# University Knowledge Commercialisation through an Institutional Logics Perspective

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# University Knowledge Commercialisation through an Institutional Logics Perspective:

## The case of Oman

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## Abstract

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Key Words: Knowledge Commercialisation, Institutions, Institutional Logics, Power, Intermediating, Networking

University Knowledge Commercialisation' (UKC) has come to be seen as a stimulant for developing economic performance. Regardless of the increasing body of literature in the UKC, it is revealed to be undertheorized, whilst existing theories are the result of inductive theorizing based on successful KC stories within the western context. Moreover, the literature provides modest practical directions and pay insufficient attention to the role of mechanisms, such as power, mimetic isomorphism, and intermediation, in bridging differences in institutional logics between actors. These gaps inspired the study aim, which is to explore the implication of such mechanisms in bridging differences in logics within UKC institutionally emerging context, Oman.

Through a qualitative, multiple case-study approach, data was collected from four contract research projects through semi-structured interviews. The first three interviews served as a pilot study, the results of which were then used to formulate the second stage which was interviews with participants from academia, industry, and government. This approach improves the internal validity of the research, and provides a rich picture of the Omani UKC emerging institutional environment.

The findings suggest that the influences of power, mimetic isomorphism, and intermediation have significantly shaped bridging, though not always positively,

in logics in the Omani UKC context. The findings show that adverse influences in this process included: asymmetric power relationships, mimetic isomorphism's simplistic view of logics convergence and negligence of institutional fragmentation, and insufficient intermediation activities.

The novelty of introducing the concept of power adds a new theoretical dimension into the UKC and ILP theories. Additionally, the novelty of using case of Oman as an empirical study added new contribution into the field. In addition, this study contributes to a better understanding of the Omani policy actions with regard to shift to an effective UKC approach.

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## Dedications

This thesis is dedicated to my lovely mother, Duhiyah Awlad-Thani, and to my loving memory of my great lovely father, Salim Awlad-Thani, who raised me to love, hope, believe and achieve,

To my husband, Ra'aid Al-Shahumi and my lovely sons, Mohammed, Ammar and Fayisal,

To my family, the Sons and Daughters of Salim Awlad-Thani,

To my people, the future generation of Oman who are paving the path towards a better innovation and UKC Omani context

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## List of Abbreviations

**KC-**Knowledge Commercialisation

**UKC-** University Knowledge Commercialisation

**SI-**Sociological Institutionalism

**ILP-** Institutional Logics Perspective

**M.I-**Mimetic Isomorphism

**U-I-G-** University-Industry-Government

**AC-** Academic Capitalism

**THM-** Triple Helix Model

**SQU-** Sultan Qaboos University

**TRC-** The Research Council

**MoCI-** Ministry of Commerce and Industry

**PEIE-** Public Establishment of Industrial States

**SMEs-** Small Medium Enterprises

**IIC-** Industrial Innovation Centre

**IIAP-** Industrial Innovation Assistant Program

**CIIAP-** Community and an Individual Innovation Assistant Program

**ORG-** Open Research Grant

**KTOs-** Knowledge Transfer Officers

**TTAs-** Technology Transfer Agents

**ROP-** Royal Oman Police

**IAD-** Innovation Affairs Department

**IPRs-** Intellectual Property Rights

**IP**-Intellectual Property

**PI**-Principle Investigator

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# Chapter 1: Introduction

This chapter provides an introduction of the study. First, the chapter discusses the background of the study, highlighting the research issues and the significance of the study. Next, the research background, the research questions of the study, and the unit of analysis are clarified. The chapter then explains the research process including the methodology used in the study. Finally, the chapter discusses the main findings, contributions, and structure of the thesis.

## 1.1 Research background

Knowledge has become the main driver of economic growth since the 1980s. In the last two decades, many countries around the globe have been actively pursuing national and regional innovation strategies aimed at establishing a knowledge-based economy. Special emphasis has been placed on broadening the role of academia to contribute to socio-economic development and entrepreneurship (*knowledge exploitation*), in addition to the traditional roles of teaching (*knowledge dissemination*) and research (*knowledge creation*). In the context of socio-economic development and entrepreneurship, the concept of 'University Knowledge Commercialisation' (UKC) has come to be perceived as a stimulant for developing economic performance and capabilities of regions (Viale and Etzkowitz, 2010; Duch et al., 2011). This can be achieved by transferring research outcomes generated inside universities into economically valued products/technologies (Lundqvist and Williams, 2006). In this respect, countries pursue effective ways to utilise the knowledge generated by their universities. They share the aspiration to exploit their human and funding resources in order to utilise their production of knowledge in a better way (Al Harthy, 2014).

