as per OECD and other international consulting firms published research) in feedback sessions was apparently seen

as positive, as project members seem to welcome the opportunity not only to hear back about their own issues, but also hear about how others may have gone about solving similar problems around innovation development and management and collaboration within a different (and a more regional and global) context, and better horizontally-integrated service sectors.

Whilst connected through key 'hub' individuals served the longitudinal elements of the research well, ultimately however, as a few of the original protagonists moved on from the firm, my access became more limited and essentially, was wound-down in 2014 after about a decade.

6.3   The brokerage in the case vignettes

In order to portray the brokerage encounters in the case vignettes, a brief background to the individuals concerned and their context is useful: outlined in the tables below, I have labelled these 'core actors' as the *protagonists* in the formation, unravelling processes and the eventual outcome of the learning episodes. They are the living mechanisms that make the DEAL processes and skill webs come alive.

As noted from the tabulated details below (tables 6.3.A and .B), the function and speciality of the protagonists are diverse: they display a range of professional (technical and business) experience levels, including a few which possesses international (regional and global) project exposures. The overwhelming majority are university graduates with a significant number holding additional higher level and professional postgraduate degrees; a number of the individuals have also taken further 'functional' (e.g. mobile operating systems; multi-platform web design; online 'advertising/creatives[109] methods and tools, and marketing) courses. This is primarily undertaken on the individuals own time and with their own resources (although at times, the firm has contributed to these efforts) with a view that such professional learning would increase technical and commercial prowess, and would lead to higher employability and progression prospects[110].

Equally, at the time of the projects, all protagonists, regardless of their different particular intellectual assets and skills, were considered to be proficient and with a 'good standing' within their professional peer groups. During the prolonged interactions, especially on one-to-one meetings, the protagonists would speak at length about their career histories and trajectories, the problem-framing and -solving strategies that they have found useful in practice (as well as, somewhat ironically, the theories that have failed them in their context - highlighting the 'theory, practice and policy' conundrum in small creative firms) and the macro and sectoral operating conditions, including those specifically related to the sector's operation in Tehran, and lived experiences, including 'working under tight timescales and deadlines' to meet client expectations, under which they have to operate.

The physical layout and conditions of their workplaces was also a shared topic of concern (and would often act as an informal 'ice-breaker'): the issues around open plan offices, air-

conditioning level and ambient noise, as well as, at times the 'highly variable' speed of the internet connection were among the issues. Generally, the team members shared a room with two others: the firm also had a couple of formal meeting rooms and a small open plan space in the basement; the latter was used as canteen space for lunches, celebrating occasions such as team members birthdays, and a place for tea and biscuit/cake breaks, and other informal discussions.

As office space is at a premium in central (up-town) Tehran, only the *Managing Director* (MD) has a separate room, which is large enough to accommodate meetings with up to four or five other people, such as the *Technical Director* (TD), *Venture Support* leads (VenSup), *Creatives and Branding* leads, *Financial Planning and Management* lead, and other internal/project staff and visiting external clients.

All rooms are furnished with modern office technology: additionally, the MD's room was furnished with a dual-purpose flat screen which would allow for watching terrestrial TV as well as for presentations. This would become a 'hotspot' during the live tele-voting and SMS programmes 'on air', such as on late Monday evenings football programme (Programme 90 [Barnameh Varzeshi Navad]) as outlined before. As the programme run late into the night (passed midnight), team members 'on duty' are normally granted the next morning off, under time off in-lieu (TOIL) or flexible working hours arrangements.

Within both case vignettes in m-services and m-banking, further unpacking of the encounters and brokerage relies on both my longitudinal observations as well as the protagonists view points and working experiences regarding their approach to frame and solve problems, in order to innovate. Their individual and collective narratives, actions and at times, silences and withdrawals, clearly displayed the challenges of the production of innovative mobile software application solutions, socially organised under conditions of inter-professional project work.

My formulation and articulation of the DEAL model aimed at assisting to unpack and reveal important facets of this social learning relationship (and learning from relationships), above and beyond the remits of a community of practice (CoP) model, and towards a transitional (as project-based) 'community of inquiry' or perhaps better phrased 'inquirers', embedded in performative nature of their firm's strategies. This de-layering further afforded the possibility to explore the controversial relationship on 'innovating' on 'projects', not only as a viable option but also as a widely diffused mechanism.

Table 9 [6.3.A]: The function of selected protagonists in the episodes of the described case vignettes

	Pseudo-name (and age range/levels)	Title and function
1	Mr MD (40+) Senior/Partner level	Managing Director key negotiator and local 'fixer' and 'lynchpin': Tehran
2	Mr TD (45+) Senior/Partner level	Technical Director key 'broker' and solutions ideation lynchpin: London
3	Mr Technical Lead (35+) Share/Equity holder	Technical Team Leader: Tehran Solutions/application development – 'Scrum Master'
4	Ms Marketing & Branding (25+) Mr Creatives & Branding (35+)	Tehran: development of market and brand London: development of 'creatives' and products
5	Mr FinPlanMan (35+) Ms Accountant (30+)	Both based in Tehran: FinPlanMan (Financial Planning and Management) of project and capital
6	Ms AnaDev: Analyst & Developer Mr Senior AnaDev (both 25+)	Tehran (with potential/actual secondments to London) Technical reframing, problem-solving; coding/testing
7	Ms SecSup (22+) x 2 [positions/roles]	Secretarial Support and project assistance
8	Mr SysSup (30+) Mr Logistics (25+) x 3	System (hardware) support both internally & clients Logistics and practical procurement/fulfilment
9	Mr VenSup (40+) x 3 Senior level/Equity holder	VenSup (Venture Support Leads): entrepreneurial vision Advisors on business and technology trends: brokers [*sleeping partners* in Iran and EU (UK and Germany/Austria)]
10	[Since expansion of firm in 2011-12] Ms HRLead (35+) Ms StratCord (30+) Mr R&DLead (30+)	[all Tehran based] Lead role on HR (HRM/HRD) issues and contracts/PRP Strategy Coordinator: Lead on strategic coordination/projects Lead role on firm's R&D in new service/product development

Table 10 [6.3.B]: The speciality of selected *protagonists* in the episodes of the described case vignettes

Pseudo-name (and age range/levels)	Technical/functional speciality and years of experience [plus qualifications indicators]
1 Mr MD (40+) Senior/Partner level	Senior management, negotiation and networking skills MSc [Industrial Engineering] with 15+ years of experience
2 Mr TD (45+) Senior/Partner level	IT project management and venture capital skills MSc [ICT and Project Management]: 15+ years of experience
3 Mr Technical Lead (35+) Share/Equity holder	IT project management: software design and coding/testing MSc [Computing/IT Security]: 10+ years in Banking IT
4 Ms Marketing & Branding (25+) Mr Creatives & Branding (35+)	Marketing skills [BA/BSc]: 3 to 5 years of experience Creatives and Branding skills in London: (BA) 10+ years
5 Mr FinPlanMan (35+) Ms Accountant (30+)	Financial planning, management and forecast: (MA) 10+ years Financial management of project (BA/BCom) 5+ years
6 Ms AnaDev: Analyst & Developer Mr Senior AnaDev (both 25+)	MSc [IT]: started as an IT Project Intern in the firm: 5+ year MSc [IT]: Technical/project development and training
7 Ms SecSup (22+) x 2	Secretarial Support and project assistance: (BA): 2+ years
8 Mr SysSup (30+) Mr Logistics (25+) x 3	MSc [Computer Science]: Hardware and compatibility support BA/BSc/BCom: Logistics and procurement/fulfilment skills
9 Mr VenSup (40+) x 3 Senior level/Equity holder	Venture support and entrepreneurial skills – active brokerage skills and dense social networks [MSc/PhD/DBA]: 15+ years
[Since expansion of firm in 2011-12] 10 Ms HRLead (35+) Ms StratCord (30+) Mr R&DLead (30+)	[all Tehran based and all part of *Senior Management Team*] DBA [HR] performance appraisal & contracts; 10+ years PhD [Industrial Engineering] systematic monitoring; 8+ years MSc [IT]: business development & prototyping; 8+ years

(the age ranges are within a 5+ years approximation, at the time of the waves)

Building on the background details to the case vignettes' protagonists, the following sections trace the interactions within the episodes with reference to the DEAL model.

6.3.1 DEAL processes

This section is divided into two sub-sections: part one (representing stage one of the analysis) provides an overview glance of the significant residual issues across both vignettes and acts to provide a grasp on the rich context and protagonists. Part two (stage two) of this sub-section takes a thematic view of the phases of development across both vignettes. It does this by focusing on, describing and unpacking the firm's core problem around market-creating service innovation activities, with mobile services and innovative business models. Taken together with the earlier and later concluding part of the chapter, the next section provides the material to further discussions around the core role of brokerage and intermediation in chapter 7.

The material in this chapter highlights that brokerage processes have different types of outcomes; the different combination of people working together at times create breakthroughs or unintentionally could end-up in cul-de-sacs. As part of the discussions, in the next chapter, we will further highlight how some of these outcomes relate to the way in which people use knowledge and skills (in explore/exploit modes) to create exploring or exploiting skills webs (later re-titled expansive/contractive). These discussions will then leads us to consider issues about who should assume responsibility for and how they should facilitate brokerage as a form of workplace learning in a national context.

Stage One

As it is apparent from the previous description, one of successful characteristics of AlphaCo was the ability to bring a diverse yet 'performative' group together, and in the process attempt to span boundaries, both functional/organisational and professional, in order to imaginatively and creatively solve clients' issues, by innovating via technical means through their problems.

The initial inquiry would conventionally start around a team of business analysts and application programmers, starting a dialogue, mediated (and at times, punctuated) by scrum and sprint project

management heuristics. The focus of the iterative cycles would revolve around the following activities (which have also empirically informed the backbone of the DEAL model, as previously described):

- *Design*: establishing what is desirable and viable, and how feasible it may be, within the context of both physical, business climate and budgetary environment of each project. This phase draws on the organisational ethnographic tradition of considering 'distributed design' including prototyping and 'deep-dives' as a solution-oriented and iterative process that captures the whole, yet pays attention to the details. A potent and generative view of this, states that:

  "[design] is not the creation of discrete, intrinsically meaningful objects, but the cultural production of new forms of practice…" (Suchman et al., 1999, p. 404);

- *Execute*: at this phase, questions around what is the expected outcome and the impact of the process and artefact were tackled and often, rapid-prototyping would be required to establish a 'proof of concept' application that can be used to guide the dialogue between the different groups of team: analysts, programmers, project partners and client representative (who would then 'sign off' the tasks on the project at different stages). Execute phase often seemed like a 'beta' type learning: it acted to produce 'something tangible' that could later be improved upon[111]. It also helps to surface issues around 'mutual adjustment' in the firm, and between the firm and the client, with reference to scope and specification of work;

- *Adjust*: at this stage priority is given to examining the prototypes (and initial proof-of-concepts) to establish what needs to be improved, and if tested, what worked and what did not, and if not, why not, including striving to reach a deliberate 'breaking points' to ascertain the range of operation and limitations, when software overload and interoperability were issues of concern.

- *Learn*: at this stage, often captured by a project phase labelled as "Sprint Retrospective" within the project management terminology, issues around the 'core problem' and cause (of failure or shortcoming) are examined. As the 'performative nature of learning' is unpacked by the team and a collaborative grasp and understanding of the inquiry is

shared, suggestions on alternative framing and re-framing of the problem are made. It is also at this phase that the project team's members further develop their ability to infer and make better interprofessional judgements.

This can then feed into the [re-]design phase and the iteration across the DEAL phases can continue till an adequately robust and workable solution is found and stabilised.

In the course of both vignettes, involving the protagonist as outlined, I personally came to observe numerous occasions, where and when, the inter-professionals dialogue was 'hard going' and mediated by artefacts such as project management tools and 'flowcharts'. Similar to other forms of professional services, the dimension of time, be it the team's own or the clients' (billed) time was high on the mind of team members: this was further embedded in the 'scrum and sprint' lexicon and the ever-presence (or lacking) of 'written specifications' forms to act as remote guides, for moving tasks along and handing them over. Intertwined with this, there was also words and concepts, between the different team members and the clients, which at times needed decoding: application programming technical or business-related concepts and words such as 'interoperability', 'modularity', 're-usage' and 're-combinability and transferability' and 'follow-the-Sun' patterns (in sourcing some of the creatives and software tasks between Tehran and London) would act as possible bridges (or at times to the uninitiated, hurdles and gates) in the inter-professional communications.

In all stages of the DEAL processes, the team members would draw, at times heavily, on the internet and the web as a rich resource. These could include a range of communication tools as well as web-based sources, libraries and databases, and virtual communities including bulletin boards and user groups. All protagonists were professional web users, assisted at times by bespoke software, who could rapidly use the web to extract information and potential paths to a technical and business case solution. As the Technical Director (TD) highlights;

> "In our line of work, the web has been, and will continue to be an essential source of easily accessible and timely information as well as a lifeline to [synchronous and asynchronous] communication on project monitoring. […] time is often of the essence and minutes and hour quickly count up [...] so we need to strive for lean solutions [including 'lean innovation' methods]. (Wave III: Tehran)

The web and other interfaces [such as mobile device platforms] also act as our 'shop window', where we can display our skills, previous successful collaborative campaigns and further build our reputation and brand" (Wave IV: London).

On the important issue of team work and inter-professional networking, there was a wide range of opinions and 'conventional wisdom' at play. The senior members of the firm viewed 'teaming' more important and appropriate based on the required tasks of the firm, rather than the traditionally defined stable 'team work' and structure. Seemingly, it was the lack of long-term stability in the projects and the need for multiple sources of skills and expertise that promoted those views. At first glance, younger and less [sectorally] experienced members of the firm seemed to value, perhaps nostalgically, the traditional format of a 'caring and sharing' team, which shared responsibilities and support. On deeper probing however, it seemed that the 'guaranteed' peer support was the core attraction of the traditional team setting: to be able to draw on others, and their resources, skills and networks was seen as a core asset of 'team work' and these were developed, in time, via informal networks to draw upon, as professional and project circumstances required them.

As an Analyst and Developer (AnaDev) expanded on the issue, when she outlined that;

"Within the innovation-generation activities, my notion and understanding of teams and team work has certainly evolved over time and with experience. Initially when assigned a large and complicated project with tight completion timelines, I would choose to find assistance from people I knew well: we would each focus upon a particular part of the task according to her/his particular expertise and speed of performance. Being able to discuss potential queries and problems within the same field and being close-by was an outstanding benefit, despite the potential costs […].

As time went by, I came to realise however that those closest-by may not be the optimal choice of problem-solvers, based on the tasks requirements so I looked carefully at ways of opening up my social network so as to have a larger portfolio of specialist skills to draw upon." (Wave IV: Tehran)

The notion of team, teaming and team work, blended with practical ideas about, and experiences of *networks* and *networking*, is taken-up on many occasions from different perspectives. On a basic level interprofessional teaming in practice is viewed as a valuable opportunity to gain complementarity so as to secure access to new sources of knowledge, skills and enhance their ability to infer and judge situations. It is also viewed tinged with related difficulties that derive out of the challenges of interdisciplinary dialogue; the time and effort needed to sufficiently

unpack and untangle the case so that all parties can firstly, intricately comprehend and secondly, significantly contribute to the problem in hand.

On the related themes, the explanatory comments of a *Venture Support Lead*, as an experienced member of the management team and a co-founder of the firm, is worth outlining:

> "If you ask me whether we are 'highly networked' or 'highly informed' at the firm level, my answer has to be 'probably not'; [are we however] 'strategically networked and informed' [through individuals] to survive and prosper: 'probably yes' (for now, at least before the network nodes and the 'game' changes [articulated with a reflective smile]). Our sector, prevailing [national and international] business climate and our [modest] size dictates our cautious action and will not yet allow us to reach 'best practice' states. […] Also, coordination and control mechanisms matter here, as much as collaboration, as it demonstrates [to the market and to our customers] that we possess the discipline to make things happen and offer an innovative and yet functioning superior product to service continuum. […] Yet, we are smaller, agile and better connected [for decisions than our competitors]... Connected to perform." (Wave IV: Tehran)

Having observed a number of similar 'transitions' within the leading protagonists, I found these inter-professional learning episodes of immense interest and value.

Abstracting from the occasions, the pattern was one of professional transition, grounding and changing (which may seem paradoxical), and development. The team members were not just looking for a 'problem-solving' framework, but also looking for an alternative 'problem framing', provided by an 'outsider' who can grasp and understand the issues from multiple perspectives, and can potentially add complementarity, to contribute with fresh, and yet practical insights.

After a few months close to the team members, it became clear that whilst engaged with the DEAL processes and activities, knowledge and skills brokerage and sourcing is embedded and infused in the team members often informal means. These would in practice be operationalised by

[1.] regular visits to local technology fairs and workshops and thus

[2.] increasing their exposure to global and glocal professional and R&D networks; and for a few lead team members and protagonists,

[3.] 'deep-diving' and participation in online developers' space including, inter alia, brokered contacts with Diaspora members of the technical community, seeking hybridised solutions.

These efforts would then push forward to transform the business solution and/or software application prototype to an adequate archetype. As it was concisely summarised by a leading team member (a project technical lead/senior analyst with over a decade of technical and business solution exposures), in a 'boundary-spanning' dialogue session with the client representative and project partners:

> "Our learning here is all about 'beta': learning and innovation are coupled and yet learning comes first [for us, as technical project implementers]... Our learning is embedded [encapsulated] in the performance of the application software and should manifest itself in our [team's] interconnections[112] with the users and clients, through desirability, viability and usability of our feasible [technical software and business] solutions". (Wave IV: Tehran)

Stage Two

Having provided an overview account of the significant concerns and issues across both vignettes in stage one, this sub-section takes a thematic view, via a temporally based account, of the phases of development across both vignettes. The text will draw on observations and quotations across the different waves of the study, interspersed by my commentaries or clarifications. Where appropriate, it will also highlight the interaction between brokerage features and project breakthroughs and cul-de-sacs.

So as to trace the core thread within the themes, I have returned to the basic overall purpose, and provided a focus on an over-arching challenge (and core problem) of the project teams which is *market-creating service innovation* activities, enabled and enhanced with mobile services and innovative business models. Following detailed analysis by segmenting and re-assembling the data along the ESRI iterations (exploration, specification, reduction and integration) phases, I have condensed and collapsed the issues around the range of related activities in *market-creating service innovation* in the vignettes into two broad strands.

These are *business model* (including processes for a new service, finance and financial modelling, and revenue/charging mechanisms) and *technical and technological* (including specific mobile platform and usability) issues. There are clearly some overlaps too: issues around socio-economic context, human resources for projects and above all, knowledge brokerage and intermediation may prominently fall under either or both of the categories.

Figure 17 [6.3.1]: A simplified table indicating the two iterative core strands within the DEAL model thematic

DEAL iteration	Business Model	Technical and Technological
Design		
Execute		
Adjust		
Learn		

Whilst the remit of the *technical and technological* issues is fairly self-explanatory, the *business model* activities may benefit from a more updated and (telecom and mobile) sector-specific dynamic definition. Whilst somewhat over-comprehensive, I have thus taken the business model definition as;

> "a blueprint for a service to be delivered, describing the service definition and the intended value for the target group, the sources of revenue, and providing an architecture for the service delivery, including a description of the resources required, and the organizational and financial arrangements between the involved business actors, including a description of their roles and the division of costs and revenues" (Bouwman et al., 2008, p. 33).

The different elements of the above definition clearly play out in the evolution of the firm's effort to continue to generate market-creating service innovation. Writing specifically about a market-creating service innovation strategy, although primarily drawing on case-study examples from larger firms, Berry and colleagues (2006), highlight that the sustainable service innovation requires a holistic approach, connecting different and at times, divergent groups and processes. They propose five (out of nine) elements as essential for service innovation: these are a scalable business model, comprehensive customer experience management, investment in employee

performance, continuous operational innovation, and brand differentiation. The remaining four are an innovation champion, a superior customer benefit, affordability and continuous strategic innovation.

Of relevance to the vignettes here, they (ibid) further highlight that

> 'Technology has transformed many former inseparable services into services that can be consumed any time or place' (Berry et al., 2006, p. 57)

This amalgamation of services with technology, and convergence then leads us back to the challenges of interprofessional activities within knowledge intensive work. Over the last two decades, a large volume of interdisciplinary studies, have widely viewed software development as a knowledge intensive work, requiring shared activities. Similarly, undertaken over two and half decades ago and spanning about two years (between October 1992 to May 1994, with various repeated measures and interviews, examining a four-year long project in a large financial services company), a study that we have drawn on in this thesis before, to calibrate our methods, explored and highlighted software development work as "knowledge intensive". Whilst oriented within a psychological rather than sociology or organisational studies, framework, what Waterson and colleagues articulated in their study was a clear acknowledgement that building complex software systems demand selecting and coordinating multiple sources of knowledge. Although their study is prior to the wave of outsourcing and off-shoring and now in-shoring trends, and they did not have to tackle significant challenges with cross- and co-locational and temporal issues, they highlighted that the coordination of the expertise of project members (across both software and business functions) as a major challenge.

Returning to Guile's study, which we have also drawn upon earlier, in which he makes a number of interconnected arguments around the role mediation in interprofessional working and learning, it is worth recalling the following synopsis. The study focused on (Guile, 2011, p. 343);

> "the emergence of spatially and temporarily distributed interprofessional project teams that are concerned with the creation of a new product or service."

As the paper offers many vistas, bearing the empirical details of this study in mind, I have only zoomed on the core issues around the workflow pedagogic processes that assist in the formulation

of professional judgement in the project team members and their ability to infer, inter-professionally. This is important as

> "the reasons that inform an individual act of judgement can be shared in a way that others' can appreciate and/or contest and, as a consequence, infer collectively how to use other professionals' insights as a resource to accomplish the task-in-hand…" (ibid, p.361).

And in summarising (ibid, p.362), reiterating that

> "interprofessional learning is establishing, what Redding (2007) referred to as "a shareable conceptually articulated perspective" (p. 151). In other words, the way in which individual professional's form and explain their judgements in a way that can be made intelligible to professionals in other fields."

Having read above the above, let us reflect back for a moment: taken with the performative-nature of the project teams' learning and tasks in mind, Guile's argument is conceptually similar to the core role of frames and framing, in Schön's work. Let us recall that frames, framing and re-framing was a core part of the professional inquiry process for Schön (similar to the Dewey's reflection and inquiry, as a 'technology' for setting and solving problems).

For Schön, the ability and willingness to confer about, and revise one's professional tasks, 'on the fly' (i.e. real-time) was part of the process of designing better problem-setting and -solving scenarios. His choices of words were 'frame experiments' and the situation's 'talk-back': by which he meant that the professional and interprofessional dialogue had to be 'scaffolded' so that all parties are firstly, able to comprehend and grasp the issues and secondly, negotiate and find their way to contributing to the problem's re-framing and potential solution. So in short, grounded on professional specialities, genuine conferring whilst engaged with actual practice as it unfolds can accommodate and lead to inferring.

This is well-captured in the concluding part of his, now classic work, as follows:

> "[I]nquiry, however it may initially have been conceived, turns into a frame experiment. What allows this to happen is that the inquirer is willing to step into a problematic situation, to impose a frame on it, to follow the implications of the discipline thus established, and yet to remain open to the situation' talk-back. Reflecting on the surprising consequences of his efforts to shape the situation in conformity with his initially chosen frame the inquirer frames new questions and new ends in view." (Schön, 1983, p. 269)

And elsewhere, highlights a cautionary note;

> "When practitioners are unaware of their frames for roles or problems, they do not experience the need to choose among them. They do not attend to the ways in which they construct the reality in which they function; for them, it is simply the given reality. […] When a practitioner becomes aware of his frames, he also becomes aware of the possibility of alternative ways of framing the reality of his practice." (ibid, p.310).

So with those brief reminders about the knowledge- and expertise-intensive nature of software development projects in mind, as well as the essential need to exercise professional judgement and infer, in interprofessional settings and the role of frame and framing in it, we turn selectively to examples of DEAL iterations, across different waves.

Already in Wave II, there was a clear emphasis on the localised and internal design aspects. Whilst it is not mentioned explicitly, the project team is working around 'distributed design', which accommodates slowly bringing on board views from different stake-holder groups. This gets picked-up at a higher conceptual level, in later waves (i.e. Waves III and IV; in Tehran and London).

The business model is already, in Wave III (i.e. 2008) getting sophisticated enough to attempt to package and bundle service offerings as a software-as-service model within the telecom value-added segment. It also highlights that the design of the service has to go beyond the technical and technological teams' priorities, if it is going to remain sustainable and continually relevant and marketable to the client.

Following the theme of design, the view from the London-based partner had also evolved significantly with time on both the banking sector and TV programme. Whilst in the earlier waves, the London partner firm was instrumental in bringing-in a whole range of ideas to the table, as time went-by, and the Tehran-based firm 'caught-up' with potential solutions and generative metaphors for presenting their locally-congruent ideas, the input of the London partner turned to be more specialised and advisory, and lost some of its enthusiastic evangelism of new products and services, mapped on service offering innovation in Europe, advocated in early months and years.

The practicalities of the 'execute' phase certainly grounds the project iterations. In both vignettes, initially after the 6 months and then between the 18 to 24 months project implementation cycle, there were a large number of 'problems/issues tracing' activities. Whilst that is not unusual in the software development process, it could and on occasion had created significant problems with the project timetables. At some point, as humorously phrased by project members retrospectively, all 'scrums' were abandoned and/or delayed or postponed, while all members were 'sprinting'. This was not far from the truth.

It is also in the execute phase, and by extension the follow-up adjust phase, that the project teams really gelled together, including contacts and professional friendship and mutual understanding, formed. In the TV programme case, software analysts had to 'stretch-out' of their usual skill zone to fully comprehend and then be able to deal with the intricacies of producing information 'on the fly' so that the live programme, via the programme anchor, could for example announce results of the question of the week, and/or opinions which had been put to televoting. As time went-by, the software team developed the idea of 'rehearsal' for the live broadcasts, including the potential 'disaster management' and business and TV programme continuity interventions. On the other side, the TV production team had also had to become better aware of the actual operations behind the scenes, to write appropriate and robust codes to receive, process and present, different aspects of a large volume of data, highlighting potential duplicate entries, at times reaching into millions of SMS, being sent out or received.

Having briefly covered the design and execute phases, we now turn to the adjust and learn phases. These were interesting in that they were often implicit, broadly 'invisible', and would be part and parcel of other processes, such as the two earlier phases of design and execute, or as part of separate but related activities such as brokerage and intermediating on a particular project problem, at the stage of design and execute.

The phases of adjustment and learning also included a range of *business model* and *technical and technological* features; adjustment and learning were nearly always performative in nature and linked to the current task in hand for the project teams and its members

As a last illustration on the adjust and learn phases, let us return to and end with a concrete example, offered by *Mr Technical Lead*, in which he articulates the importance of the

interprofessional learning, not only in shaping the service offering but also the logic of the internal processes, as follows:

> "[on software project and business development] by having an early and continued input from and engagement with the client and the users, and in working closely with our advisors, in and outside Tehran [meaning abroad], we stay close to a 'performance-oriented development process': that means many things, to different people but as a start, it alerts me to make sure that we do not *code ourselves into a corner*, nor [financially] *resource ourselves into a corner* [my italics]…
>
> […]... So a simple negotiated rule of keeping the application logic and user interface logic clearly structured separately and 'clean' [meaning, clear and lean], brought about by a real project group effort, meant that we could make better decisions, which are validated weeks, months, and hopefully years, afterwards.
>
> That separation [of the application and user interface logics] makes code maintainability and code portability much easier to deal with. We found that we can then easier explore different costing for clients and users within freemium and IAP [In-App Purchases] models[113]:.. It took a bit of discipline but a good decision, [for] all around and we learnt well from that so will feed it through our other [future] project activities." (Wave V: Tehran)

There are clearly many issues embedded in the above rich description of the interactions so I will only highlight three related ones, as follows. Firstly, the performance nature of the relationship is one that we have pointed out before, primarily in the design phase. As the mobile App/software saying goes: "start with performance; stay with performance". To put it simply, that is engrained in the projects' DNA.

Secondly, parts of the quotes also demonstrate a key point that technical and technological and business model issues are deeply intertwined and inter-dependent, as these factors quickly effect the costing of the project. The metaphors of [avoiding] *coding or resourcing ourselves into a corner* is to me, highly generative and useful both for the adjust and learn phases. It is the firm's way of articulating means to avoid cul-de-sacs in favour of some mediated way, even if small and interim, break-throughs.

Third and finally, the quote highlights and articulates what I had previously heard about across various meetings with reference to 'decisions and decision-formation/-implementation'. After some reflection on the context, content and use of the term, I have come to the understanding that what the project members are actually articulating is the importance of the necessary processes to infer and make professional judgements, distributed across time, space (i.e. temporal and

locational) and fields of expertise (interprofessional thus interdisciplinary). It is the appropriate technical/technological and business model 'distributed-judgements', that leads to appropriate, sustainable and profitable decisions.

In summary, having considered the above three factors, I end this section by returning to one of the last completed short essays of Drucker (2001), in which he argues that specialised knowledge in knowledge work indicates that knowledge workers need to access the organisation – the collective that brings together a diversity of specialised knowledge workers to achieve a common goal. For example, a software development project involves engaging with a variety of technical personnel such as designer, analysts, programmer, tester, implementer, and manager. Collaborations therefore are of key importance.

Drucker also reiterated the trend that knowledge workers will not only need formal education to enable them to engage in knowledge work in the first place, but also need continuous learning opportunities through the work practices to keep their knowledge up-to-date and active. In our vignettes, global and local work practices become co-dependant and co-constructing of each other and local situations are transformed, by brokerage and skill webs, so as to offer the potential for a nascent form of workflow pedagogic processes. This is further explored in later sections and then in Chapter 7 through deeper probing of brokerage, via expansive and contractive skill webs, in aid of the ability to infer and form interprofessional judgements. Chapter 8 then will offer a more specific discussion on the implication of these analyses, both for Iran and potentially the regional economies and sectoral labour markets.

6.3.2 DEAL processes facilitating informal professional networks

As indicated in earlier theoretical and methodology sections, examining the timeline of the creative projects, some of the more intricate connective features of the skill webs play an important role in the success of learning episodes. These include the potentially expansive (bridging and linking) and contracting (bonding) brokerage opportunities.

In this brief section, in preparation for the case study vignette discussions and implications in the next chapter, I have therefore created by preliminary drawing on the data, in ideal-typical terms, two types of performative skill webs, which I have labelled as 'Expansive Skill Webs' (ESW) involving bridging and linking activities and 'Contractive Skill Webs' (CSW) involving bonding activities, both have the potential to lead to project break-throughs. A third type, labelled as 'Fragmented Skill Webs' (FSW), which is an unsustainable form of skill webs, ultimately does not get to the stage of performative-learning as it breaks down or metaphorically 'evaporates' mid-stream of projects, before reaching performative collaboration, thus leading to project cul-de-sacs. These key features are outlined in the table below.

Table 11 [6.3.2.A]: Dominant features of brokerage in skill webs

Brokerage Feature	Activities	Potential Project Outcome [dominant character]
expansive skill webs (ESW)	bridging and linking	break-through ['exploration' sphere]
contractive skill webs (CSW)	bonding	break-through ['exploitation' sphere]
fragmented (non-functioning) skill webs (FSW)	singular/unsustainable bridging and linking occasions	cul-de-sacs

We will return to these categories and classification in the chapter 7 as part of the discussions of the case study vignettes. We turn next to highlight brief concluding remarks in the last section of this chapter as a bridge to take us to the more substantive issue in the next chapter.

6.4   Concluding remarks

In exploring and re-examining the case study vignettes, two early strands of implications clearly stand out.

Firstly, based on the context of the study, the firms and the teams have to do the best that they can, under the limited and limiting socio-political and geo-economic circumstances in the use of technology, to bring innovative solutions to fruition. While the socioeconomic and socio-political climate is not conducive for leading-edge technological implementation (such as via fast mobile internet connection or interactive television systems), the firm has to, and often does find ways around the problem. This happens by taking full pragmatic account of the status-quo and thus, contextualising all potential solutions to fit within the restrains placed on the technology, by the regulatory environment. In short, the firms attempt to introduce novelty and utility, as the two 'active ingredients' of successful innovating and innovation, without the use of state-of-the-art technological facilities and infrastructures.

The second implication implied by the vignettes is around the highly rich and resourceful nature of brokerage in practice, primarily via informal means, about which the innovation literature is rather thin and therefore still has many 'blind-spots' (for "technical contexts", see Barley, 2005; cf. Powell and Grodal, 2005, pp. 70–72). It is somewhat reassuring however to see that as the level of formal professional linkages (via licensing, FDI and IJVs) drastically reduces in the technology sector due to the geo-strategic positioning, individual professionals catapult themselves above and beyond their immediate environment to ensure that they remain up-to-date, able to infer and make judgements across domains, and so become enabled to offer competitive solutions for their project's difficult and at times, impoverished context.

Previous research has noted that networkers within the sector rely heavily on their own personal social networks (Nardi et al., 2002), as they seek to get and retain the 'knowledge and skill' to keep them competitive, able to span boundaries to form better judgements in order to make better decisions and ultimately, develop and retain better employment prospects and/or enhanced professional reputation.

The next chapter (i.e. chapter 7) offers a concise yet in-depth and thematic discussion and implications of the vignettes, before moving to the final chapter.

Chapter Seven: Discussion of the case study vignettes

This chapter builds substantially on the last chapter to provide an in-depth analytical and conceptual commentary on the case vignettes, and in so doing, further highlight selected strands.

7.1   *Skill webs as brokerage for interprofessional judgement*

This chapter offers a concise discussion on the analytical focus of the vignettes: skill webs as means of brokerage and intermediation in projects assists in, and aid the development of interprofessional judgement which forms a core part of decisions whilst innovating. The text also reverts back selectively to previous sections, in an effort to make sense of, and locate the innovation processes at play. We unpack the issues about interprofessional judgement as these lead us to how judgement supports innovation decisions, whether via further exploration or timely exploitation. Based on a constellation of findings, and the utilisation of the DEAL model in practice as an analytical lens, we highlight the interplay of the interprofessional judgement processes that lead to exploration, and/or exploitation decisions. Finally in this chapter, and taken up again in the next chapter, we point to the formation of the capability for, and then application of, interprofessional judgement on project tasks, as a core (and highly valued) outcome of skill webs.

In the previous chapter, we took stock of the inter-related data so far and considered an interim summary of the key findings of the vignettes across three themes. These were, firstly, the primacy of the performance and performative-nature of the project interactions. This is as professionals look for ways and means, to learn and relearn, to design and redesign (or in other words, frame, reframe and resolve) service issues and thus, engage in practices that serve the overall purpose of the project.

Secondly, reiterating the metaphorical quote of '*avoiding coding or resourcing ourselves into a corner*'; is the firm and the team's way of articulating the means to reduce the associated and embedded uncertainties and risks in the practice of learning and innovating.

Building on the first and second themes above (performative-nature of learning and uncertainty/risk management), the third cumulative theme points toward the importance of the necessary processes to foster the capability to infer, and come to joint interprofessional judgements. As outlined before, it is the culmination of appropriate technical/technological and business model via 'distributed judgements' that paves the way towards appropriate, sustainable and profitable decisions[114].

In later sections (7.2.1 and partly in 7.2.2), I will expand on the interactions between the individuals and teams, which were facilitated in a particular kind of way, and how this allowed for a set of activities and processes on interprofessional learning, plus developing and inferring judgement. As the discussion will illuminate, skill webs and brokerage are here used a resource for performative interaction and where required, project risk management. It is worth recalling that I have positioned my methodology, through a 'pragmatic inspired' set of lenses, to focus on professional inquiries related to the purpose of the projects. Thus as previously discussed, I am not only dealing with epistemology and epistemological issues, but in essence with the ontological issues of how people come to know, and as part of that, how to infer professionally.

My methodology, methods and a selection of the data, outlined at length in the previous chapter, therefore attempts to unpack and untangle how people come to know through making inquiries, assisted and enhanced by professional and informal brokerage, and communicating with others in firms, at times leading to professional inference.

There is scant research, globally, on interprofessional judgement, beyond guidelines around statutory multi- and inter-agency cooperation[115]. The existing frameworks often act as a way of better fulfilling 'delegated authority' placed on agencies by the public bodies. The current situations in creative sector projects may, depending on the task in hand, involve delegated authority but that requirement is not seen to be amongst the primary constituents in our project: the priority for performative-learning and innovating, leading to innovation takes precedent.

With projects enacting the new modus operandi of many creative sector activities, engaged in innovating and innovation, it is perhaps not surprising that the need for interprofessional learning and judgement, in aid of innovating, is felt more acutely in this sector.

A caveat may well be in order however, with specific reference to our examined case and a cautionary use of 'interprofessional' as an intermediate term: the range of 'newer' professional expertise, such as software analysts/coder, TV production staff (with various sub-segments within each of them) and telecom business analyst, may not be immediately viewed as 'fully fledged' (older) professions. This then harks back to much earlier discussions about the definitional and cohesiveness of any set of professions and its processes and standards, which was long debated in sociology, over fifty years ago (Bucher and Strauss, 1961). That debate has run its course so for our purposes, it is prudent to assume that aforementioned 'newer' professional expertise are legitimate and legitimised by the firm, in and via actual practices, with the purpose of innovating.

We next turn to further consider the core issue in framing of brokerage in the case vignettes.

7.2 Framing the brokerage and intermediation in the case vignettes

I have in the last chapter provided a number of examples and selected a few to unpack and provide a commentary upon.

As a way to further illuminate the black box of brokerage and intermediation[116], and having discussed the DEAL processes and the dominant features of brokerage in skill webs previously, I now return to selectively expand on these. Our previous analysis and observation, came to develop in ideal-typical terms, two types of performative skill webs, namely 'Expansive Skill Webs' (ESW) involving bridging and linking activities, and 'Contractive Skill Webs'(CSW) involving bonding activities. As outlined before, with the appropriate support, both of these categories[117] have a performative potential and can lead to project break-throughs.

Before we go further however, it is worth reminding ourselves of two strands of work discussed earlier. In the first strand, we recall an early discussion spearheaded by a robust study (Lester and Piore, 2004) which views innovation in firms, as comprising of analysis and interpretation, ultimately aiming for integration. The authors' astute investigation convincingly concluded that firms essentially over-analyse and under-interpret their activities around innovating and innovations, adding that to reach integration, a rebalancing in favour of interpretation should be prioritised.