University Knowledge Commercialisation has been defined in numerous ways (see, for example, Lacetera, 2010, Debackere, 2004, Rossi, 2010, Mehrabi et al., 2013, Jahed, 2012, Fakour, 2005, Salter and Martin, 2001, Bardley et al.,

2013, and Perkmann et al., 2013). This study, however, adopts Salter and Martin's (2001) definition of Knowledge Commercialisation as (KC) "a process that converts the produced knowledge in research organisations into suppliable products in the market or industrial processes'' (Salter and Martin, 2001, p.516). Almost the same definition is provided by Mitchell and Singh (1996), who defined Commercialisation as ''the process of acquiring ideas and complementary knowledge, and developing and manufacturing saleable goods'' (Mitchell and Singh, 1996, p. 170). Taking these two definitions as a basis, KC can be considered as an intentional, goal-oriented process that typically occurs between two organisations: the source or knowledge producer (i.e. universities), and the recipient or knowledge user (i.e. firms). Thus, these two definitions are relevant to this study, because they consider UKC as an activity that brings actors (i.e. researchers, end-users) together and denotes a collaborative and engaged process between actors. Its emphasis is placed at the micro, operational level, i.e. where interactions between actors take place. Hence, KC is the activity which encompasses the institutions (rules and norms) governing interaction. This could bring significant input to our understanding of the actual processes of knowledge production and appropriation.

UKC can take on various mechanisms such as spin-offs, the collaborative research between firms and universities, consultancy, contract research commissioned by either industry or government, IPRs- Intellectual Property Rights development (i.e. patenting), and licensing of inventions by universities (Debackere, 2004; Rossi, 2010**;** Perkmann et al., 2013**).** This study focuses on contract research projects as a mechanism of interaction. Many scholars (e.g. D'este and Perkmann, 2011, Bjerregaard, 2010, Rasiah and Govindarajy, 2009, D'Este and Patel, 2007, Fontana et al., 2006, and Ham and Mowery, 1998) emphasize empirically the importance of such mechanism in informing mutually beneficial collaborations between university and industry. D'Este and Perkmann (2011), for instance, found that industry and academics engage more actively in the process of generating knowledge in contract research than in other mechanisms. They found that the motive behind academics' engagement is

strongly positive as industry aims at both furthering academics' own research and commercialising the outcomes of their research. Their research motives are strongly informed through using the mechanism of contract research.

The development of University Knowledge Commercialisation is constrained by different logics between participants in the interaction or transactions of transfers (Bjerregaard, 2010; Siegel et al., 2003; Gassol, 2007)**.** Within the UKC context, three different institutional logics are present: the logic of the university, the logic of firms, and the logic of the government (i.e. public funding agencies). In other words, there are different logics at the university than in industry and government (Lind et al., 2013). The logics within firms and universities, for instance, tend to give rise to differences in goals, interests, and time horizons informing R&D behaviour (Bjerregaards, 2010). This, in turn, might act as an obstacle because institutional logics between actors are likely to cause differences in interests and goals generating different institutional assumptions for knowledge production and appropriation.

Differences in logics might be overcome through mechanisms such as power, mimetic isomorphism, intermediating, and networking. Such mechanisms might act as potential solutions for bridging differences between the three spheres. Bridging logics differences between university and firms, for instance, often requires an intermediating mechanism to assist partners in discovering commonalty in needs and interests (Håkanson et al., 2011) as well as in improving and correcting individuals' ways of understanding how to approach the entire UKC process and provide guidelines appropriately (Villani et al., 2017). Relatively large empirical research on UKC has addressed how those potential mechanisms (i.e. power, mimetic isomorphism, intermediating, and networking) emerged and how they exert influence on bridging differences in institutional logics. This study takes the same approach and addresses the on-going debate pertaining to how such mechanisms enable/constrain the bridging of differences in logics, particularly, at the micro-level of contract research.