In the second strand, drawing firmly on the work of Schön which was built on Dewey's legacy of inquiry, it is noted that professionals, in pursuing their purpose and projects can find themselves in 'indeterminate zones of practice': these are characterised by Schön's original writings with the metaphorical label of "low, swampy ground" of practice, where messy confusing problems defy rigorous technical problem-solving based on specialised scientific and canonical knowledge, and there needs to be an initial stage of 'problem-construction' out of the fluctuating circumstances, originally described by Schön as:

> "These indeterminate zones of practice – uncertainty, uniqueness and value conflict – escape the cannons of technical rationality. When a problematic situation is uncertain, technical problem solving depends on prior construction of a well-formed problem – which is not itself a technical task." (Schön, 1987, p. 6)

We further recall that Schön had partly articulated his position as a push-back against the standard operating- and 'effective procedures', dominant in, and promoted for standardisation during that era.

Bearing those two strands in mind, our core contention is that performative skill webs provide a highly valuable resource to creative project professionals, not only to analyse but also to interpret, by framing and reframing, the situation. The actual act and processes of doing so, such as those captured within the DEAL model, develop their capability for interprofessional judgement, which in turn assist the creative professionals to deal with their inherent indeterminate zones of practice, in which they must operate and navigate a break-through so as to learn and innovate.

7.2.1 Skill webs and DEAL model in action

With those conceptual reminders covered, I will next re-visit two specific examples from the vignette materials covered before, around m-Services on national TV and m-Banking to enhance multi-channel service delivery.

The concept of skill webs was introduced in previous chapters to explain, inter alia, how the firm captures opportunities for bridging and linking, and bonding activities to enhance its resources.
As highlighted before whilst unpacking and untangling the core learning episodes of the vignettes, there were evidence in the vignettes to indicate that skill webs serve different purposes. To highlight these different purposes and processes, I therefore further discuss the previously introduced distinction between expanding and contacting skills webs. This distinction is based on examining and re-examining the data and project outcomes over a longitudinal period (of five waves, as described before) over a number of years.

In broad terms, the features of the brokerage in skill webs which led to break-throughs, were in ideal-typical terms, either expansive, which involved bridging and linking activities or contractive, which involved bonding activities. In addition, expansive skill webs (ESW), involving bridging and linking activities, would tend to lead to a project break-through in and towards 'exploration' sphere, whilst contractive skill webs (CSW) would pave the way for a project break-through in and within the 'exploitation' sphere.

So as to better highlight and ground this distinction, it may be useful to illustrate it with an example from the data described within the last chapter.

As previously stated within the data described specifically for later waves (such as wave IV, and V), the project's protagonists were by this stage, deeply involved in interprofessional working (and by extension, 'stealth learning'), so as to co-construct ways forward around their problems. For the sake of clarity, I will narrow down and strip-away much of the details and therefore focus on just two examples, with one overall issue, matching them to expansive and contractive skill webs and associated activities. I will focus on the issue of 'service design and delivery' for both examples and as we will see, whilst there are some overlaps, there are significant differences in the purpose of each ideal-type. I will also abstract the details in the form of a table below (Table 7.2.1), by re-drawing a table outlined before and expanding and populating it with a few examples to better highlight and illustrate the activities.

Let us outline briefly then the two situations within the two case vignettes, the peripheral details of which were previously described in full. We will first consider an example of an expansive skill webs (ESW), within the activities on the *m-Services on national TV* case, and secondly, will turn our attention to an example of a contractive skill webs (CSW), within the activities on *m-banking* case.

One of the overarching and continuing issue (i.e. a core 'project purpose'), related to the service design and delivery on the m-Services on national TV case was (and remains to be) maximising audience participation. This ongoing task has a dynamic nature and changes from week to week, and season to season, such as during debates between clubs and managers and local, national, and friendly and/or competitive international events, e.g. AFC (Asian Football Confederation Cup, which is similar to UEFA games) and the FIFA World Cup.

Based on the existing technical platform, empowered by SMS based infrastructure, the task of the interprofessional teams was to continuously keep-up with new ways and means to retain and enhance audience interest and participation. Whilst the TV programme's production team had their own ideas on how to pursue this objective, the firm's business analysis and modelling, and technical staff had to validate and prototype various technical requests to see if these can be operated swiftly and be robust-enough for an on-air transmission usage (where the software

response rate is key, and the data loads – i.e. incoming and outgoing SMS from and to the audience – may be rather unpredictable). A typical case would be to engage the audience on answering a football match or players related question and whilst on air, the presenter or a guest would choose a number of (five to ten) winners to receive a prize, at random, from all the correct answers (which could on average run into a few millions). Linked to the audience members' mobile telephone number (as a unique identifier), the technical platform would also have to be able to sort out and disregard duplicate entries (i.e. more than one answer from a mobile number), and once the weekly winners are selected at random, provide information like how many other times, in previous programmes, the particular audience member had participated, whilst retaining anonymity of the winners' number (by not broadcasting, live on air, a few of the digits from the winners' mobile numbers).

Based on the prolonged nature of the contact and the dynamic requirements of the task, the teams had weaved an expansive skill webs around the required professional knowledge and skills so as to reframe and resolve problems, or find 'workaround' mechanisms, in the service design and delivery. Additionally, the bridging and linking activities could then lead to further discussions and follow-throughs, which potentially results in future possible exploration activities. Some of the practical joint project activities and flows are outlined in the top part of table 7.2.1 below.

Turning our attention to the second example, it focused around weaving a contractive skill webs (CSW), within the activities on *m-banking* case, enhancing multi-channel delivery services. An overarching and again a continuing core 'project purpose', and of direct relevance to the service design and delivery on the m-banking case was (and remains to be) enhancing user experience.

As enhancing user experience, on a mobile phone as a platform (enabled via SMS, and pegged to the 'lowest possible common denominator' on the handsets specification) involves multi-dimensional requirements, it has led to a close working relationship between the banking and the firm's teams. This has also meant that successive iterations of a mobile banking app would be cyclically refined and rolled out, in close collaboration with the client (i.e. the banking ICT team).

Similar to the previous case, whilst the individual bank's ICT teams had their own views, ideas and preferences on how to pursue this objective, the firm's business analysis and modelling, and technical staff had to validate and prototype various technical requests, to see if these can work

swiftly and in a robust-enough manner, so as to satisfy the industry best practices and regulatory requirements for financial transactions.

Similar to the previous example, based on the prolonged relationship, the teams had weaved, in this case, a contractive skill webs around the required professional knowledge and skills so as to reframe and resolve problems, or find 'workaround' mechanisms, in the mobile banking service design and delivery. Additionally, the bonding activities could then lead to further plans, and project follow-throughs, which potentially results in future possible exploitation outcomes. Some of the practical joint project activities and flows are outlined in the bottom part of table 7.2.1 below.

Re-drawing a table outlined before, now expanded and populated with other examples, intends to better highlight and illustrates the activities, as below.

Table 7.2.1: **Dominant features of brokerage in skill webs, with examples**

Brokerage Feature	Activities	Potential Project Outcome [dominant character]
expansive skill webs (ESW)	bridging and linking	break-through ['exploration' sphere]
examples of practical project activities/flows (e.g. for m-Services on TV)	- written reports | drawing and design | advice - computation and diagnostic (of software tasks) - benchmarking | project management groups/tools - training and workshops to gain in-depth insights | professional and trade exhibitions	
contractive skill webs (CSW)	bonding	break-through ['exploitation' sphere]
examples of practical project activities/flows (e.g. for m-Banking)	- joint prototyping of software/design for delivery - sharing insights on accessing research and technology | feasibility of technology platforms - financial/charging models and new business or service model creation - secondment/placement of a domain expert temporarily within the project team	

Having outlined the situations in brief, it may also be interesting to note that in both cases, elements and processes described in the DEAL model (Design, Execute, Adjust and Learn) cycle would be utilised to ground the discussions and the particular stages of the joint project.

As discussed at length in chapter 6, the DEAL processes provide a simplified tool and a resource for interprofessional debate and dialogue. In projects played out in the real-time, there are rapid decisions that need to be made and discussions to be held, and as part of that, arguments and

contestations occur. Team members from the firm side and the client side (such as banking ICT team, 'FinTech' [Financial Technology] experts or TV production team) put forward an idea, or opinion which they need to defend and promote to other project members based on a sound business and technical/technological advantage and feasibility, and/or ideas need to be revised over time. The DEAL processes provide a platform for such debates and contestations. On the other hand, the expansive and contractive skill webs highlight the variegated and task (including project-stage and –purpose) dependent nature of interprofessional learning and judgement.

The broader implications of the expansive and contractive skill webs within this thesis and broader work is an empirical acknowledgement that workplace project-based learning has multiple shades and nuances, based on the performative nature of the task to be addressed and delivered, and as fundamental yet often invisible part of the inter-professionally distributed decision-making processes, judgements have to be formed, inferred or promoted and defended.

A reflective note may be in order before ending this section, and one which will be returned to and expanded upon in the next chapter. As it is apparent from the previous discussions, whilst the initial untangling and conceptualisation of the case study vignettes pointed towards brokerage and intermediation, as means of workplace and interprofessional learning for innovating, the longitudinal time-span and 'follow-throughs' of the people and projects, has gradually led me to explore interprofessional judgement, and the development of the capability for such attribute, as an important (if not pivotal) outcome. What has become clearer, through my interaction with the account and the people of the projects, is that the issue of interprofessional judgement is an invisible, yet highly significant 'silent' activity. Additional to this, a brief overview on the existing literature on judgement points towards a individualistic account (and bias) of professional judgement, whereas the case study material, the nature of the project requirements discussed and my conceptual and theoretical endeavour, combine to call for a more plural view of professional (and often interprofessional) judgement.

It is with that task in mind that we will return to briefly outline a number of recent conceptualisations related to interprofessional judgement, so as to enhance the study's findings and recommendations, later in the next chapter. For now however, and the reminder of this chapter, we will return to the core issue of innovation, as a process.

7.2.2 DEAL model and innovation

So far we have focused on the role of brokerage, in the form of processes around what we have labelled as *expansive* and *contractive skill webs*, with *bridging, linking and bonding* activities. These brokerages assist in the formation, development and ultimately transformation of interprofessional judgement. It is these judgements then that flow in, and lead into decisions which reinforce the sustainability of innovation activities.

In this sub-section, we will therefore briefly highlight how the DEAL model, which shapes the operationalisation of interprofessional judgment, actually assists with innovation activities. We recall from early parts of this chapter, drawing on the data within the previous chapter, that in the actual innovation projects, two core factors were constantly returned to: with the *purpose* of projects firmly in mind, these were the importance of the performative nature of learning, and ways and means to deal with the inherent risks, and its management, within innovation projects. These two factors, i.e. the performative-nature and uncertainty/risk management aspects require balancing and regular in-practice rebalancing. The attempts to achieve a rebalancing point toward the processes which foster the capability to infer and arrive at interprofessional- and at times, distributed judgements.

So as to ground this argument in an actual scenario, I will outline this further with a brief example. Within the data outlined previously, we recall that we came across the following (at times metaphorical) discussion and quotes, while hearing about the firm's view from one of the senior team members [as reported in wave IV]. Whilst the assertions initially seemed to be about positioning and the ways to deal with competition, it actually highlighted the core way that the firm has chosen to deal with the above twin factors of performative-nature of learning, and uncertainty/risk management, in projects.

Recalling the assertion that *coordination and control mechanisms matter, as much as collaboration…* the notion of connectedness soon gets raised as a way to deal with the other two, larger and better resourced, sectoral competitors (at the time) within the market and how by being better 'connected', both on the business model and technological trends, via addressing the clients' evolving needs, the firm differentiates itself so as to survive and prosper. Using the phrase of *we are smaller, [yet] agile and better connected [for decisions]... Connected to perform…* places the importance on dealing with the competitors whilst also managing the

overarching twin issues above, within their context. *Connected to perform* is thus another way that the firm and the embedded teams articulate how they attempt to link new learning and knowledge with performance, as well as using the interprofessional insights as a possible early warning shield against uncertainties and risks in the practice innovating projects.

We can also draw a distinction, although it may be more on an ideal-typical manner, to point out that some of the judgements required are about exploration and others are about exploitation, based on the resources needed and stage of the projects. We can direct attention within the episodes, to identifying circumstances when and where project team members utilise and scaffold upon their skill webs in order to better formulate an interprofessional judgment to influence a group decision, so as to keep the inquiry moving forward with the aim of reaching a 'break-through'. The break-throughs then seem to build on the judgements to continue to explore for solutions within a product or service project, or make a commitment to start to exploit the product or service.

Recalling the earlier theoretical reviews and the existing research literature on innovation management and brokerage, we can now better see that the increased complexities and multifaceted nature of the project tasks within the sector brings about its own learning and knowledge challenges, as well as the need to more coherently bridge the gaps and distances between innovation actors and agents within a project, by appropriate *connectedness*. This in the actual practice of our cases, seem to be more on the side of individuals acting informally, rather than institutional agencies playing an active enabling role. The brokerage activities then offer the opportunity to enable others to better grasp the problems and act to diffuse, transfer know-how and technology details and ultimately innovate.

Amongst a range of in-depth activities, foresight and diagnostics, combination/recombination opportunities and gate-keeping and brokering towards commercialisation seem to appear as the backbone of interprofessional judgement processes that supports innovation. As we recall from earlier chapters, recent insights from empirical and theoretical studies, such as one by van Lente and colleagues (2003), attributed three basic functions to brokerage processes, around *demand articulation*, *network composition* and *innovation process management*.

Demand articulation refers to the diagnosis and analysis of a problem, which includes re-framing and the articulation of the needs of the project/s and the firm/s. Secondly, network composition

involves recruiting, retaining and expanding external relations to and for a firm by scanning, scoping, filtering and matchmaking of sources of complementary assets such as technical knowledge, material and funding. Lastly, innovation process management relates to activities for enhancing learning, interprofessional communication and other forms of interaction, and the alignment of these among partners, to operationalise the project, *as it unfolds*. Developing and nurturing interprofessional judgement, in our study, completes that list across all the processes.

A last point in this section about informal ties, feeding the innovation processes and activities, in our context is worth expanding on. As briefly mentioned before, although not widely studied or even rapidly observable, informal ties are highly embedded and utilised in the national and city-wide context of this study. We recall that within geopolitical studies, policy research indicates that 'informal is [considered] normal'.

We have in the previously outlined that informal relationships[118] are not unique to Tehran, Iran or the Gulf region. Within our sectoral context and innovation activities, informal relationships tend to be viewed as a form of social capital, for pursuing mutually beneficial projects.

Whilst the details of this discussion fall outside the remits of this section or the original analysis, the informal relationship arrangements, exercises in an unfettered manner, could act as a double-edged sword, as the ease of access to that form of *social capital*, in the long(-er) term leads to a type of *core rigidities*, where the firm-based actors no longer actively explore other arrangements, in favour of informal channels (lubricated by incentives), and by extension could potentially pave the way to distorted judgements on performance and risk/uncertainty management.

We now turn to summarise the section: As it is clearly identified from above, whilst the interactions between individuals, professional groups and tasks are important in both categories, *expansive skill webs* tend to metaphorically 'open-up' and utilise and build upon discrete and tangible project activities and flows, whilst the *contractive skill webs*, tend to metaphorically 'narrow-down' and draw on more intangible, tacit and process-oriented elements. This is in line with previous observations that while moving to an exploitation phase, the 'bonding' between the different professionals is more perform-oriented and productive. Furthermore, we are also aware that tacit and explicit elements in skills and knowledge get exchanged, redefined and reshaped, leading to inference in the course of interactions.

Examples of the interactions, particularly within the *contractive skill webs*, grounded on professional specialities, suggest that genuine conferring, whilst engaged with the actual problem and/or practice as it unfolds, can accommodate and lead to a collective capability to infer. That inference therefore acts as a start of the journey to make an indeterminate situation, into a more determinate and bounded situation.

As previously stated, these types of interactions were similarly captured, in a recent study, as:

> "the reasons that inform an individual act of judgment can be shared in a way that others' can appreciate and/or contest and, as a consequence, infer collectively how to use other professionals' insights as a resource to accomplish the task-in-hand" (Guile, 2011, p. 361)

We will trace and continue this discussion in a section of the next chapter, by turning to and briefly expanding upon some recent studies, on viewing an essential part of workplace and entrepreneurial learning as developing capability for judgement (Foss and Klein, 2012; 2012b, 2011; cf. Livingstone and Guile, 2012, pp. 357–358; Ranzilla et al., 2011), set within the background of re-visiting some of the older commentaries by Schön and others[119].

7.3 DEAL model as a framework for learning and innovation in Creative New Technology-Based Firms

We start this section with a brief reminder: the study's vignettes have fallen within a specific context, namely undertaking project-based tasks in a fledgling creative sector in Tehran, within a rapid and transitional societal and sectoral change. The longitudinal elements of the vignettes have pointed towards the capability for development of skill webs, and within those, interprofessional judgement as a core differentiator in project break-throughs.

The two partner firms and their associated teams, groups and clients, examined in this study have endeavoured to operate in a hybridised niche within the Iranian context: they desired to create, design and deliver products and services that were a match for equivalent ones being produced elsewhere globally but were inhibited by a range of 'local' circumstances.

However, despite the difficulties, they have managed to move beyond their constraints, relying on a range of 'survival' and (local market) competitive strategies, including knowledge-transfer and upskilling activities, accommodated via sectoral brokerage and intermediation in aid of product and service innovation. These have provided means to not only overcome the potentially stifling tensions embedded in their operating environment, whether related to the relevant (implicit) policies or infrastructure shortcomings, but also to potentially prosper within a decade.

Whilst some the business environment issues (such as the technology embargos and economic and financial sanctions) are unique and perhaps soon to be changing for the better, many of the strategies employed by the firms and teams are quite similar to the ones that researchers have identified and explored in contexts that are very different to the regional creative sector and to Tehran, as the business hub city of Iran.

Taking a broader view, the creative sectors continue to evolve since the late 1990s, when their definitional notion emerged in the political discourse, initially in Australia, and soon after in United Kingdom and United States, and has since been gaining promotion via international bodies (such as UNCTAD and OECD) and entrepreneurial practices, globally.

Despite the significant differences and divergence within the sector, there are indications that the learning required in the digitised segment of creative sector may share similarities. Factors such as production of symbolic content, the use of highly skilled specialised labour market, projects (often undertaken in hub cities and urbanised locale) as modus operandi and the utilisation of advanced ICT tools seem to play an intrinsic role. Equally of importance, a strong connection with other like-minded professionals (and entrepreneurs and artists, as appropriate) in connected cities, connection with 'global trend-spotters' and their material, and development of brands and intellectual property are amongst the other core business environment/extrinsic factors.

Within this study, whilst 'unpacking and untangling' the learning episodes, interconnected processes were identified embedded within the processes of the DEAL model and skill webs, which also pointed towards the use of informal skill webs, and via knowledge brokerage, in developing the capability for interprofessional judgement, to promote innovating.

Our framework, both in the DEAL model and in the categories of the skill webs, can act robustly as a potential framework for future analysis of the sectoral learning activities. Our model breaks away from the regional clustering literature, similar to a recent ICT sector study (cf. Huber, 2012) and is more aligned with recent research undertaken by UK NESTA focusing on UK SMEs, highlighting the critical importance of brokerage activities in small firms' development and growth (Huggins et al., 2010), and confirms that interprofessional and interdisciplinary learning is hard at work, to enhance untangling, framing and reframing problems, in aid of innovation.

Focusing on knowledge sourcing characteristics of the firms, Huggins and colleagues conclude that the importance of regional clusters to the competitiveness of the firm is not supported by their findings, so based on their data suggest that (Huggins et al., 2010, p. 35):

> "firms source knowledge more frequently from a variety of sources outside their own region, rather than within it. For the great majority of firms, knowledge sourcing networks have become international. […] These locations are often developed economies in Europe, the US, and Asia, but increasingly stretch to developing economies."

This is entirely in line with our analysis. Furthermore, and as a consequence, there may be a need for further analysis and investigations suggesting that skill webs may offer additional opportunities, as well as challenges in distributed judgement formation in project tasks. One of these areas may be the need to cater for developing *swift trust* (Kramer and Tyler, 1996) within an

expanded social and interprofessional network and the capability for 'teaming' skills and associated activities (Edmondson, 2012a, 2012b; Edmondson and Nembhard, 2009, pp. 131–135), some of which have received attention in earlier sections of this work. Whilst we have offered a circumscribed view and have not dwelled on trust in project collaborations, we recall that

> "Individuals with whom one has a continuing relation have an economic motivation to be trustworthy, so as not to discourage future transactions" (Granovetter, 1985, p. 490).

The framework model, both in the form of the DEAL model and skill webs and its categories, has aspired to capture some of the delicate inter-connectedness between knowing and doing, in practice via distributed means, in the research context. Finally, it is important to acknowledge that further refining and fine-tuning work may have to be undertaken to work through and refine the model and the underlying argument presented.

7.4 Concluding remarks

As stated previously, the findings and interactions described in the vignettes can be read and unpacked on a number of levels: untangling the most prominent features, for a sustainable performance, have led us to focus on the importance of brokerage within the skill webs as a key resource in the nurturing the capability to develop professional connectedness and interprofessional judgments.

In the last two decades, brokerage and intermediation have increasingly been seen as a core element of innovating; as a process of recombining and integrating past knowledge and practices, with novelty and utility. Examining a range of related issues, Dodgson and Bessant (1996) and Hargadon (2002; cf. Hargadon and Sutton, 1997) were amongst the first researchers to highlight the critical role of brokerage in innovation and learning[120], within the field. Nearly two decades on, Hargadon (2014) and colleagues have, by using historical and contemporary cases, reconfirmed this prominence and have identified:

> "the central role of brokerage in explaining the generation and success of innovation, addressing key management questions such as continuing success in the innovation and the virtues and challenges of diversity" (Dodgson et al., 2014, p. 16).

In our vignettes, we looked to illuminate the actual processes involved in the operationalisation of brokerage and intermediation, via the skill webs: the critical issue for the firms and their creative projects is how to best use their skill webs to facilitate the processes of learning and innovation. In pursuing that aim, development of the capability for interprofessional learning and judgement has been a cornerstone.

On a tangential but important note, it is one of the implicit contentions of this work that as the development of interprofessional judgement requires important 'domain specialities', specialisations on project tasks and in professions retains its importance in the sector. We recall that the advantages of the specialisation and division of labour in terms of productivity growth were first pointed out by Adam Smith (Marengo and Dosi, 2005; in innovation activities, cf. Pavitt, 1998). In a somewhat simplified articulation, this is due to the fact that the "narrower the range of skills", the higher is the "returns to the time spent on the tasks" (Becker and Murphy, 1992, p. 1157). Notwithstanding, in highly 'connected' settings such as the digitised creative sector, there needs to be an acknowledgment on the balance needed, and the 'specialisation

overlaps' required, between productivity increases, coordination costs and utilisation of other professionals' expertise, in order to re-frame and settle problems in aid of innovation break-throughs.

Returning to the another aspect of the vignettes, whilst there has previously been much discussion, policy instruments and investment to promote regional clusters (and such efforts are currently in planning and progress for Tehran and other aspiring regional cities), this study's longitudinal observations within its specific sector, do not conform to the literature with emphasis on the importance of regional clusters and clustering in learning and innovation activities.

Our findings are however in line with a number of most recent research findings, within the technology sector (for local context of Tehran and Iran, cf. Dadashpoor and Allan, 2007; Ghazinoory and Jamali, 2013; Huber, 2012; Huggins et al., 2010; Rezaeian Gharagozlo, 2013).

This leads us to further rethink how distributed learning and innovation, and with it interprofessional judgement may play out in practice. We will consider this, along with a brief conceptual tour of professional (and interprofessional) judgement, as well as the potential and practical implications of the study, such as constructability of skill webs as a resource strategy for the firm, as well as managerial and policy directions, in the next and final chapter.

Chapter Eight: Conclusion

The aim of this chapter, across two sections, is to conclude the study and in so doing review the implications, as well as the strengths and limitations of this work, followed by an outline of vistas for potential future research and policy directions.

8.1   Principal theoretical remarks and conceptual contributions

Drawing on an interdisciplinary literature within social science and management and economics, this research has positioned itself in the intersection of learning and innovation within a fledgling digitally-entrepreneurial sector. My research orientation and philosophy have been to investigate practice-based problems and processes that the digitised creative sector firms (primarily in Tehran) face in the area of developing a sustainable capability for innovating, and digitised entrepreneurship. In the foreground, I have combined theoretical conceptualisation with longitudinal qualitative research data carried out as fieldwork, and held within the background, area- and policy-studies.

8.1.1 Conceptual and theoretical contributions

The potential output of this research can be summarised in two strands on micro (strand 1) and meso (strand 2) levels: my work, at a micro level (strand 1), focuses on the strategies that enable the firms to discover, develop and commercialise their digitised technologies, in the form of telecom VAS software and services. In particular, I have come to consider the importance of the development of interprofessional learning and judgement, in pursuit of innovation, as an important area for attention, and further investigation. The goal is to better understand how entrepreneurial new technology-based firms (NTBFs) operating within the digitised creative sector, establish and utilise brokerage and intermediation, to build an interdisciplinary, and thus interprofessional capability so as to be more successful at innovation, and pursue the successful commercialisation of their new services and products.

In addition, the introduction of the DEAL (design, execute, adjust, learn) model was a way to identify and disentangle non-linear processes, which in situ, draw on interprofessional learning and judgement. This is diagrammatically sketched, in a simplified format, in the below figure.

Figure 18 [8.1.1]: DEAL processes and project stage outcomes
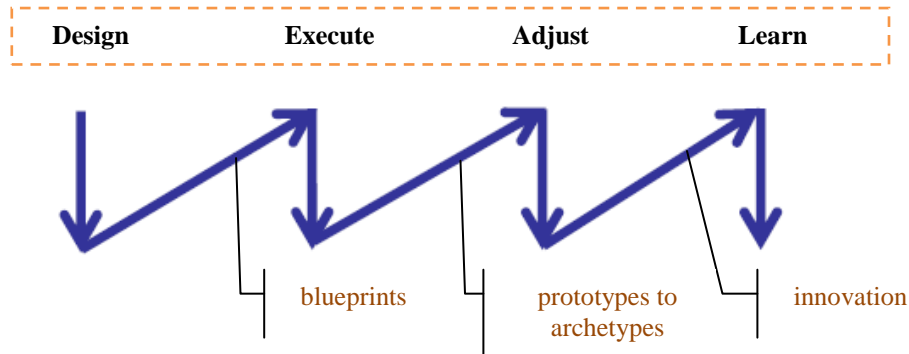
Whilst all stages of the DEAL processes draws on skill webs (be it of an *expansive* or *contractive* nature), the 'prototypes to archetypes' transition phases as outlined above, benefit particularly from the interprofessional judgement and related exchanges. These findings can thus be offered as practical insights at a micro and meso level, to other firms via a potential sectoral 'platform' policy.

There are also a number of important and interwoven educational implications embedded within the above. Whether in Tehran or elsewhere in the vast higher and technical education system of Iran (and to a fair extend, equally applicable to regional neighbours, such as United Arab Emirates and Kingdom of Saudi Arabia's system), there is no longer a shortage on the supply side. A significantly large number of teaching and research universities and training and vocational institutions now operate within the country and the region, with different levels of specialisation and at different stages of quality enhancement. However, a significant challenge for all of them is to enhance their 'university-industry' efforts and relationship, within and between the specialised sectors, and industry and ultimately graduates' job-market. This is so that their curriculum content and pedagogy can be kept relevant and up-to-date. This is no small undertaking in a region that has seen near exponential growth in its higher education in the last two decades.

Whilst similar to 'entrepreneurship', and 'innovation' (as separate undergraduate or graduate school courses and topics), interprofessional learning and judgement cannot easily be taught, a capability development framework could be facilitated by the way the courses are structured. Insights from this study (and a small but growing literature) are issues that universities, educational institutions and policy-analysts ought to be taking into account, if they are going to sustainably support the need for new forms and models of learning, closer to the practice-based requirements of the workplaces within the specialised and fledgling, yet growing, sectors. Whilst there is an increasing level of policy hype on the emergence of the *Creative Economy* within the region, there also needs to be grassroots and incremental reforms on the practice side.

Equally, the insights from the study's tools and methodology, refined as necessary, could assist in the universities and related institutions knowledge transfer and consultancy activities, to assist in initially unpacking the shortcomings and then upskilling their own staff and their target audiences' lifelong learning efforts. This inquiry-based mode of engagement, based partly on the needs of practice, could potentially further enhance the knowledge transfer in other settings and sectors, so as to support genuine lifelong learning mechanisms, beyond a 'check-list' or a fad. The study's insights on skill webs processes for example, support knowledge-transfer in different sectors and settings, so this work has a more general argument which is about the necessary 'architecture' of lifelong learning in professional settings, particularly through university programmes as a resource to pass-on to others entering into, or operating within practice-based settings.

Coming out of the above primary focus at a micro level of the firm (strand 1), my forthcoming work, at a meso (sectoral and city-region based) level (strand 2), plans to explore issues around entrepreneuriality and innovation capability development for new sectors, in aid of sustainable 'decent' job creation, and related meso level policy and practice interventions.

Drawing from policy studies and economic geography in this strand, I have in the thesis narrowed my remit to the city of Tehran, although will in near future draw on one or two other regional cities to extend the work (with Abu Dhabi or Dubai, UAE and Jeddah or Khobar, Saudi Arabia, as potential candidate sites). This could be timely for two reasons: firstly, if small and medium enterprises are to develop and play a more important role in the industrial policy and (be borne in mind as a value-chains of) foreign direct investment (FDI) policies[121], the way they enhance their

learning and innovation capabilities must be better comprehended. Secondly, this meso level engagement may then provide another avenue to consider the sustainability of the region's current 'start-up spring' (The Economist, 2013b).

On the meso strand, whilst acknowledging the dearth of robust studies in the city-region context, and particularly on Tehran (and by extension, other large cities of Iran), I am conscious that whilst some recent (comparative and descriptive) studies have been insightful, a number of core issues remain that need to be examined on a disentangled and disaggregated level of data. My finding therefore supports the call for further research in opening-out the black-box, as recently echoed recently by management scholars, Estrin et al, at different levels of analysis (2013, p. 499) and Foss and Klein's (2012) call, advocating that future research should carefully explore operationalisation of judgement, so as to explore the links between entrepreneurship and the theory of the firm (ibid, p. 81).

On a more conceptual level, my contribution aims to redefine the role, and the importance of intermediation as an existing resource, in light of brokerage to form distributed judgements (as applied to the digitised creative sector) and show their value for innovation (strand 1), and identify how these potential successes can assist and contribute towards the State's policies and programmes in up-skilling and sectoral employment creation (strand 2). My thesis findings therefore contributes to a better grasp of the practice-based perspective on the issues, including on the sectoral *catch-up* strategies as advocated by international advisory organisations such as ILO, OECD, World Bank/IMF group and UN economic, trade and labour specialist bodies.

Methodologically, I have two contributions to expand upon: firstly, I have introduced and expanded several new measures and concepts (e.g. a *lean*-inspired DEAL model, expansive and contractive skill webs, and learning episodes) whilst exploring the weaving of the skill webs that pave the way for 'bridging, linking and bonding', to assist in formation of distributed interprofessional learning and judgement. Whilst these tools may require further refinement, they make studying firm's complex and in-situ innovation behaviours, and the distributed learning and judgment formation within it, better tractable and can act as resources in other studies.

Secondly, as discussed at length earlier, I have provided an in-depth exploration of the pragmatic-oriented methodology which offers a unique combination of means and methods, in the interpretation of innovation activities and firm-based processes.

Looking back reflectively and with the benefit of the hindsight on the entire research process and findings, there are some issues about judgement and (particularly in professional and distributed settings) that actually have become raised through the data in the previous chapter. The way these have transpired has actually gone above and beyond the way which I had original framed and discussed the matter, with a focus on brokerage and intermediation, in earlier discussions. This reframing will benefit from a fresh look at some of the concepts: a task which will be undertaken in brief in the next sub-section, together with an introductory reminder of the issues.

8.1.2 Conceptual and theoretical contributions: questions and issues

As it was clearly identified from previous chapter, whilst the interactions between individuals, professional groups and tasks are important in both categories, *expansive skill webs* tend to metaphorically 'open-up' and utilise and build upon discrete and tangible project activities and flows, whilst the *contractive skill webs*, tend to metaphorically 'narrow-down' and draw on more intangible, tacit and process-oriented elements. This is in line with previous observations that while moving to an exploitation phase, the 'bonding' between the different professionals is more perform-oriented and productive. Furthermore, we are also aware that tacit and explicit elements in skills and knowledge get exchanged, redefined and reshaped, leading to inference in the course of interactions.

Examples of the interactions, particularly within the *contractive skill webs*, grounded on professional specialities, suggest that genuine conferring, whilst engaged with the actual problem and/or practice as it unfolds, can accommodate and lead to a collective capability to infer. That inference therefore acts as a start of the journey to make an indeterminate situation, into a more determinate and bounded situation.

As previously stated, these types of interactions were similarly captured, in a recent study, as:

> "the reasons that inform an individual act of judgment can be shared in a way that others' can appreciate and/or contest and, as a consequence, infer collectively how to use other professionals' insights as a resource to accomplish the task-in-hand" (Guile, 2011, p. 361)

We now continue and extend this discussion a little further by turning to some recent studies, on viewing an essential part of workplace and entrepreneurial learning as developing capability for judgement (Foss and Klein, 2012; 2012b, 2011; cf. Livingstone and Guile, 2012, pp. 357–358; Ranzilla et al., 2011), as well as re-visiting some of the older commentaries by Schön and others[122].

Notwithstanding a recent turn to explore and examine issues around judgement, and specifically moral judgement, in management and leadership corpus (Gkeredakis et al., 2014; Shotter and Tsoukas, 2014), as there is a dearth of studies on interprofessional judgement generally and within the evolving digitised creative sector (Handke and Towse, 2013; Künstner et al., 2013; Potts, 2013), I turn selectively to features of two recent studies (Foss and Klein, 2012; Ranzilla et al., 2011). This is then briefly supplemented with a glance at a theoretical commentary (Frega, 2012), in an effort to shed further light on the processes at play in the development of the capability for professional judgement in practice, and subsequently, potentially draw comparable insights for this study's circumstances.

The choice of the two studies above is not random: not only both studies are relatively recent, but they are also complementary. The first, is broadly a theoretical study with multi-layered issues of entrepreneuriality in its core and the second, is a practice-based synopsis and recommendation, with its sight set firmly on operationalisation of capability for judgement.

Foss and Klein's recent work has advanced an interesting way to explore entrepreneurship activities, building on the underlying theoretical work of Frank H. Knight (cf. 1921) who emphasised the development of judgement as a core component of entrepreneurship. Their conceptualisation links entrepreneurship with the resource-based theories of the firm and views entrepreneurship as a particular type of action, particularly, the entrepreneurial exercise of judgement regarding the utilisation and use of resources, under conditions of uncertainty.

They view judgement as

> "… residual, controlling decision-making about resources deployed to achieve some objectives; it is manifest in the actions of individual entrepreneurs; and it cannot be bought and sold on the market, such that its exercise requires the entrepreneur to own and control a firm" (Foss and Klein, 2012, p. 78).

They make a number of observations around historical interconnections of the entrepreneurship field, and later on practice and policy (much of which lay outside the current scope[123] of this work) and also advocate that future research should carefully explore the 'black box' of judgement, so as to explore the links between entrepreneurship and the theory of the firm (ibid, p. 81).

Lastly, related to our argument, they invoke the notion of 'dispersed knowledge' and link it to delegation (i.e. a form of 'delegated authority' which can then lead to capability for interprofessional judgement), as follows:

> ""Dispersed knowledge" is knowledge that is not possessed by any single mind and which may be private, fleeting, tacit, and subjectively held… – but which is still needed for effective allocation of resources under complexity…" (Foss and Klein, 2012, p. 213)

and in the following page, clarify their position by stating

> "The fact that firms exist and thrive would seem to indicate, however, that they can somehow successfully cope with dispersed knowledge. The reason, of course, is delegation." (ibid, p.214)

This delegated authority then raises the circumstance that in entrepreneurial activities, professionals may have to exercise 'meta-judgement', which may be described as "judgment about other people's judgment" (ibid, p.216).

As a contrast to the first study's in-depth theoretical positioning and integration, the second study that I draw on is essentially a synthesis of recent practice and theory, organised and advocated by KPMG auditing and consulting firm (produced together with Brigham Young University faculty), specifically on formation of professional judgement (Ranzilla et al., 2011). Whilst the study is pitched as a practice-based modular compendium for trainees and practitioners, it covers a number of interesting features, especially on operationalisation of professional judgment.

Their definition of professional judgement, grounded in their sector, is

> "the process of reaching a decision or drawing a conclusion where there are a number of possible alternative solutions. […][and which] occurs in a setting of uncertainty and risk.
>
> [and is] typically exercised in three broad areas: - Evaluation of evidence…- Estimating probabilities… - Deciding between options..." (Ranzilla et al., 2011, p. 2)

They also pay particular attention to the 'framing of judgement' as a concept that they view as an early step in the process of developing the capability for judgement formation, including taking on board, and building on views of other professionals. They define frames and the framing[124] as:

> "Frames are mental structures that we use, usually subconsciously, to simplify, organize, and guide our understanding of a situation. They shape our perspectives and determine the information that we will see as relevant or irrelevant, important or unimportant. Frames are a necessary aspect of judgment, but it is important to realize that our judgment frames provide only one particular perspective. This is similar to looking out one window of your home—it provides one view that might be quite different from the view through another window.

> [...] frames help us make sense of things but they also make it difficult for us to see other views. By being proactive in our use of judgment frames, we can improve how well we do with the initial steps in the judgment process: clarifying issues and objectives and considering alternatives. This is important because a distinguishing characteristic of professionals who consistently exercise sound judgment is that they recognize the judgment frame they are using, and they are able to consider the situation through different frames, or what KPMG professionals refer to as a "fresh lens."" (Ranzilla et al., 2011, p. 6)

When it comes to learning about, practically developing and operationalising judgement the KPMG study offers a range of behavioural activities and signals. The study relies heavily on, and promotes the notion of 'scepticism', as a mean of risk awareness and thus, risk management, defined as (Ranzilla et al., 2011, p. 6)

> "a questioning mindset and an attitude that withholds judgment until evidence is adequate"

and goes on to list a number of personal and group attributes, drawn as summaries from another recent study (Hurtt, 2010), which they prescribe as a potential method of developing the capability for better judgements. I quote the list at length (Ranzilla et al., 2011, p. 6) including their brief description for clarity, before turning next to look at some of the earlier commentaries.

These are:

> "- [a] questioning mind — a disposition to inquiry, with some sense of doubt
> - suspension of judgment — withholding judgment until appropriate evidence is obtained
> - search for knowledge — a desire to investigate beyond the obvious, with a desire to corroborate
> - interpersonal understanding — recognition that people's motivations and perceptions can lead them to provide biased or misleading information

- autonomy — the self-direction, moral independence, and conviction to decide for oneself, rather than accepting the claims of others
- self-esteem — the self-confidence to resist persuasion and to challenge assumptions or conclusions".