Oman is an interesting context to study this because of the additional complication of institutional development and transfer. This can be justified with two main reasons. First, Oman is a wealthy country as it has an oil-based economy. However, oil wealth is a constraint that works against knowledge commercialisation. The fact is that the petro-chemical industry and its oil revenues dominate the economy in a way that they create discouragements towards KC because the economy grows mainly to service this sector (STIP, 2014; AL Harthy, 2014). The Omani economy is dominated by the oil and gas industry, with few large companies supervising and managing this industry (STIP, 2014). The socio-economic development in Oman is heavily dependent on oil and gas revenues, as those few companies are still only focusing on finding solutions for exploring and extracting crude oil and gas (UNCTAD, 2013). Therefore, University Knowledge Commercialisation is yet to take place in Oman as the sustainability of industry relies on oil and gas availability rather than on fostering knowledge and commercialisation capabilities (Al Harthy, 2014). Second, the institutional environment of knowledge commercialisation in Oman is still emerging. Although knowledge commercialisation has been acknowledged recently as one of the TRC's proposed policies under the knowledge transfer goal (TRC, 2014), the policy for implementation and practical activities towards commercialisation remains unclear. For instance, the policies on whether or not to directly support the commercialisation efforts of Small Medium Enterprises SMEs is not yet clear (STIP, 2014). Moreover, Omani universities still lack clear knowledge commercialisation programs (STIP, 2014; AL Harthy, 2014) as the necessary institutions have only recently been established. SQU (the only public university), for instance, established the innovation affairs department in 2010, and since then the efforts are still on-going to resource and strategize the department.

Therefore, a need to re-strengthen the innovation system in Oman has been acknowledged as a 'high national priority' at all levels. His Majesty the Sultan of Oman has urged related stakeholders and policymakers to design and re-evaluate all innovation programs and policies in order to close the gap between

the innovation system outcomes and the relevant actors, such as industry and universities. All three actors (university, industry, and government) are urged to play a vital role in the socio-economic development through knowledge production and commercialisation. To my knowledge, no single study has yet investigated this phenomenon in Oman. Therefore, this research also intends to provide an important lesson for Oman in order to foster its knowledge commercialisation approach through bridging differences in logics.

### 1.2 Research Gaps and Questions

The review of literature in this study captured theories and research streams relevant to UKC, in which the role of actors and institutions were interpreted and conflicts between logics were identified. Although, there has been a volume of published research on this area and researchers have indeed examined the impact of such conflicts, critical gaps were observed (as will be discussed in more detail in the following Chapter). First, although Triple Helix Model (THM) scholars emphasize the co-existence of diverse institutional logics in the context of knowledge commercialisation, they rarely address the implications of conflicting logics methodologically (Tuunainen, 2002; Lu, 2007) at micro-level interactions (Viale and Pozzali, 2010; Fogelberg and Thorpenberg, 2012). In particular, the underlying assumptions of the necessity of pre-existing cooperative relations and the common interests among the three institutional spheres. Actors from different institutional spheres have their own institutional logics guiding principles, assumptions, and symbolic construction, which they draw upon to guide their actions and form their own identities (Friedland and Alford, 1991; Thornton and Ocasio, 2008). Thus, despite the role of government being considered significant in forging university-industry linkages (Sohn et al., 2009), institutional conflict may exist between the university, industry, and the government resulting in incongruity of goals and interests. However, the empirical evidence underpins that university knowledge commercialisation involves studies focusing either on universities (primarily) or on enterprises, seldom both (Ankrah et al., 2013), and hardly ever exploring the implications of

the existence of multiple actors, often possessing different goals and interests. This may obscure the implications and the potential for conflict of different logics between multiple actors and the effectiveness of University Knowledge Commercialisation. These two gaps demonstrate that THM and studies in UKC provide modest practical directions on how to bridge differences and nurture cooperation between actors. They don't pay sufficient attention to the role of different mechanisms that surround and exert a direct or indirect effect/influence on knowledge commercialisation. Therefore, this study focuses on exploring the implications of mechanisms as potential solutions for bridging differences in institutional logics within the micro-level interaction of knowledge commercialisation.