Clearly some of the attributes listed above may in fact be by-products of the professional and interprofessional experiences gained through time, with its associated development of the capability for judgement. Notwithstanding, although ambitious in its range and scope, the list is useful to highlight the perceived requirements, increasingly being viewed as a requirement of the processes and outcomes, in professional practice.

Having selectively discussed the two recent studies, and before concluding this section, we now return to revisit some of the earlier insights by Schön, supplemented by a new commentary on Dewey's work. Let us recall that Schön's had only tangentially referred to judgement formation, and usually in terms associated with intuition that derives out of the processes of *moving the inquiry forward*:

> "In management as in other fields, "art" has a two-fold meaning. It may mean intuitive judgment and skill, the feeling for phenomena and for action... [ ] it may also designate a manager's reflection, in a context of action, or a phenomena which he perceives as incongruent with his intuitive understandings" (Schön, 1983, p. 241)

and further highlighting the resources for coming to such understandings, as:

> "Organizations, furthermore, are repositories of cumulatively built-up knowledge: principles and maxims of practice, images of mission and identity, facts about the task environment techniques of operation, stories of past experience which serve as exemplars for future action." (ibid, p.242)

So whilst he was tangential on the use of judgement, he had articulated here and in numerous other studies, issues around intuition. Furthermore, the issue of 'interpretation' (as an equal partner to analysis), was also given some attention, for example in his comments on 'interpreting the market phenomena' and use of inference (ibid, p.244).

> "If prototypes of the new product are produced (and it takes money to develop and produce them), then consumer panels may provide information from which managers can make inferences about actual market behavior." (ibid, p.244)

And eventually arriving at judgement, via interpretation and interference, (ibid, p.244-245)

> "At each stage of the development of a radically new product, managers must make investment decisions in the absence of adequate information or rules for rational decision. Each such judgment is a unique case, and the market tests, which may reduce uncertainty, come only at the price of further investment". [...][as] "managers often find themselves confronted with surprising data that demand interpretation."

This then reminds us of, and brings us full circle back to the required balancing of analysis and interpretation, so as to lead to integration, in innovation processes (Lester and Piore, 2004).

As indicated earlier, we end this section by returning to selected summary of Dewey's work, articulated in a recent commentary. The objective of this commentary by Frega (2012) is multifaceted but for our purposes, he (drawing on Peircean theory of inquiry, supplemented by Dewey's ideas both on inquiry and epistemology of practice) highlights that:

> "[...] Dewey's epistemology of practice shows that regulative criteria are at one and the same time immanent and normative. This is possible because practices inherit the self-corrective property of inquiry. [...][and] beliefs are grounded in our former experience and are therefore granted a prima facie validity due to their previous efficacy in facing situations and resolving doubts.

And illuminates issues around judgement, as follows:

> [...] a practice-based conception of judgment, whose most relevant trait is its temporally extended, articulative, and transformative nature. Reasoning is not limited to sequences of deductive, inductive and abductive inferences, but extends to the articulative and transformative phases through which the indeterminate situation faced by the agent and submitted to inquiry becomes first "determined" and then "settled". In these activities, we "reason" in the sense that we identify the most significant traits of the situation, we try to discriminate significant from irrelevant elements, we examine the present situation in light of previous ones, [and] we assess the coherence of each of them..." (Frega, 2012, p. 67).

Whilst as a summary, this is not an easy text to grasp due to its philosophical lexicon; it creates a useful and robust conceptual link between the issues of inquiry, indeterminate zones of practice, reasoning and judgement.

Whilst Dewey had considered judgement, in a more philosophical domain, Schön had re-articulated it in his terms more tangentially and indirectly.

In this 'evolutionary line' of Dewey's concepts, and transition from inquiry to judgement, what other recent authors (Frega, 2012; Guile, 2011) have managed to articulate is to further draw our attention towards and illuminate the unified nature of action within the context of practice.

We conclude the discussion by returning to writings, attempting to unpack the multi-layered innovation processes, particularly radical innovation in larger organisations. Pavitt (2005) reminds us of the complexity of processes and highlights, albeit tangentially, the importance of judgement particularly on managing embedded risks: an issue that we have discussed previously in our data analysis. He cogently reminds us that following rule-based systems runs the risk of over-simplification within a complex process (such as that of innovation) and thus, failure. Somewhat ironically, he also observes that judgement-based systems run the risk of failure as it is, in the short-term, impossible to rapidly distinguish between good judgement and good luck.

He concludes his chapter on innovation processes, published posthumously, by stating that

> "…there can be no simple tools or model to neutralise the uneasy, politicised task of dealing with… innovations. Good judgement, experience, trial and error learning remain the only feasible 'toolkit' available to today's innovative corporations." (Pavitt, 2005b, p. 108)

With this conceptual discussion completed, we next turn our attention to refocus on the implications of this study. Having discussed some of the issues in brief in earlier part of this chapter, we further turn to expand on two points.

8.1.3 Implications for management and education

As stated in the early parts of this chapter, a number of important educational, and workplace learning implications are interwoven and embedded within the findings. Other practice and policy implications will also be highlighted further, with reference to 'smart specialism' policies in the following pages. That said, it is worth specifically highlighting two factors for clarity here.

Firstly, the implication of our findings supports the emerging view in the region that there needs to be a much closer interaction between the business sectors, and universities and other educational establishments. In short, the supply side of the skills needs to a more nuanced overview and gain much higher acuity on the requirements of the demand side. As the university enrolment and graduation rates have soared in Iran (and the region), this is no longer an isolate problem. University-Industry links (and other deriving terms such as *Triple-* and *Quadruple Helix* arrangements), and horizontal sectoral links are by and large, weak at present.

Secondly, this lack of interlinkages both at the sector and university-industry level makes the task of the firm even more burdensome. The firms, including small firms and new technology-based firms, on their own or via sectoral 'platforms' have to be able to provide ample opportunities for the much of the technical and business-model related learning. This places workplace learning as well as lifelong learning efforts on an entirely different elevation: a sector and a firm wishing to compete in the global value-chains, would require much action in this area.

8.2   Full circle: addressing the research questions and limitations

In this section, we return to the research propositions and I address these concisely. We will then consider related factors around limitations and strengths of the study, along with potential avenues for future extension of the work.

As we recall from chapter one, supplemented by other earlier chapters (primarily chapter 6, on abductive construction of the research design), my core research propositions were to conduct an exploratory study to examine and address the following concerns:

- What activities, as observed in 'learning episodes' and brokerage, do the project team members of the firms engage in, that facilitate their ability to innovate? [RQ1]
- Within the context of the study in contemporary Iran, what are the macro effects that influence the firm's capabilities to innovate? [RQ2]

Supplemented by a meso level question, with the following focus:

- Within the context of the study, what tangible policies could assist and promote firm-based learning episodes, with a view to innovation? [RQ3]

As a concise answer to first question above, based on longitudinal research and data analysis, and the significant 'reduction in noise' by the use of thematic clustering, I have come to view the formation of knowledge brokerage, to aid and assist in performative learning and distributed judgement formation, as the core 'productive' activities that the project team members have engaged in, which in turn facilitates and enhances their capabilities to innovate.

Additionally, within the firm-based activities to form interprofessional learning and distributed judgement, 'workflow pedagogic processes' are developed in situ: these entail team members hearing each other out, so as to assess competing and contending frames on how to set and solve problem, and the resulting acts to infer and/or further confer.

Equally, the utilisation of informal and personal networks[125] plays a central role in some early, grounding stages, or final transitional phases of the processes.

Addressing the second question, numerous macro effects continue to influence the firm's capabilities to innovate in Iran broadly, and specifically in Tehran's digitised creative sector. The ongoing geopolitical tensions with the new Republican White House administration on retention or abandonment of the JCPOA (*Joint Comprehensive Plan of Action* known commonly as the Iran nuclear deal - an international agreement effective from October 2015) has meant that Iran has not as of late 2017 opened-up to significant digitised technology sector foreign direct investment (FDI) and technology-transfer from the United States or close trading partners. Internally, while the policy ambivalences of episodic or thematic policies, under the current presidential administration in recent years, have lessened, there are still ongoing sporadic and deeply held differences. Digitised creative firms would therefore need to continue to establish hybrid and locally-constituted solutions in tackling the market demands and requirements, and economic uncertainties related to potentially new unilateral US sanctions, for the medium term.

As to the third question and linked to the above, it seems that a range of internal and external factors play a role in 'tangibility' (and *'implement-ability'*) of any potential policies (e.g. for the enhancement of the business environment of the digitised creative sector SMEs in Tehran) and many of these are offered by international advisory reports, undertaken by the Iranian government ministries and agencies in recent years. However, staying with the specific focus on the promotion of firm-based learning episodes, with innovation as a focus, two core factors stand out.

Firstly, pragmatic and evidence-based policies can better enable the opportunities for sector-specific network creation, for example, by attending and/or hosting professional and specialised events and exhibitions, in order to engage with not only local products and services, but also regional and global developments. These will then offer the firms the possibility of a metaphorical 'platform' to build-upon and further develop the professional, firm or individual based engagements.

These could then potentially offer resources for construction of (what this study has identified and labelled as) expansive and contractive skill webs in projects, which will be enhanced by the passage of time and means to nurture professional trust, with emergence of joint commercial or

professional purpose (such as via IJVs and contracts, or informal interactions, as deemed appropriate).

Secondly, as part of an enhanced and coherent national innovation and industrial posture, on a sector-specific level of disaggregation, the foundations for 'smart specialisation' policies could be laid. These would then pay further close attention to the global hubs for the digitised creative sector (such as in cities in EU, US and Far East) and could endeavour to tap into the significant professional diaspora community to assist with, and smoothen the processes of knowledge and skills transfer. Whilst this is not traditionally where the Iran's Executive branch and related civil service agencies have placed their diplomatic and commercial resources, there are some encouraging signs[126] that it may consider doing so in future based on a geopolitical détente in international policies particularly with EU (as well as Russia and China, and sectorally yet informally with US), focusing on economic catch-up priorities, internally and within the region.

Our thinking about facilitating brokerage as a form of workplace learning, on a firm or sectoral context, and the broader policy context, can also benefit from recent (re-)conceptualisation of how to assist workers to develop and share their essential performative learning and knowledge, so as to function effectively in knowledge-based sectors of the economy.

These include a clear move away from the credentialist approaches (ironically both dominant in Iran and the Persian Gulf region's societal fabrics, as well as - till recently, at least - highly embedded in the OECD and similar international advisory body's solutions), where qualifications are viewed as a proxy for vocational or professional skills, and towards acknowledging the multi-faceted role of social capital, and specifically related to our argument here, a gradual transition;

> "from conceiving learning as consisting of the accumulation of prespecified outcomes to seeing it as the development of judgement. [by undertaking practice-based inquiries, and rehearsing and revising procedures, mid-stream]" (Livingstone and Guile, 2012, p. 357)

Having briefly discussed and addressed the research propositions, we now turn to some of the limitations, along with the potential strengths of the study, before bringing this section to a close and turning our attention to the specific managerial and policy implications.

Upon reflecting on the limitations of study, two strands, around the obstacles to my own 'analysis and interpretation' leading to an integrated position, stand out.

Firstly, analysis has resource implications, including time and (lack of) previous work: despite the longitudinal nature of the work, the study's core resource was a single researcher (pursuing a PhD course, with its own structural framework), with limited resources in terms of time and primarily self-funding or 'boot-strapping' mechanisms. The focus of the thesis and the theoretical and conceptual work had taken time to settle and the case study, is by its nature, an explorative type, within one sub-segment (i.e. digitised) of the creative sector, anchored around one firm within one city (i.e. AlphaCo in Tehran) linked to another single city (of London) partner. Whilst there are no claims on the nature or direction of causality, nor have I made ventured into correlation of comparative factors, there are still powerful insights that can be taken from the study, although we have to be prudent about the applicability and extrapolation of the findings and models.

There are very little published materials on the strand 1 of my thesis topic and the few local publications, either on the core or peripheral elements of this thesis, are by and large, either not robust enough or draw on severely restricted (and non-representative) proxy measures and/or datasets to paint an ideological (either fabulously 'rosy' or terribly 'doom-and-gloom') landscape or 'journalistic' portrait. It should come as no surprise that longitudinal studies in learning and innovation management, and allied domains, and/or work undertaken in firms are exceedingly rare in Iran. There is also still a strong tendency and preference for quantitative measurements, or short snapshot qualitative cross-sectional designs, where the researcher (including many Iranian researchers now studying or employed at outside-of-Iran higher education or research centres) utilises on- or offline questionnaire surveys and/or a round of interviews or focus group, to "fly-in and -out" of the research site. Whilst these "flying-visits" do produce some insights, they are grossly impoverished in practice-based situations where change (such as learning, innovating and capturing the trajectory of new business/new sector development) is amongst the unit of analysis.

The position is slightly better on the strand 2 of my topic, as there is some, however limited, policy borrowing material in the Iranian and Persian Gulf States region, which may open up some productive linkages. The problem with the policy oriented material is they are, often taken literally as a potential panacea to complicated and embedded socio-economic paradoxes without sufficient contextualising to the local context. A more nuanced picture and justification on use of globally pervasive policies and practices are therefore much in demand.

Secondly, interpretation of both theories and concepts and longitudinal data has consequences, especially when dealing with a new sector, the borders of which are not as yet clearly marked. Having gathered information not only from the firm and through the empirics of the study, but also through a broad range of stakeholders, and related documentation, assisted my aim to present an up-to-date and pragmatic view of the field. That said however, within the interviews, the use of language to explain the role of tacit elements of concepts such as learning, knowledge, skills and judgement was not easy to 'verbalise', and therefore my role as the researcher, in interpreting what was actually happening in practice, at times as opposed or an addition to what was being said, has relied on triangulation means and methods, to validate and revalidate, my inferences.

At times, my attempts to get interviewees or the broader data (such as observations or documentation) to articulate and demonstrate the type of knowledge connections that guides action was found to be short lived and contradictory. Other times, it was easier to disentangle successful factors that led to the project break-throughs. In all my interactions, I was mindful of the potentially negative effect and biases that the researcher could accidentally introduce whilst 'interpreting' the scene. Procedures such as thematic clustering and mapping, getting a firm grasp on the sectoral issues, and validation meetings were organised so as to minimise such interference or 'noise' in the study, and inform my, and the team's understanding of the processes at work.

Practically, conducting interviews in English and Farsi (and when in Farsi, these were translated into English as part of analysis) and checks prior to thematic clustering, has meant that there have been a number of stages where validations could take place.

Whilst it is common to describe the processes of qualitative analysis as producing a 'mosaic' of data, my interpretative activities influenced by a pragmatic orientation, aimed for clarity by staying with performance. This is not to underestimate the usefulness of the mosaic metaphor for my findings, as an informative and multi-layer, yet nuanced with common and co-ordinated and at time, contrasting themes. However, staying with the performative nature of practice resolved, or lessened the relevance, of a number of sub-strands. One of the other challenges confronted in the study, was the sheer volume of data, based on the time period and the number of 'proxy' indicators that one could take into account. Again, conferring with practice and practitioners simplified these as many were not viewed to have significant impact, for example in the sustainability of the learning to innovate, or the performativity of skill webs.

Whilst I have drawn on Tehran based firms, specialist exhibitions and academia, and extensively on official publications and reports, an area which may have added to the insights of the study could have been some form of direct contact with policy makers. This however proved to be impractical as the digitised creative sector, and generally service sector innovation, has not, until very recent months been given much serious considerations or potential specific policy priority.

As a final thought and when reflecting back, I appreciate that this has become an ambitious thesis: one in which, within the process of the research, concepts and themes have been identified, developed and based on the signals from practice and the firm, further retained, refined or rejected. In attempting to pose, frame and reframe, and address the central questions of the thesis, I have had to interrogate a number of social, management and philosophical theories: in so doing, I hope that I have provided the reader with both a set of tools and content to shed new light on ongoing and old problematic and indeterminate situations.

Lastly, the findings of this work feed into wider debates around workplace learning both at the micro and meso level, as well as policy designs that could potentially cater for such multi-level objectives. As previously mentioned for example, the concepts of clusters have had very little support in this, and other recent work, within similar sectors. Whilst physical regional and sectoral scales and related policy interventions continue to be seen as important, we pose the question that perhaps the spatial dimension of certain knowledge-based sectors are more complex than first anticipated and highly contingent on the project task and skill requirements.

The findings on the importance of nurturing the capability for distributed judgement also may enable us to move the analysis on, to consider the global socio-economic interconnections, facilitated by informal means, and in a far less dichotomised view of interprofessional learning and development, enabled by elements of, at times overlapping, social capital. Within digitised creative projects, this then points to a 'rediscovery' of the importance of specialisation, just at a time when calls for generic skills are gaining momentum. These, as well as the challenges of policy implementation and/or policy reframing issues (within a local to global spectrum), raised in later sections, are amongst the identified key themes which we have not had the opportunity to fully unpack or develop in this work, as they have fallen outside the core scope of the thesis, but can be further scoped so as to warrant future investigations.

8.2.1 Concluding remarks on practice and policy implications

We now turn to outline in brief, the core managerial issues within the firms and subsequently the related public policy issues. Clearly some of the managerial issues will naturally link to, and could be enhanced by supportive policies, at the firm and sector levels (such as enhanced sectoral learning/training and development, and tax breaks, as R&D incentive grants).

Bearing the sector specific characteristics of the creative firms in mind, the core related management issues for the firm is likely to revolve around an acknowledgment, and then the facilitation of 'workflow pedagogic processes', by accommodating for the intersection of the firm-to-sector infrastructure, and allowing the project team the opportunities to engage with and draw from its network, as part and parcel of the work activities. Pioneering SMEs apart, in a region where 'command and control' style of management still has a firm foothold, this may take some persuasion and incentives, in the form that is attractive to local SMEs and their activities.

One way to frame this may be to remind the firms that in a market opening out to the global trade, emphasis on professional up-skilling and performative learning should be paramount. So to become, and then stay sectorally competitive, that lexicon can be more rapidly grasped by the entrepreneurs and firm owners, and taken ownership of. As there are horizontal connection in the digitised creative sector, management action could be enhanced by appropriate micro and meso level, and merit-based policy incentives, for skill webs 'platforms' to be created and maintained.

Whilst some movement is in progress, efforts to further promote the internationalisation of the digitised creative SME firms in Tehran (and Iran, and Persian Gulf region, by extension) could act as a first step towards legitimising the necessary time and cost to nurture project ecology infrastructures. This work and previous research[127] confirms that once the SME firms start to view their performative learning and skills, as a core capability to significantly enhance their international business performance in areas such as customer satisfaction, market growth and brand recognition, and ultimately share of sales, a 'virtuous' cycle will steadily replace the vicious cycle of SMEs' lack of interest in workplace learning interventions.

As to the public policy design and intervention mechanisms, we should start with a firm caveat: there are no shortage of policy and practice recommendations in promoting innovation in SMEs,

including in Iran and the surrounding Persian Gulf region. Much time, money and effort is spent on national development plans (including 'National System of Innovation' plans); labour market, education, and skills policies; and strategy documents including industrial and sectoral scenarios which are then available and accessible to stakeholders.

A continuous challenge in Iran (and the region) however is around an instrumentalist view of strategy[128] and policy design[129] that over-estimates the importance of formal and macro strategies, at the cost of grossly under-estimating the implementation mechanisms, including capabilities, timescale and costs, and of course, potential unintended consequences on other allied or related policies. We recall that Iran has had valuable experiences of wide range industrialisation in many of her heavy and light industries, as a national import-substitution strategy. Nearly five decades on, notwithstanding the perpetuating self-sufficiency arguments, these policies are not only generally considered to be out of touch with the current realities of Iran's and global economy, but also they have contributed to the entrenchment of strong lobbies and economic pressure groups, which whilst talk about export-led strategies, in actuality benefit from status quo and the continuation of a four decades plus, long infant-industry protectionist policies, stifling competition and innovation.

In light of the rich political economy of Iran and the region therefore, particular consideration is needed to re-design and promote a systematic support system for innovating SMEs. The circumstances call for a fundamental rethinking of the supportive structures, within public policies, offered to fast expanding and employment generating small firms, including those in techno-entrepreneurial activities. A 'borrowed policy' template is unlikely to provide the level of nuances that a tailor-made, pragmatically supportive policy can provide to such firms.

We turn now to two specific policy enhancements that could be worth considering. The first is about making better use of the creative SMEs, as part of the value-chain of larger companies and especially State-Owned Enterprises (SOEs)[130]. As SOEs take the lion's share of much of the national economic activities, but are limited in their scope for innovation and particularly creating new private-sector and sustainable employment, an enhanced values chain system could provide a promising venture to explore. The project inter-linkages has the potential to upskill the SMEs project teams and add to their interprofessional learning and judgement capabilities. Equally, it has the transformative potential for SOEs to capture and benefit from the agility and lean nature

of SME activities. This then ties in with the learning imperative to improve the company level skills, which translates to a core asset in the catching-up processes (OECD, 2013a).

The second potential policy enhancement is around a more systematic use of the personal and informal networks, created via the Iranian diaspora community (cf. Kapur, 2001; The Economist, 2011) engaged in related sectors, as providers of specialist brokerage and actors in sector-specific intermediation. There are already limited activities in hand inside Iran and practical examples from other Asian countries, primary amongst which in digital technology sector are South Korea, and more recently India and China, so future policy interventions would benefit from the experiences already gained. As our case study demonstrated, their role, especially around nurturing skill webs was immensely important, especially at the early stages of the firm establishment and its niche formation.

Related to both of the above suggestions, is a common thread which is improving the capability for development of interprofessional judgements on a policy formation, design and implementation level (OECD, 2013c, p. 248) based on professional and practical expertise. As OECD rightly draws attention to this, the complex nature of such policies demands a range of skills which are not likely to be present in any single government department or organisation, especially in the developing economies. Better governance and advisory mechanism would then place the policy makers in a better position to comprehend the nuances of the different strands, such as the political economy of workplace learning (Ashton, 2004) as well as the changing and the multiple facets of the workplace learning theoretical and practical conceptualisation (Unwin, 2008). This will also pave the way to pursue an 'strategic incrementalism' in policy design and implementation, as suggested by the World Bank programme of research (Kutznetsov, 2010, p. 264). Strategic incrementalism refers to developing and facilitating methods of gradual change by which many small policy changes are enacted over time in order to create and facilitate a larger broad based policy change, increasing confidence in the implementation stages.

Figure 19 [8.2.1]: Core elements of 'Strategic Incrementalism' in policy implementation
Source: (Kutznetsov, 2010, p. 264)
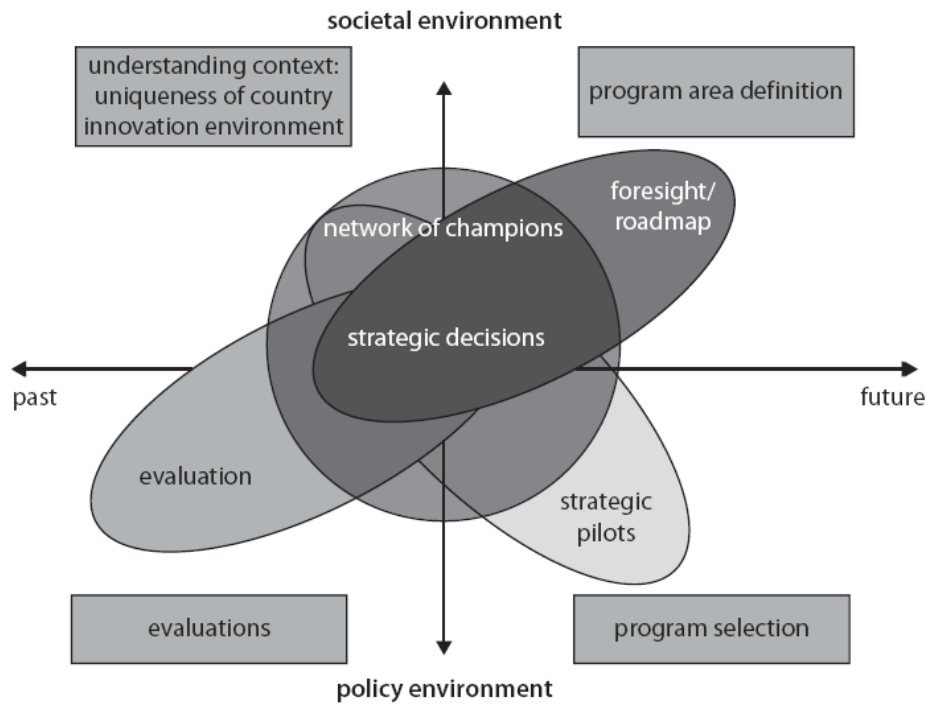
A better policy advisory and collective governance structure around multidisciplinary strands of learning, skills and innovation, will not only better ground the future policies and consider their implementation trajectory but can also offer a pragmatic mean to explore means of 'learning by monitoring' in the related policy domains. The overall aim of 'learning by monitoring' is to devise practical ways to address specific policy and practice situation, and develop

"an institutional device for churning, amidst the flux of economic life, the pragmatic trick of simultaneously defining a collective-action problem and a collective actor with a natural interest in solving it" (Sabel, 1994, p. 272).

It is via such interventions that we may create the possibility to move beyond an instrumentalist view of policy and in so doing, allow ourselves to frame and reframe indeterminate situations, so as to explore way to settle and solve policy controversies and conundrums.

As Martin Rein, a departmental colleague and collaborator of Donald Schön remind us, by summarising as follows;

> "Public policies are often problematic because the ends they seek are themselves problematic. The defining challenge of public policy lies not in finding the best means to given ends, but rather in reframing ends so as better cope with unavoidable problems of vagueness and conflicts among the ends themselves. Those problems are largely neglected in the standard instrumentalist approach to policy research. (Rein, 2006, p. 389)"

8.2.2 Potential policy vistas for Iran and other regional emerging economies

Having discussed the research, its limitations and strengths and associated managerial and policy issues, in this last section of the chapter, we briefly turn our attention to possible policy vistas for Iran, and other regional emerging economies (specifically with Saudi Arabia and United Arab Emirates in mind, as they are making great strides in exploring different industrial diversification policies). The importance of learning within human capital factors is now gradually returning to underlying modern industrial policy thinking (Felipe and Rhee, 2015a, 2015b; Nübler, 2014).

As previously stated, there are ample policy and practice advice around innovation and SMEs. Amongst the various schemes and suggestion, a new idea, entitled 'smart specialisation' (Foray and Goenaga, 2013; OECD, 2012; UNECE, 2013) which has grown out of Europe (via European Commission and OECD) whilst facing the post-2008 recessions and articulated in recent months, may have a uniquely contextually congruent characteristic and therefore merits further attention.

Whilst acknowledging the importance of innovation strategy and eco-systems, and the core role of interconnectivity and collaboration for sectoral learning and innovating, it essentially attempts to join-up regional and sectoral innovation strategies (UNECE, 2013, pp. 15–19), based on the distinction of the available skills and resources to the sector, within the region in question.

> ""Smart specialization" strategies include public support to a process of entrepreneurial discovery that capitalises on existing strengths and seeks to facilitate collaborative leadership of this process and provide necessary complementary inputs in the innovation process. […] Critical dimensions of these "smart specialization" strategies are appropriate stakeholder involvement and the synergy between different sources of funding and instruments. The private sector should have a leading role in the identification of sectors with growth potential but it is also important that this process of entrepreneurial discovery is not captured by vested interests that block or distort change." (UNECE, 2013, p. 18)

and of relevance to the policy design process

> ""Smart specialization" does not prescribe specialization in particular sectors but emphasises the policy process through which the identification of areas to be developed emerges. The outcome of this process should result in distinctive areas of specialization, not on the imitation of existing ones. The focus should be not only technological but

include also other forms of innovation, which are practice based. More than one sector can be targeted in the search of synergies." (ibid, p. 19)

Whilst it is too early to cite any tangible examples of 'smart specialisation' policy design and implementation, leading to city or regional growth, it seems to have been well received by the practitioner community and policy makers. Returning to the specifics of our study, a commentary paper over a decade ago, looking at the Iranian software development sector and government's policy at the time with considerable investment, in relation to Iran's NICTA (*National ICT Agenda*, also locally known as *TAKFA*, which was part of a national aspiration for a 'software movement' [*nehzat-e narmafzaree*], emphasising indigenous R&D activities and "knowledge creation" rather than mere "imitating and translating"), highlighted the importance of choosing priority strands or running the risk of an instrumentalist strategy not leading very far. As cautioned at the time (Alyani, 2003, p. 9);

> "the agenda tries to be everything to everyone. As such, it is likely to run into major difficulties in delivery and execution. The interim results point to a maze of bureaucracy, while many of the private-sector small and middle-size enterprises are not properly accounted for, sectorally linked or adequately represented."

And it laid bare a number of the antecedents to the current study (ibid, p.10);

> "On the firm level, there are few initiatives that bring together individuals with different technical capabilities to work jointly on projects and the output tends to be of variable quality. The input of the émigré community is being felt in these type of joint activities with a number of small and independent firms, with niche market strategies, forming on the periphery of the sector and managing to mobilise some level of expertise sharing. …desperately lacks project management skills, especially involving teams of developers… organising any level of teamwork in the average Iranian workplace is seen as a challenging task in itself, mainly due to an organisational culture where information is considered as power and hence rarely freely distributed."

A decade on, fortunately a number of these issue, at least for the leading private SME firms have been significantly alleviated. Whilst there remains a perplexing sum of conditions that jointly produce the optimal infrastructure for SMEs and the digitised creative sector's blossoming, most business domain factors constitute a necessary but not a sufficient condition for sustainable growth. A unified view on the critical importance of the relationship between learning and innovation, leading to interprofessional judgement in practice, is an essential start in balancing that equation.

8.2.3 Epilogue: hybrid solutions and beyond clusters

Finally, two issues are worth revisiting here before closing. Firstly, as a last glance back, it is worth stating that AlphaCo, the firm under study in the empirical elements, has developed to a fully-fledged creative digitised sector player not only in Tehran but also operational nationally in Iran. Despite its youth, it was included in Iran's Industrial Management Institute's top 500 (Iran IMI 500/100) Iranian companies ranking (and on some qualitative categories, within the top 100 firms as a SMEs) in 2016. Late last year and in early 2017, the firm has also witnessed a successful partial IPO (initial public offering) on one of smaller Tehran Stock Exchange (TSE) exchanges (Iran Fara Bourse) to prepare in financial and structural terms for a main TSE listing in the next two years.

The solution reported in the two vignettes have evolved and are still in full operation as of late 2017. The SMS VAS solutions powered by SMS are now run in parallel with data and smart phone solutions, using 3.5 and 4G connections. The firm continues to rely on brokerage with European partners and has a number of additional banking and creative hybrid solution projects.

Secondly, I return to the contribution of the different type of the skill webs outlined in this study. As outlined before, learning episodes that led to breakthroughs within the context of different layers and the mobilisation of expansive (for *bridging and linking*) and contractive (for *bonding*) skill webs did not display a local or regional characteristic, but were essentially global in nature. This meant that the prominent exchanges and upskilling is with global (mainly EU) partners and not within local or regional clusters.

The exact and unfolding reasons for this require further analysis which can be an extension of this work: it could for example be due to intensive competition or low trust between sectoral SMEs that AlphaCo finds it more appropriate to reach out, rather than to reach inside the city or region. It is also that as a pioneering firm, the senior technical or management staff may not feel that the local and regional space, under the influence and impact of a 'self-sufficient' policy environment, has much to offer the firm, either in seeking hybrid solutions or in its future strategic branding and positioning.

As reported before, our model breaks away from the regional clustering literature and this is similar to a few recent, but well-cited ICT sector studies (Huggins et al., 2010; Huber 2012).

Recent research undertaken by UK NESTA focusing on UK SMEs has also highlighted the critical importance of brokerage activities in small firms' development and growth (Huggins et al., 2010), and confirms that interprofessional and interdisciplinary learning is actively pursued, to enhance untangling, framing and reframing problems, in aid of innovation.

While the thesis started by arguing a broader set of propositions in the interaction between the firm, economic sector and the society, in the course of my theoretical exposition of the related issues on different levels, and empirical investigation within the context of the study, an enhanced (and hopefully, better nuanced) and transformed argument has emerged.

This echoes the analysis and findings of this thesis. As a new phenomenon supporting the 'fading lustre of clusters' (The Economist, 2007b) in specific sectors and locations with underlying business environment conditions, further and follow-up work specifically in Iran and the region may offer fruitful vistas for future investigations, to arrive at a more nuanced argument for clustering and networks.

[259 pages - Core text word count: **81,100**]

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Appendix One: Interview questions and focus group themes

The below text was fine-tuned and initially used in Summer 2007 (during *wave II*) and updated, as the research progressed. The actual name of the firm is replaced by AlphaCo.

Exploring innovation and learning in [AlphaCo]

Innovation and learning [*No'avari va Faragiri (dar mehvar-e kari) – in Farsi*] are amongst the key components of maintaining future sustainable competitive advantage in [AlphaCo]. Based at the University of London, I am acting as a doctoral researcher who would be grateful to hear your perspectives related to your practical experience and views. This research is trying to better understand how people learn as they go through innovation processes, and by so doing, positively contribute to [AlphaCo's] R&D effort, with future analysis on the firm's potential/possible paths ahead.

The content of our discussion will remain confidential: all responses are kept anonymous and views will be analysed and reported without referring to individuals. The process of our discussions is likely to revolve around a number of themes and questions as stated below, taking about 45 to 60 minutes and audio-recorded, with your consent, only to assist with later analysis. You can withdraw from this project, anytime you wish. The purpose of our discussion will be:

- To collect insights, views and experience from individuals who work as part of teams (both inside and out of [AlphaCo]), developing new services or products
- To identify factors that facilitate or impede workplace learning and innovation

It is important to note that we do not necessarily have to follow the questions or the themes below, and that there are no right or wrong answers. Instead, the questions and themes are presented, based on previous and piloted studies, to assist our systematic thinking on the subject and to guide our discussions.

1. *Think back over the last year and recall, what in your opinion, has been the company's most successful example of developing a new product or service.*
2. *What is your criteria and definition for considering a project as a successful innovation? Who was involved in the process and who were the intermediate persons and customers?*
3. *What do you see your role as on your current software or Value-Added Services development project?*
4. *What is your training and education background? (plus demographic profile)*
5. *Can you describe a typical project activity that required a new or unusual way of resolving a business or technical challenge, which you were recently involved in?*
6. *How many other people do you work with on this project? Where are they located? How does the necessary knowledge or skill transfers and/or flows between people, projects happens both internally and external of the firm?*
7. *What external sources of expertise do you call upon? What unique expertise do you have and how are these utilised within the project and firm?*
8. *What technology, if any, do you use in the innovation process? (e.g. simulation, experimentation, concept or schematic design and prototyping)*

Lastly, what factors do you believe enhance the innovation process in AlphaCo? Would you like to make any additional comments that we have not covered? [thank you for our discussion].

Appendix Two: Supplementary and explanatory material endnotes

[Word count: **7,700**]

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[1] During the case study, the IJV arrangement was resolved due to the adverse external factors and the non-proportionate "issues management" efforts required, based on the unique business-environment factors.

[2] (Williams, 2002, p. 166).

[3] The recent history of ICTs and particularly software and application programming in Iran in the last six decades is initially tied to the close US-Iran relations, both for Iranian Imperial Armed Forces' R&D in the military and industrial technology domains and the civilian equivalent by the establishment of a branch of IBM (International Business Machines) in Tehran in late 1950s as a regional hub for the IBM corporation. The company operated as a subsidiary until 1981, when IBM's operations in Iran were nationalised and taken over by the Iranian government (New York Times, 1982) with the firm's names altered to the 'Data Processing Iran' company (DPI). In 2001, DPI became a private company, listed under the Tehran Stock Exchange and to date remains a core player in the local market. Tehran continues to be the national hub of the sector's cluster although other large cities (e.g. Mashhad, Esfahān, Tabriz and Shiraz) with active technical universities are attempting to catch-up. The regional ICT hub is now Dubai, UAE.

[4] Drawing on the American pragmatic philosophy tradition of James and Dewey, Roger Säljö has highlighted (2010, p. 61) that the "performative nature of learning and knowing thus implies a focus on what is new, relevant and productive, rather than merely on what is true in an absolute sense."

[5] An early interdisciplinary example of this is manifested in the early work of D.A. Schön on innovation.

[6] NTBFs not only contribute to fast growth and entrepreneurial employment generation, but play a significant role in *technological dynamism* by *introducing* a technology; improve *accessibility* to a technology; and contribute to the *diffusion* of a technology (2001, p. 80, 1996). This is similar to what has been explored and found in the case study of AlphaCo presented in this thesis.

[7] For details, see (2003, 1999, 1998; Alyani and Nahi, 2003).

[8] I refer here to both 'natural' (e.g. English and Farsi) as well as 'professional' or rather, 'interprofessional' languages. This was further enhanced during this thesis development as part of my research co-ordination role on *Learning and Technology at Work SIG*, attached to the 'Kaleidoscope' European Network of Excellence (EC FP6). The group focused on workplace learning with technology, reflecting the views of a diverse community of researchers in Technology Enhanced Learning (TEL), represented by a many disciplines such as computer science, engineering, education, philosophy, psychology and sociology, across universities in five different European countries, embedded within a wide range of, and at times oppositional, research and disciplinary traditions. Given the diversity of the backgrounds within the special interest group, maintaining a joint vision and forward traction proved to be a challenging endeavour.

[9] For further details, see (Guile, 2010a, p. 386; Stone, 2003; Woolcock and Narayan, 2000).

[10] Ashton, Brown and Lauder (Ashton et al., 2009, pp. 330–331) classify *skill webs* into four types: *the traditional, transactional, transformative* and *transitional* and provide a brief explanation for each type.

[11] (for details on SST, cf. MacKenzie and Wajcman, 1999; Williams et al., 2005; Williams and Edge, 1996, p. 866).

[12] Scrum methodology refers to an agile software development model based on multiple small teams working in an intensive and interdependent manner. The term is named for the scrum (or scrummage) formation in rugby, which is used to restart the game after an event that causes play to stop, such as an infringement. Scrum employs real-time decision-making, and 'bind' processes based on actual events and information. This requires well-trained and specialised teams capable of self-management, communication

and decision-making. The scrum concept was introduced in a Harvard Business Review article in 1986 by Takeuchi and Nonaka (Takeuchi and Nonaka, 1986) entitled "The New New Product Development Game" within their original context of lean manufacturing. J. Sutherland, J. Scumniotales and J. McKenna are credited with adopting, implementing and documenting the model for software development at Easel Corporation in 1993. In 1995, Ken Schwaber presented an influential white paper at OOPSLA, entitled "SCRUM Development Process" (Schwaber, 1995; Schwaber and Beedle, 2001).