Second, the THM's simple and modest view of institutional and normative convergence between academia, industry, and government portrays it as the only institutional order surrounding all three spheres. This is similar to the Mimetic Isomorphism (M.I) concept through which the concept of TH and its related activities have come to be the templates for action, which generates unified or monolithic responses to uncertainty that might lead to isomorphism, and a commonality in function and form (DiMaggio and Powell, 1983). This overlooks the embeddedness of actors within different, conflicting logics (Thornton et al., 2012). Although there exists, within the institutionalism literature, some research exploring the space between institutional logics (e.g. Furnari, 2014, 2016), very few empirical studies have attempted to study the effect of M.I on UKC. Thus, considering mimetic isomorphism as a potential mechanism in bridging differences in institutional logics promises fresh insights.

Third, the implications of conflicting logics can be bridged by the mechanism of power. Power is shaped by the opportunities provided for actors to challenge conflicting logics (Thornton et al., 2012). When institutions (i.e. rules) of a project are established through processes of appropriating one logic over another, actors supporting the appropriated logic become more powerful. Actors who are in power often preserve their own logic as they have more

control over decision-making compared to those without power. Thus, achieving synergistic cooperation is difficult as it requires bridging between different logics. However, THM ignores incentives and power relations among actors (Hira, 2013). More importantly, there are very limited studies on UKC pertaining to how power bridges differences in institutional logics. This calls for exploring the effect of power as a potential mechanism in bridging differences in logics.

Fourth, undoubtedly, the conflicts associated with logics' differences call for intermediation (Yusuf, 2008; Swan et al., 2010; Lundberg, 2013). However, both perspectives (i.e. THM and ILP-Institutional Logics Perspective) provide modest practical directions on how to bridge differences through intermediation mechanisms (i.e. intermediary and networking). THM, for instance, doesn't pay sufficient attention to the role of intermediaries (Howells, 2006; Pollard, 2006), though the significance of bridging logics has been recognized (Suvinen et al., 2010). ILP, however, gives relatively little explanation about the ways through which to manage such conflict at the micro-level (Greenwood et al., 2011). Although the interest in exploring this area is growing (e.g. Reay and Hinings, 2009, Suddaby and Leca, 2009, and Lawrence and Suddaby, 2006), no attention is given to bringing about intermediation in specific situations within micro-level interactions. This is in part because the ILP has not, to date, provided the conceptul tools to help assertain how conflicts logics are resolved at this level (Cloutier and Langley, 2013). Hence, there is a need to explore the effects of intermediation as potential mechanisms in bridging differences in institutional logics.

Finally, the development of THM is a result of inductive theorizing based on successful knowledge commercialisation stories within the western context. Although many followers have empirically examined THM in different national contexts (e.g. da Silva et al., 2012, Saad et al., 2008, Saad and Zawdie, 2011a, and Zhou and Peng, 2008), these studies have attempted to employ the model in their studies on countries despite institutional differences (Pugh, 2014; Cai,

2015). From this, an investigation into the implications of potential mechanisms (i.e. power, mimetic isomorphism, intermediation and networking) that can be used in bridging differences in institutional logics within University Knowledge Commercialisation and in the Omani (institutionally emerging) context promises fresh insights.

In light of the outcomes of the literature review, this study conceived and formulated research questions, which can potentially lead to filling the critical gaps identified above. Therefore, the study's research questions are:

**The main research question is:**

What are the implications of power, mimetic isomorphism, and intermediation in bridging the differences in institutional logics involved in University Knowledge Commercialisation?

**The sub-research questions are:**

1. What is the effect of power in bridging differences in institutional logics?
2. What is the effect of mimetic isomorphism (i.e. transferring institutions from the West) in bridging differences in institutional logics?
3. What is the effect of intermediation (intermediating and networking) in bridging differences in institutional logics?