[13] In defining the skill in the 'skill web', I draw on, and tangentially mobilise Green's recent review (2011) on an interdisciplinary synthesis of skill and the *PES* (*Productive, Expandable and Social*) model features.

[14] (for a policy critique, cf. Cunningham, 2009; Guile, 2012b, for learning challenges in SMEs, cf. 2007; Howkins, 2001; for policy overview in Asia, cf. Kong et al., 2006; O'Connor and Xin, 2006; for a recent overview, cf. UNCTAD, 2010; UNDP & UNESCO, 2013).

[15] Vibrant cities such as London and Tehran (although in a more 'measured manner'), exhibit what Richard Florida labelled as the 3Ts model, i.e. *technology, talent and tolerance*, required for a 'creative economy'.

[16] For details, see: (Cooke and Morgan, 1998; Dirks and Keeling, 2009; Florida, 2008, 2002). Additionally, as recently reiterated (Sorenson et al. 2006), it is increasingly clear that when the nature of knowledge and learning is complex or even moderately complex, and tacit rather than codified, there are significantly stronger chances of a successful 'transfer' when parties are socially proximate.

[17] (Chesbrough, 2003a, 2003b; Chesbrough et al., 2008; Hippel, 2005, 1988; Huizingh, 2011).

[18] Hargadon's recent thinking also highlights that for innovation to materialise, new ventures need sustainable 'capital': he points out however that capital is a much more nuanced concept than usually described, outlining the four types of capital needed for innovative activities: financial capital (credits, funds and money); physical capital (real estate, equipment and lab space); intellectual capital (know-how) and social capital (know-who). He points to the last two of as significant factors to consider in any sector.

[19] This is further highlighted by the continuing realisation that firms play a paramount role in any potential 'triple-helix' and 'quadruple-helix' (Carayannis and Campbell, 2012) arrangements, beyond the university-industry links (Tether and Tajar, 2008). Despite the obstacle, and notwithstanding technology, it should be noted that Iran's 'basic science' scientific position is strengthening (Royal Society, 2011, p. 21).

[20] (Donner, 2008; Kang, 2010; Ling and Donner, 2009; Ngai and Gunasekaran, 2007; Steinbock, 2007).

[21] (Kent, 2014; 2005, 2004, 1995; as a management of teams' tool, cf. Sutherland, 2014; Woodward et al., 2010a, 2010b).

[22] (Gann and Salter, 1998; OECD, 2011; Teece, 2007; for a review on skills and innovation, cf. Tether et al., 2005; Tidd and Bessant, 2009; Toner, 2011; Tynjälä, 2008; for a workplace learning review, cf. Unwin, 2008).

[23] (Newell et al., 2009; Scarbrough, 2008; Scarbrough et al., 2004; cf. Sole and Edmondson, 2002; Tyre and Orlikowski, 1996)

[24] Learning in firms has previously been considered, and defined as a "response to the need for adjustment in times of uncertainty" (Dodgson, 1993, p. 378); this echoes the circumstances explored within this study.

[25] (Boden and Avram, 2009; Hargadon, 2014, 2003, 2002; Hargadon and Sutton, 1997; Pittaway et al., 2004; Thorpe et al., 2005).

[26] Within the high-tech sector, NTBFs regularly operate as the vanguard of product, process and service innovation: the firms are usually formed by highly educated and skilled entrepreneurs, with a high rate of growth and firm mortality significantly contributing to sectoral and national economies.

[27] My 'cautious' operational definition is in line with OECD and the World Bank (Grootaert, 1998; OECD, 2000a, pp. 43) as *'the norms and social relations embedded in the social structures of societies that enable people to co-ordinate action to achieve desired goals'*.

[28] 'Absorptive capacity' was first coined by Cohen and Levinthal (1989; 1990) initially defining it as (1989, pp.569-570): *'the firm's ability to identify, assimilate and exploit knowledge from the environment'*. Their refined definition in a subsequent paper (Cohen and Levinthal 1990, p.128) referred to a firm's absorptive capacity as: *'... an ability to recognize the value of new information, assimilate it, and apply it to commercial ends.'*

[29] Following the Schumpeterian economics line of argument (Schumpeter, 1954, 1943, 1928; The Economist, 2007a) , the process of commercialising existing knowledge is essential for entrepreneurial activities in firms: this is in essence bridging as yet unconnected sources of expertise, knowledge and learning, and recombining already known inventions in an effort to create new business opportunities (for a view of innovation as learning, cf. Beckman and Barry, 2007; Hargadon, 2002).

[30] Also known as 'global start-ups', 'high technology start-ups' and 'international new ventures' (McDougall et al., 1994), the concept of 'born global' micro firms originates from the International Business and Marketing literature in the last two decades and refers to firms that internationalise instantly from inception or rapidly soon after their foundation, often without initially developing revenue-generation or sales activities in their home market. This is in stark contrast to conventional firms who tend to nurture a significant period of domestic business activities before venturing internationally.

[31] The initial brokerage drew on the 'skill webs' of the Iranian diaspora community in EU & US, beyond local clusters. For the nurturing role of diaspora in business links, see: (The Economist, 2011, 2007b).

[32] Short Message Service (SMS) is believed to have started in the UK in December 1992: available on digital GSM networks allowing text messages of up to 160 characters to be sent and received via the network operator's message centre to customer's mobile phone, or from the Internet, using a so-called 'SMS Gateway' websites. If the phone is powered off or out of range, messages are stored in the network and are delivered at the next opportunity. The main attraction in Europe has been to send a short message to someone without calling them and low costs. Public and private/corporate SMS services include news, information and transaction, and leisure. It is the introduction and expansion of private and corporate services in Iran (information exchange and transaction) which is the subject of the empirical study.

[33] Java ME was designed by Sun Microsystems, recently becoming a subsidiary of Oracle Corporation. There are presently an estimated 3 billion Java ME enabled mobile phones and PDAs used globally (http://www.java.com/en/about/), although the technology is increasingly viewed as 'old' technology as it is not used on any of today's newest mobile platforms (such as iPhone by Apple, Android now owned by Google, Windows Phone by Microsoft, MeeGo, initially supported by Intel and Nokia [now subject to change due to Nokia's major reorientation] as well as Linux Foundation, Novell and AMD; and BlackBerry/RIM's new QNX).

[34] Despite the technological progress on smart phones and mobile platforms in the West and Pacific Rim, based on their market size and large heterogeneity of mobile handsets, SMS VAS remain a significantly healthy segment in markets such as India, China, and much of developing Middle East, Africa and Far East.
[35] Certain iterative features, which are better known as a core characteristic of 'grounded theory' research (Corbin and Strauss, 1990; Strauss and Corbin, 2008; Strauss and Glaser, 1967), were also mobilised within the design, especially in assisting with thematic clustering and data compression.

[36] (Barley, 1990; Leonard-Barton, 1990; Van de Ven, 1986; Van de Ven and Polley, 1992).

[37] (Bickman & Rog 2009; Maxwell 2009; Yin 2009b; Ritchie & Lewis 2003).

[38] (Hitt et al., 2007; Stake, 1995, 1978, Yin, 2003, 1994, 1981).

[39] I am grateful to Shirley Williams for highlighting this fact and drawing a striking similarity in the format and social costs of the Iran-Iraq War (1980-88) and the First World War (1914-18), the importance of which are expanded later in the text (in personal and small group conversation with Baroness Williams of Crosby PC; British politician and academic; as guests of Lord Lamont of Lerwick, Chair of The British-Iranian Chamber of Commerce's annual reception: House of Lords, London, UK, 28th November 2008).

[40] It may be argued that theories are generally *'either constructed through inductive generalisations from so called empirical facts or are purely speculative reasoning.'* Whilst I follow that logic to some extent, following Guile (2005, pp. 10–12), I acknowledge that, *'this is not the [only] view of theory adopted'* in this thesis. Whilst I do not intend to operate within, or utilise a CHAT framework, I firmly subscribe to the view that theories could also be *'conceived of as a way of putting us in touch with the world because it is a product of our activity in the world'* and as they supply us with *'clues and insights as to how to answer questions'* and critically for innovation *'in a way that leads to a constructive reformulation of the problem rather than [necessarily a definite] solution'*. This line of methodological argument runs a close parallel to the underlying view of framing innovation under two fundamental processes of *analysis* and *interpretation*, and the required balancing of both to lead to *integration* (Bugos, 2006; Lester and Piore, 2004).

[41] Tehran is 3.5 hours ahead of GMT and Thursday (half day in private sector) and Friday are the weekend days. This means that the overlap 'realtime' project hours are limited to, at best, 7 hours for 3.5 days per week. This is part of the logic for 'shifting' the weekend to Friday and Saturday in some GCC States.

[42] The roles in a sprint cycle may resonate with what Brown et al. (2011, p. 81) distinguish as "three types of knowledge worker: developer ['creator'], demonstrator ['executioners'] and drones ['digital routine']".

[43] It is not my intention to draw a distinction between 'theory and practice' in the context of my research site: thus, I share the insight of Keith Pavitt (1998, p. 436) and Richard R. Nelson's (2000, p. 72) conceptualisation that there are two bodies of complimentary firm-specific knowledge in operation: i.e. 'body of understanding' and 'of practice'. Technology in firms acts as both understanding and practice: technological knowledge is "at once a body of understanding and a body of knowledge" (ibid, p.66).

[44] On a practical and longitudinal level, researching small firms has its own unique dynamics, as Guile (2002a, p. 32) observes; "Conducting research in SMEs is notoriously tricky… for the following reasons: tight staffing and short deadlines means it is difficult to release people from their work roles; lack of space means that it is difficult to convene meetings; and the lack of a 'learning culture' means that SME owners are often reluctant to give up their time and that of their workforce to participate in a research activity." In attempts to overcome some of these difficulties, the research formulated ways and means around the problem to fit-in with the priorities of the firm and a methodology that reflected some of the firm's and staff's concerns and priorities.

[45] Within the recent literature, a great number of functions are attributed to brokers (Van Lente et al., 2003). Howells (2006) extensively reviews the literature and put forward the following functions: foresight and diagnostics; scanning and information processing; knowledge processing and combination/recombination; gatekeeping and brokering; testing and validation; accreditation; validation and regulation; protecting the results; commercialization; evaluation of outcomes. For Van Lente et al. (2003), there appears to be three basic functions for brokers: demand articulation, network composition and innovation process management. The DEAL model developed in this study draws on insights from both of the above studies.

[46] Briefly, an abductive reasoning process is one in which the researcher moves between deduction and induction: data is gathered, explored and examined, and propositions or hypotheses are formulated and fine-tuned, leading to eventual theory development in response to what the data reveals. The researcher

works from what emerges from the data to formulate propositions and hypotheses and eventually develop theories. This method and methodology is returned to and expanded upon in detail in chapter six.

[47] This draws mainly on Guile's recent work (2012b, 2011), as well as management and economics (Foss and Klein, 2012) and KPMG consulting (Ranzilla et al., 2011).

[48] Whilst used extensively in development and innovation economics, 'catch-up' is an 'unevely loaded' and difficult term to pin-down. It broadly refers to developing the abilities of a single country to narrow the gap in productivity and income vis-à-vis a 'leader country' or a cluster of countries. Prime examples of successful catch-up strategies have historically been associated not only with the adoption and full utilisation of existing technologies in established industries, but also with innovation, particularly with new vistas into nascent sectors and industries. A related term, 'convergence' in national economies, refers to a trend towards a reduction of the differences in productivity and income in a region, or the world as a whole.

[49] Bauman here appears to paraphrase Marx and Engels (1972)[1848] original German text: the full text in English (translation) is generally known as "All that is solid melts into air, all that is holy is profaned, and man is at last compelled to face with sober senses his real conditions of life, and his relations with his kind."

[50] It should be noted that the 'actual practice' of rulership in recent decade has become a more pluralistic affair, drawing on other political elites and diverse factions, as highlighted recently: "The current rulers in Iran have been able so far to overcome the factional rivalries on economic, sociocultural, and foreign policy issues. […] Often, authority is delegated among different state institutions, thus circumventing the velayat-e faqih system and therefore the absolute power of the supreme leader." (Rakel, 2009, p. 124)

[51] The artwork and this figure is from 'Toronto Star', a Canadian broadsheet daily newspaper, as below: http://www.thestar.com/news/world/2013/09/06/sunnishia_split_the_mideasts_new_great_divide.html and for further and expanded details, please see: http://features.pewforum.org/muslim-population-graphic/

[52] For further details and commentary on the original text, see (Algar, 1984).

[53] A prime example of this is Ayatollah Khomeini's "opposition sermons [in 1964] focusing on legislation granting diplomatic immunity to U.S. military personnel in Iran" (Hooglund, 2001, p. 467).

[54] Sutherland (2011, pp. 151–152) provides this concise summary of the affair: "Stuxnet was designed to spin centrifuges out of control while displaying normal readings to plant operators." Iranian authorities acknowledged in September 2010 of infection in equipments… and yet "in a May 2011 report on Iran's nuclear programme, the IAEA stated that the main production site at Natanz was producing enriched uranium faster than before the attack." Stuxnet is thought to have been developed by 'State Actors' in United States and a number of other countries with help from European allies. Based on the tenacity of the defensive team's effort, "the computer virus, widely considered to be the world's most sophisticated has apparently failed."

[55] A more elaborate analysis and interpretation for example, could make use of the DIME (extended to DIME-RC) model in Iran's power projection: the acronym DIME, standing for Diplomacy, Information (including intelligence), Military and Economic, is utilised within the US Department of Defense (DoD) in practice and its related literature (Joint Chiefs of Staff, 2001) to describe the elements of national power and power projection. In the case of Iran, the acronym can reasonably be extended, I would argue, (with an additional -RC) to include the power of Religion and Culture, specifically via regional groups and proxies.

[56] There are still a significant number of mustard gas and VX nerve agent victims, in need of treatment in Iran: see, for example: (Ghanei and Harandi, 2007; Khateri et al., 2003; for a brief recent view, cf. Murray and Woods, 2014, p. 2 (footnote 5)). The last cited source confirms that "Evidence that Iraq used chemical weapons is undisputed. From August 1983 until the final campaign in July 1988, Iraq employed various combinations of mustard gas and VX nerve agents against Iranian forces. Iran developed a chemical

weapons capability (offensive and defensive) in response to Iraq's first use; however, there is no compelling evidence, including Iraqi intelligence reporting at the time, that Iran employed chemical weapons…" (ibid).

[57] The sales of, and the associated training and *skills' value-chain* for F14 Tomcats to the 'Iranian Imperial Airforce', at its time, one of the most advanced and versatile fighter jets, so as to counter-balance Soviet Airforce intrusions into Iran is a pre-revolutionary example of this state of affairs. For a detailed discussion, including the training and skills elements, see (Cooper and Bishop, 2004; United States Senate, 1976). For an overview of the very recent ('factional-politics fuelled') discussions on military planning and strategy skills and leadership, including questions on why the last 120 days of war were so costly for Iran, see (BBC Persian, 2014a, 2014b) and for the broad storyline in a lucid style, see (Jaudeau and Percy, 2009). For a reflective and broader historical coverage, see (Ward, 2008, pp. 242–298), including a brief commentary note on the new military professionalism, politicisation and praetorianism (pp.303-308). For a well-structured recent historical overview, see (Axworthy, 2013, pp. 277–282).

[58] As well as Iran, this would include a number of 'resourceful' regional neighbours, such as Kingdom of Saudi Arabia (KSA) and United Arab Emirates (UAE), who carefully explore and examine the current industrial signals and sectoral moves of the classic role-model of the East, i.e. Republic of Korea (Arirang News, 2013a, 2013b; Bloomberg, 2013; Dobbs and Villinger, 2010; Lim, 2013; McKinsey Global Institute, 2013; Oliver and Buseong, 2012; Schuman, 2010).

[59] In the second decade of the 21st Century, and looking ahead, learning in many sectors is increasingly viewed as skills for 'connectivity and interactivity' often enhanced digitally, with an emphasis on the importance of horizontal structures, and moving from 'presumed authority to collective credibility'. This reinforces the need for lifelong learning. For a foresight report, see Davidson and Goldberg (2009).

[60] According to the Oslo Manual, a widely used guideline for innovation studies, product innovation is defined as: "the introduction of a good or service that is new or significantly improved with respect to its characteristics or intended uses. This includes significant improvements in technical specifications, components and materials, incorporated software, user friendliness or other functional characteristics" (OECD and Eurostat, 2005, p. 42). Whilst the conceptualisation within the academic and policy literature remains in a state of flux, especially with reference to innovation in services, product innovations are generally considered different from process innovations that are intended for in-house use.

[61] (Newell et al., 2009; Acha et al., 2005; Scarbrough et al., 2004; Scarbrough, 2008; cf. Sole and Edmondson, 2002; Tyre and Orlikowski, 1996).

[62] For a detailed example, examing instituional structures and systems, see (Davidson and Goldberg, 2009).

[63] Within the high-tech sector, NTBFs regularly operate as the vanguard of product, process and service innovation: the firms are usually formed by highly educated and skilled entrepreneurs, with a high rate of growth and firm mortality significantly contributing to sectoral and national economies.

[64] I will refer to, and return to this and expand on the 'small world' patterns in later sections of this chapter.

[65] Exactly what constitutes innovation is a complex matter, and measuring and comparing innovation is a subject area still under development. Traditional perspectives have viewed innovation as closely related to science and technology. However in current practice, innovation can take many forms, including commercialisation of science and technology as well as the development and implementation of new ideas (for products and services) more generally, as in the form of organisational change or inventing new ways of doing things. Innovation is thus viewed as key not only to economic progress, but also to identifying new solutions to pressing social issues, such as an ageing population or environmental degradation.

[66] Whilst one can trace ideas of a theory of innovation back to the early examinations of a capitalist system and especially the role of science and technology in society (such as Sir Francis Bacon's ideas on a

'science-created utopia' in early 17th century, and opposition to that view by others who believed that priority should be given to utilisation of new discoveries for societal wealth rather than their own creation), early studies here refer to work of Adam Smith (1776), Marx (Marx & Engels 1848) and Marshall (1920): for a recent historical account outlining other protagonists, see Swann (2009). See also below footnote.

[67] Some theorists draw a contrast between the Schumpeterian and Marxian accounts on conceptualisation of innovation. Social science and management theorists within this camp (e.g. Whittington, 2000, p. 74), refer to Marx and Engels (1848/1972, p. 5) when discussing innovation in its broader context of social and economic change, but they do so however within the changing role of labour (and skills). This is not of direct interest to this thesis so whilst I note it, it will not be engaged with it here. Instead, I trace the Schumpeterian account, selectively outlining that work in the historical context of the current literature, so that the reader can trace how the trajectory of the seminal ideas and thoughts have continued or in places, varied, within the mainstream economic and practice-based management literature.

[68] This was partly in response to Karl Marx's ideas. In the first half of the 19th century, Marx advocated the view that technological advancements and with it, improved industrial production, had displaced the 'worker' causing alienation, confusion and potential massive upheaval in the social order. For a comparison, including similarities, between Marx and Schumpeter's views, see Elliott (1985, 1983, 1980).