### 1.3 Research Methodology and Unit of Analysis

Critical realism was selected and justified as being the appropriate paradigm for this study. It shows how the underlying assumptions influence the study's main focus on agency (i.e. actors' experiences and institutions) and structure (i.e. different institutional logics). First, its ontological realism - what the world must be like to bridge differences in institutional logics - helped in establishing a better understanding as it explained the actual process of KC by considering the perspectives and institutions of actors who are involved in the same context and their decisions or actions determined by different, potentially conflicting logics. Second, in critical realism, logics and institutions are considered to be

interdependent, but empirically they are examined separately. As institutions are the rules of the game, institutional logics are the underlying, fundamental principles of the game (Leca and Naccache, 2006). Hence, institutional logics cannot be reduced to institutions. This separation brought greater explanatory power to the study. For more details, see section 3.2 of Chapter-3.

A qualitative research approach was adopted as the most suitable research design (see section 3.3 of Chapter-3). First, it helped in obtaining rich and diverse accounts of KC actions in Oman, which would have otherwise remained obscure. The institutional and governance of UKC has emerged recently in Oman. Consequently, relationships are impacted by the underdeveloped institutional frameworks of interacting actors. Second, the qualitative approach supports the legitimacy of the main goals of the philosophical perspective of critical realism adopted in this study (Robson, 2011). These goals include: the understanding of actors through using a process-oriented, instead of a variable-oriented, approach of explanation (Maxwell, 2004); the explanation of single situations and events by using an inductive flexible design through applying case study strategies rather than basing explanations on regularities or universal theories (Savin-Baden and Major, 2013). Third, the qualitative approach has been explained as being effective in examining institutions and logics. A qualitative approach helped in generating intense and instructive data regarding peoples' decision-making and actions (Museus and Harper, 2007). Finally**,** the selection of a qualitative methodology is justified more by its effective application in this research piloted study (for more details see sub-section 1.3.1 below).

The research was based upon an exploratory qualitative study examining four cases of publicly funded research projects involving public university researchers and SMEs, which were sponsored by a new governmental research and innovation program under the TRC in Oman. The context of the research was therefore a triple-helix environment and was investigated at the micro-level interaction of the actors partaking in collaborative research and development.

The unit of analysis in this study is the research project. This corresponds with the definition of IL, adopted in this study, which conceives logics as causal powers for shaping and influencing actors' actions and decisions within the micro-level interaction (i.e. the investigated contracted research projects). Moreover, it allows for, within the context of institutional logics (IL), the exploration of socially constructed, historical patterns of norms and rules ''by which individuals produce and reproduce their material subsistence, organize time and space, and provide meaning to their social reality" (Thornton and Ocasio, 1999, p.804).

### 1.4 The research process

This study was carried out through two phases comprising of (1) the pilot phase, and (2) the main study. Due to the shortage of empirical research that looks at University Knowledge Commercialisation (UKC) in the Omani context, the field trip was especially helpful for developing an understanding of the local dynamics and contexts of knowledge commercialisation in Oman. The field trip was also instrumental in the refining of the research questions. In the second phase, the researcher executed the investigation on the ground having obtained a clear understanding of the Omani context and refined the research questions. This second phase, which is the main study, entailed the use of the process approach to implement a case study design (Yin, 2003b) that involved four publically funded research projects.

**Phase 1 – Pilot phase** (September 2013)

The field trip was conducted in Muscat, Oman with the following set of objectives: (1) To test the research design before commencing the actual empirical phase of the study, and (2) to generate a preliminary understanding of the processes of knowledge commercialisation particularly in the Omani setting. Data was collected through three open-ended interviews, which involved one university officer, one user-funding manager, and one TRC officer. All the

interviews were recorded and subsequently transcribed. Additionally, secondary data from reports, policy documents, and other publications were collected to gain more insight into KC processes. These involved national policy reports, Oman Vision 2020, research projects records, statistical and institutional review reports, the university's annual research reports, and the projects' master plans.

The pilot study provided several key lessons for the researcher. First, it enabled the researcher to further develop and refine the interview protocol that was used for the main empirical phase of the study. The pilot also allowed the researcher to gain awareness and understanding of how respondents may perceive the research. This brought to light potential barriers that may be encountered in the process of gathering data, as well as how these barriers might be resolved. Thus, the pilot study yielded the first empirical observations that complimented the researcher's understanding of knowledge commercialisation and the institutional literature. Moreover, the pilot study led to the identification of 4 empirical contexts that were deemed suitable for exploring the research questions. These are: (a) SQU which has, as per its close geographical proximity to industrial incubation zones such as the Rusayl Industrial Area and Industrial Innovation Centre (IIC), a history of collaboration with industry at the publically funded research level with local SMEs; (b) TRC as funder and policymaker has launched many knowledge innovation program initiatives at the university and national levels as a way to encourage research collaborations; (c) Manufacturing SMEs within the AL Rusayl Industrial Area which had research collaborations with SQU through TRC, and (d) IIC which was etstablished to encourage R&D collaborations between academia and SMEs. A detailed examination of these four contexts led the researcher to conclude that these actors were the most appropriate for examining the process of University Knowledge Commercialisation within an emerging knowledge-economy.

Furthermore, due to this field trip, the researcher was able to understand that the research can best be explored through a qualitative methodology using the

case study approach. All the empirical contexts that were selected exist under a natural setting in which the researcher has no control (Denscombe, 2007). Another justification for the selection of a qualitative methodology stemmed from the fact that the researcher had been in the field and had carried out the interviews successfully.

**Phase 2 - The main study**

The main study was conducted in Oman through the period from April 2014 – September 2014. This phase of the study was guided by the above mentioned research questions. Four publically funded research projects involving perspectives of multiple actors (academia, industry, and government) were selected for this case study research. The researcher used a set of proxy criteria to select projects that fit with the overall research design as well as research questions. In total, 32 interviews were conducted in this multiple case research. Each case in the study was designed to include academics, enterprise, and personnel from university and government who can provide important insights into the institutional settings and governance structures of the selected projects. Finally, secondary data from brochures, websites, organisations' documents, and newspapers was also collected and used to complement the primary data. These involved the University's strategies, national research and innovation strategies, industry regulations and frameworks, Oman Vision 2020, the national five- year plans, TRC annual reports, and His Majesty's speeches.

The data obtained from this empirical phase of the study was processed and analysed in four steps. The first step involved transcribing, where all 32 oral interviews were converted into written texts. In the second step, the researcher adopted the principles of coding which involved breaking down the data into separate units of meanings (Miles and Huberman, 1994). This was followed by the within-case analysis where the researcher focused on individual cases and allowed patterns to emerge (Eisenhardt, 1989). In the fourth and final step, which is cross-case analysis, the themes that emerged from the within-case

analysis were rigorously compared and contrasted to arrive at the main findings of the study.

Several measures were taken to protect the validity and creditability of the data. First, construct validity was considered in order to guard against the chances of subjective elements driving the data. This was done through (1) explicitly defining all the mechanisms and procedures that were used from data collection through to analysis in the methodology chapter of this thesis. Thus, another study can be conducted using the same procedures and similar case settings to obtain the same results (Ellis, 1995). (2) establishing a carefully constructed interview protocol that ensured a high degree of consistency in interview procedure, questions, contents, as well ethics (3) the study applied credible conceptual constructs and theoretical assumptions in the fields of University Knowledge Commercilisation and Sociological Institutionalism (SI) to inform the research design and guide the data collection. This led to the use of the highly credible theory of institutional logic perspective as the major theoretical lens through which the mechanisms of knowledge commercialisation were examined.

### 1.5 Research main findings

The findings show that bridging differences in logics is hindered by asymmetric power relationships. Power asymmetry, associated with structuring interaction around appropriating one logic over another, perpetuated the pre-existing conflicting logics. When the rules of projects are established through processes of appropriating one logic over another, actors supporting the appropriated logic become more powerful. The logic that is supported by powerful actors contributes to preserve the status quo as they provide the rules and norms of actions that guide actors in decision-making. Hence, powerful actors have more control over decision-making and their logics come to be reflected as dominant.