[69] For a detailed recent review of the neo-Schumpeterian conceptualisation, enriched by multi-level sociological perspectives on the study of innovation, on a range of related topics, see collection of papers entitled *Elgar Companion to Neo-Schumpeterian Economics* in 2007 (Freeman, 2007; Helmstädter, 2007; Augier and Teece, 2007; Perez, 2007; Louçã, 2007; Silverberg, 2007; Lundvall, 2007; Perlman, 2007; Weber, 2007; Nelson, 2007).

[70] For a interesting discussion on ideas of Adam Smith and Joseph Schumpeter, on the level of the 'innovating firm', see Pavitt (1998).

[71] Critical issues on risk and uncertainty had previously been, and continue to be expanded on by other key contributions, such as Frank H. Knight (1921). For a recent discussion, see (Foss and Klein, 2012).

[72] The full English translation of *"Theorie der Wirtschaftlichen Entwicklung: eine Untersuchung über Unternehmergewinn, Kapital, Kredit, Zins und Konjunkturzyklus"* is *"The theory of economic development: an inquiry into profits, capital, credit, interest, and the business cycle"*.

[73] I refer to "partial planning" in the spirit of the capability to respond to threats and opportunities as *scenarios* within the *scenario planning* framework (as opposed to forecasting) as a management technique.

[74] There is a similarity here to Lundvall's idea around intrinsic aspects of learning economy, when and where, to stay with the times, individuals and sectoral communities would need to remember and to forget, certain knowledge and skills (Lundvall, 1996, p. 2).

[75] As other researchers (Cole and Engeström, 1993, p. 1) have highlighted, "It was supposedly Goethe who observed that everything has been thought of before; the task is to think of it again in ways that are appropriate to one's current circumstances." The contextualised content and processes of innovating are in line with that challenge.

[76] Within the empirical element of this study, focused on the often informal and utilitarian (at times, referred to as 'just in time') processes undertaken in firms, it is the description of innovation offered above by Guile, within the context of learning "in, through and for the workplace" (Evans et al., 2006), which acts as a selection and inclusion criteria on both the innovation and learning literature outlined.

[77] For selected examples in and around the last decade, see: (OECD, 2011, 2010b, 2010c, 2005a, 2004, 2003, 2000b, 1999, 1996; OECD and Eurostat, 2005; World Bank, 1998).

[78] Increasingly in recent decade, sourcing (in-/outsourcing) of human expertise on specific projects, has become the norm in pragmatic and perfomative-learning practices for innovation in large and small firms (Ashton et al., 2009; Chang et al., 2003; Howells, 1999; Quinn, 2000; Van de Ven, 2005).

[79] Lundvall (2005, pp.8-9), writing about the macro relationship between interactive learning, social capital and economic development, and based on his reinterpretation of Adam Smith's argument on the development of division of labour as going further than static internal and external economies of scale (Smith 1776, pp.8-9), highlights two different modes of learning for innovation, as STI- (Science, Technology and Innovation) based and DUI- (Doing, Using and Interacting) based.

[80] It is worth recalling that although the original study by March (1991), based on computer simulations and modelling, provides examples of exploration and exploitation, he does not provide an operational definition or clear boundaries that can easily be used for empirical research settings.

[81] (Birkinshaw and Gibson, 2004; Gibson and Birkinshaw, 2004; He and Wong, 2004; Gupta et al., 2006; O'Reilly III and Tushman, 2008; Raisch et al., 2009).

[82] I am mindful that 'social capital' is a notoriously fragmented concept (Fine, 2010, pp. 36–59, cf. 2001)

[83] (for small world networks, cf. Barabási and Frangos, 2002; Burt, 2004; Fleming et al., 2007; Fleming and Waguespack, 2007; Milgram, 1967; for a recent review and critique, cf. Schnettler, 2009; Uzzi, 1997; Uzzi et al., 2007; Uzzi and Spiro, 2005; Watts, 2003, 1999a, 1999b; cf. Watts and Strogatz, 1998).

[84] Katharine Anderson of Carnegie Mellon University (Anderson, 2011), has proposed an interesting perspective of viewing "skill specialization and the formation of collaboration networks" leveraging on network theory within economics. Her current work however, despite being graphically revealing and inspiring, seems at an early stage of development and as it stands, provides a partial and thus highly impoverished view, and definition of skill, in the innovation process.

[85] A *stealth* design and technology is based on the premise of hiding more than it reveals: in the context of organisational studies, the metaphor of an iceberg is often used in conceptualising processes in firms. The challenge with *stealth* is that, firstly, it is initially invisible to 'traditional form of radar' (i.e. by methods reviewing firm's practices) and secondly, once 'uncloaked', there is uncertainty on how to handle it.

[86] As the primary concern of this study is around learning to innovate in SMEs, I have not seen the clear advantage of drawing a strong conceptual line between *organisational learning* and *workplace learning*, although I acknowledge the different historical trajectories and parallel developments.

[87] Others (Guile, 2010b) and I would suggest likewise: that we should beware of accepting Schön's work 'precisely as he left it to us', and as it has been widely interpreted, promoted and 'run-away with'.

[88] Schön (see also 1987; 1987, pp. 3–4) defines technical rationality as an 'epistemology of practice derived from positivist philosophy'. He expands: 'Technical rationality holds that practitioners are instrumental problem solvers. Who select technical means best suited to particular purposes. Rigorous professional practitioners solve well-formed instrumental problems by applying theory and technique derived from systematic preferably scientific knowledge.' Broadly speaking, the technical-rational approach to decision-making was till recently held as normative in professional life in Western and Transitional societies.

[89] In a posthumous book, *Excellence by Design: Transforming Workplace and Work Practice* (1998), in which Schön participated as co-editor, he demonstrated his interest in 'the relationship between the organisation of an organisation and the organisation of the space in which that organisation does its work.'

[90] There may be a parallel here with Young's (2004) argument that conceiving all knowledge as situated or context-specific fails to recognise that there are different types of knowledge, some of which are more context-free than others.

[91] The author of *John Dewey's Pragmatic Technology* (1990), and *Philosophical Tools for Technological Culture: Putting Pragmatism to Work* (2001). Of related interest, Hickman (2001, p.12) defines technology as: "Technology in its most robust sense... involves the invention, development, and cognitive deployment of tools and other artifacts, brought to bear on raw materials... with a view to the resolution of perceived problems… [which, together] allow [society] to continue to function and flourish."

[92] it is worth noting that Schön could well be troubled by the way his work has become single tracked (mainly on *reflective practice*) and 'canonical' in a variety of policy and professional settings, paradoxically somewhat 'unreflectively', losing the 'enactment' elements of practice.

[93] The notion of inquiry that Dewey intended is not easily grasped by providing a definition: notwithstanding, Dewey's "most systematic and detailed presentation is in *Logic: The Theory of Inquiry* (1938a, p. 104), in which he defines inquiry as "the controlled or directed transformation of an indeterminate situation into one that is so determinate in its constituent distinctions and relations as to convert the elements of the original situation into a unified whole"." (cf. Bernstein and McDermott, 2006, pp. 47–48). See also chapter four of Burke (1994, pp. 109–145).

Although by-passing Schön's work, David Stark has also recently drawn significantly on the notion of inquiry in the process of innovation, based on Dewey's original formulation: outlining the relationship (whilst making a separate argument about *intercohesion* in *structural fold*) as follows "the process of innovation is paradoxical, for it involves a curious cognitive function of recognizing what is not yet formulated as a category (Stark 2009). As John Dewey ([1938] 1998) and the pragmatists argued, it is only in the process of attempting to make a transformation in the world that new problems can even be formulated. Generating novel recombinations is itself a kind of production requiring coordination and cooperation across different communities." (Vedres and Stark, 2010, p. 1157)

[94] Tom Burke (1994) in his excellent discussion highlights that Dewey's logic may have been well ahead of its time. Along a same note, Marcio (2001, p. 98) provocatively asserts that in fact "Dewey's theory of inquiry may not be a theory of logic at all, but a theory of scientific method".

[95] There is some similarity here to the processes at work in a 'hermeneutical helix' (Burke, 1994, p. 229; cf. Radnitzky, 1970), as Guile highlights when discussing Dewey's reflective stages , where "characterised… by a double move that goes 'to and from a meaning'. […] inference and implication coil around one another. The process of inference allows us to connect data that we have selected out of the situation under investigation, and that may lead to a new universal meaning emerging, while the processes of implication entails considering this data in relation to other ideas, and both processes support us to identify new concepts and/or facts." (Guile, 2010b, p. 80)

[96] Dubois and Gadde (2002, p.553-554) have referred to this as "the systematic combining approach", drawing on *abduction*, while discussing the difficulties and opportunities that are characteristic of case-study research, and particularly of research that aims to develop a theory based on a single case.

[97] A point of clarification may be in order here: Morgan (2007, p. 72) states that he has "borrowed the idea of transferability of research results from Lincoln and Guba, who treated the question of whether the things learned in one context can be applied in another as an "empirical" issue (1985, p. 297). In other words, we cannot simply assume that our methods and our approach to research makes our results either context-bound or generalizable; instead, we need to investigate the factors that affect whether the knowledge we gain can be transferred to other settings."

[98] My definition of 'skill webs' is as a dynamic *process* (as well as a *structure*), at a micro and meso level of firm's operation: defined as an analytical mean to enable the researchers "to focus on the ways in which companies chose to generate and use skills and knowledge they require" (Ashton et al. 2009, p.329). I have also taken account of the original methodology used in constructing the notion of skill webs, on a macro

level as part of the original research, by examining the original methodological assumptions (Lauder et al., 2012, pp. 48–49).

[99] Guile's work has in the past drawn on the earlier work of Robert Reich (1991) in formulating a couple of the descriptors in his model.

[100] For details, see (Powell et al., 1996).

[101] For details, see (see also Malone, 2004; Malone and Crowston, 1994, p. 90).

[102] By selecting the word *design*, I draw on the underlying 'design parameters' ideas as articulated in work on 'design thinking' and the core role of design in innovation (Beckman and Barry, 2007; Brown, 2008; cf. Buchanan, 1992).

[103] Based on the earlier parts of the research and existing (meta-summary and meta-synthesis of) literature, it was found that firm level processes of *Resource Agility*; *Search and Responsiveness*; and exploring a *Unified Design and Prototyping* are a set of pre-requisites for the success of innovation on projects.

[104] The term vignette is more traditionally used in medical diagnostics and in social work, generated from actual practice. Case scenario questions, are also known as vignettes, which form a common component of clinical interviews and test understanding of many issues and ability to apply them in a way that informs practice and research. Pedagogically, they intend to demonstrate how different people approach the vignette, rather than having as a 'correct answer' for the situation in hand.

[105] On a practical and longitudinal level, researching small firms has its own unique dynamics, as Guile (2002a, p. 32) observes; "Conducting research in SMEs is notoriously tricky… for the following reasons: tight staffing and short deadlines means it is difficult to release people from their work roles; lack of space means that it is difficult to convene meetings; and the lack of a 'learning culture' means that SME owners are often reluctant to give up their time and that of their workforce to participate in a research activity." In attempts to overcome some of these difficulties, the research formulated ways and means around the problem to fit-in with the priorities of the firm and a methodology that reflected some of the firm's and staff's concerns and priorities.

[106] For further details and ratings (in English and Farsi), please consult: http://en.wikipedia.org/wiki/Navad and http://90tv.ir/.

[107] For further details, consult: http://en.wikipedia.org/wiki/Islamic_Republic_of_Iran_Broadcasting .

[108] Adel Ferdosipour, who has been given the nickname of "John Motson [Motty] of Iran" by the *World Soccer Magazine*: For further details (in English and Farsi), please consult http://en.wikipedia.org/wiki/Adel_Ferdosipour :.

[109] 'Creatives' is a professional label for people (and means) who are involved in a range of advertising processes.

[110] The implications of some of this activities, and beneficial rotations and internships, facilitated by the firm's management along with her London and other European partners, has in time become a 'skill drain' paradox for the firm: the 'star protagonists', having gained the transferable skills, become more likely to be 'poached' or tempted away by other leading sectoral firms in Tehran and offered comparable positions abroad. Having had a significant attrition rate of 'star actors', AlphaCo has increasingly attempted to better retain them by various HRM/HRD means and incentives.

[111] This type of processes is also referred to as "probe and learn" in the innovation literature; for a brief, yet up-to-date summary and additional references and tools, see (Tidd and Bessant, 2009, pp. 330–337).

[112] Without wishing to 'read too far' into this statement, this is of significance as the choice and the availability of communication, and by extension, potential brokerage channels is key in the creation and

maintenance of distributed practices for knowledge and skill sourcing, since the overall network sustainability is broadly determined, according to previous research, by two pivotal activities of 'remembering' and 'communicating' (Nardi et al., 2002).

[113] IAP stands for 'in-app purchases' which is those payments made after the download of an application and it has become one of the primary way developers can make money off of their products, as a way of 'monetization' on large platforms such as Google Play and Apple's App Store. Freemium, as described by trendsetters in 2009, "is a business model by which a proprietary product or service is provided free of charge, but money is charged for advanced features, functionality, or virtual goods. The word 'freemium' is a portmanteau neologism combining the two aspects of the business model: 'free' and 'premium'." (Wikipedia, 2014b)

[114] Whilst there is no standard definition or a universally accepted stage model of the relationship between judgement and decisions, we follow recent practice-oriented work (Ranzilla et al., 2011, p. 2), and view judgement to be a critical, and often earlier part and sub-set of the professional decision-making process.

[115] There is, for example, an established tradition and expanding literature on professional judgement, around 'older' professional activities such as in law, civil and structural engineering, medicine (including legal and medical education, psychiatry and associated clinical judgement); public accounting and administration (such as in auditing, and tax and revenues calculations and estimations); and increasingly in social care and social work, education and education psychology. Mainstream management literature has broadly refrained from analysing judgements scenarios, in favour of examining managerial decisions and decision making.

[116] We retain Hargadon's robust and circumscribed definition of framing, taken from Schön and Beach (1997), as follows: "As Schön (1983, p. 40) described, "problem-setting is a process in which, interactively, we name the things to which we will attend and frame the context in which we will attend to them." Framing involves "embedding observed events in a context that gives them meaning" (Beach, 1997, p. 17). The framing of problematic situations provides an interpretation of the problem at hand and identifies a set of solutions normally associated with that problem, and it does so by interpreting the problematic situation through analogies to previously known problems." (Hargadon, 2002, p. 64).

[117] As the third ideal-typical term of skill web, i.e. 'Fragmented Skill Webs' which tended to lead to cul-de-sacs, were not sustainable, nor resulted in performative-learning, they will not be analysed further here.

[118] Examples stated previously included specific cultural patterns such as *Guanxi* in China, *Blat* in Russia, *Sifarish* in Pakistan and *Big Man's (Pseudo-/Tribal-Chief) culture* in Nigeria, to which one can legitimately add *Wasta* in GCC/Arab states; *Wase'teh* or *Partibazi* in Iran, and *Old Boy network* and university alumni/professional clubs in the United Kingdom (and former colonies), and United States, and additionally mobilised through previous school/university (a relationship labelled *Hakyeon*), geographical origin, religious groups and even military service in South Korea – all essentially acting as intermediary connections for gaining influence.

[119] We recall that Dewey had considered the movement from structuring an inquiry to 'construction of judgment' in the second chapter of his 1938 book (Dewey, 1938a). Primary amongst a new breed of writing on Dewey's ideas on practice-based judgement are a few publications in French language, by French pragmatist philosophy commentator, Roberto Frega. For a related chapter in English, see (Frega, 2012).

[120] Drawing on Schön's and others, Hargadon (2002, p. 64) also highlights the role of analgies as bridges in inquiry process by stating: "Schon (1993), and Hargadon and Sutton (1997) have argued that analogies play a critical role in organizational problem solving because they allow problem solving groups to create innovative solutions by linking their inventory of past experiences to the current situations they face."

[121] For examples on Iran, see (Molanezhad, 2010; UNCTAD, 2006; UNIDO, 2003). For examples of the regional states and the similarities in some of the challenges in Persian Gulf states, see (UN ESCWA, 2012).

[122] We recall that Dewey had considered the movement from structuring an inquiry to 'construction of judgment' in the second chapter of his 1938 book (Dewey, 1938a). Primary amongst a new breed of writing on Dewey's ideas on practice-based judgement are a few publications in French language, by French pragmatist philosophy commentator, Roberto Frega. For a related chapter in English, see (Frega, 2012).

[123] These include an in-depth look at various other key authors and historical events, for example, stating: "Kirzner's notion of alertness to undiscovered profit opportunities is a dominant strand of the contemporary entrepreneurship literature, along with Schumpeter's notion of entrepreneurship as innovation and Knight's idea of entrepreneurship as judgment." (Foss and Klein, 2012, p. 43) Their overarching view is that the firm emerges and grows, as the entrepreneurial means of maximising the returns from their judgement.

The authors also revisit and streamline their previous concepts (Foss et al., 2007) on how the entrepreneurs exercise 'original judgment' and other individuals lower in the organisational hierarchy (such as managers and other sub-ordinates), operate under delegated authority of decision-making power by the entrepreneur: this they refer to as 'derived judgment'.

[124] It is worth recalling that Schön had also discussed frames and framing at length in his work, and highlighted that (1983, p.310) "When a practitioner becomes aware of his frames, he also becomes aware of the possibility of alternative ways of framing the reality of his practice. […] Frame awareness tends to entrain awareness of dilemmas."

[125] As stated previously, the exploration and study of informal networks is far behind that of the formal structures, precisely as these are problematic to fully articulate, accurately map and explore. On personal knowledge networks, a recent study exploring the project ecology of advertising sector in Hamburg and software sector in Munich concluded that there is a need to de-homogenise networks, based on the varied purposes they serve (Grabher and Ibert, 2006).

[126] As an early indicator of this fledgling movement and to create a sectoral 'platform', apparent within our study's project domain, see (Iran Mobile App Festival, 2013).

[127] For recent policy and practice examples, see (Bayati and Taghavi, 2007; Ghanatabadi, 2005; cf. for Gulf region, Hertog, 2010; Molanezhad, 2010; Nicholson and Sahay, 2003; UNCTAD, 2005; UNIDO, 2003).

[128] Although in a different policy field, this was concisely captured recently, by a former US official, when he stated: " "Amateurs talk strategy, professionals talk capacity." Jeremy Shapiro, who recently left the State Department to join the Brookings Institution in Washington, has put his finger on a central question for foreign policy." (The Economist, 2013c, p. S8).

[129] Seasoned commentators of policy science (Goodin et al., 2006, pp. 3–4) refer to the promotion of this version of 'technical rationality' as a result of the 'high modernism' belief around, and after the Second World War and the continued funding of centers such as RAND in the United States, when at the time, science and technology studies were entrusted totally to resolve all human societies' complex and changing needs. As the Goodin, Rein and Moran (2006, p. 4) outline: "Traces of that technocratic hubris remain, in consulting houses and IMF missions and certain other important corners of the policy universe. But across most of that world there has, over the last half-century, been a gradual chastening of the boldest "high modernist" hopes for the policy sciences."

[130] State-Owned Enterprises remain a dominant force in many countries with Statist economies, including Iran, Saudi Arabia and United Arab Emirates. For a recent regional assessment, see (OECD, 2013b). Hertog, as a co-author of the above mentioned OECD report has recently (2011) sheds light on the role of State-Owned Enterprises (SOEs) as a new breed of efficient 'lean and mean' powerhouses of State

Capitalism (The Economist, 2012b, 2012c) in the Gulf region. These SOEs could also be seen as a prime candidate for promoting a 'closer fit' between the skills sought, developed and promoted locally, congruent both with the global and local market needs.