The findings also reveal two dimensions around mimetic isomorphism (M.I). The first dimension is that M.I gave a simplistic view of the institutional

environment. The institutionalisation of western programs means that academics and commercial users have shared, certain concepts regarding knowledge commercialisation. Hence, it presumed logics convergence and overlooked the embeddedness of actors within different, often conflicting, logics. The second dimension is that mimetic isomorphism, more relevantly, the action of transferring cutting-edge programs from the West overlooked institutional fragmentation within the Omani context. Fragmentation is rooted in the internal characteristics of bureaucracy. Despite their involvement in the governing boards, actors (i.e. government, university, and non-commercial users) still recognize bureaucracy as natural practice. Their mind-sets are much preoccupied by the deep-rooted concepts of rigid models of interaction, which has led to fragmented actions. These two dimensions hindered the bridging of differences in logics, consequently constraining the production of research outcomes that have the potential for commercialisation.

Further insights garnered from those findings established that for logics of various actors to be bridged, an intermediating network must be shrewdly designed**.** However, findings show that the role of government as an intermediary provided insufficient activities to bridge differences in logics. Minimal progress in interactions between actors was established only when the research was conducted. When the commercialisation action took place, conflicting logics regarding knowledge appropriation emerged. Countervailing arrangements that bridge different logics are absent. Rather, as aforementioned, the competition between logics led to one side winning over the other.

Finally, the findings show how the emerged informal networks assisted in bridging differences of logics. The engagement in co-production activities made the academics' and commercial users' previously existing logics less salient. However, this happened only when the research was conducted. The findings also reveal the inability of formal networks to bridge differences in logics during both the research performance and commercialisation action. This is, as

aforementioned, due to power asymmetry. Power is granted to an individual actor, who is inclined to preserve his/her pre-existing logics against others' logics.

### 1.6 Research contributions

The primary purpose of this study is to develop the research into University Knowledge Commercialisation by addressing critical knowledge gaps. Hence, the results of this study have provided theoretical and empirical contributions. The overall thesis can be said to provide three main contributions. The first contribution is the novelty of introducing the concept of power within the Institutional Logics Perspective (ILP). The concept was introduced through the adoption of arguments from two general institutional scholars (i.e. Schmidt, 1987 and Samuels, 1971), which followed a novel approach in linking institutions with power. Such introduction helped in analysing the effect of power in bridging differences in logics. The study's results showed that as power was asymmetric (i.e. socially granted as rules were established around one appropriating logic over another), powerful actors had more control over decision-making, hence their logics were preserved and came to be reflected as dominant. The second contribution is the induction of the intermediation concept within Academic Capitalism (AC), THM, and ILP theories, which provided practical directions on how to bridge differences and nurture cooperation through intermediary and networking mechanisms. The sufficient attention given to such mechanisms had generated more insights into how the role of IIC (as an intermediary) and informal networking opened possibilities for bridging academics' logics and commercial logics. IIC intermediation, through matchmaking and mediation, increased the chances of academics and users in finding a research partner, assisted partners in recognizing the benefits of cooperation, and managed disputes regarding IP rights. Moreover, the informal networking intermediation through the activity of resource sharing opened possibilities for bridging academics' logics and commercial logics around complementary knowledge (i.e. engaging in co-production for the purpose of

ensuring knowledge proximity or similarities in what they produced and how they produced it). The third contribution is that the thesis successfully implemented the effect of mechanisms (i.e. power, mimetic isomorphism, and intermediation) in bridging differences in logics in a country where UKC institutions are emerging rather than already established. The use of Oman as an empirical reference is seen as a novel and two practical contributions were identified. The Omani experience has contributed to understanding the effect of non-commercial users' logics in determining UKC. As demonstrated, the Omani context provided the non-commercial users (i.e. governmental bodies and other public organisations) with the opportunity to exercise power over academics and commercial users (i.e. SMEs). The funding rule of waiving ownership to Royal Oman Police (ROP) and Ministry gave them the power to restrain the procurement and application of the knowledge generated. Being powerful actors, they were determined to preserve their logic of budget management for the sake of controlling the good use of public funds. They were risk-averse. The Omani experience also contributed to a better understanding of the role of government as an intermediary. Empirical evidence was provided for the expansion of the Industrial Innovation Centre's (IIC) role from the traditional practices of: provision of funding (Argyris and Liebeskind, 1998) and creation of policy context for the establishment of relationships between parties (Guerzoni et al., 2014; Lawton Smith, 2007) towards supporting the processes of UKC cooperatively with academics and commercial users (Leydesdorff, 2009). Its activities of searching and matching partners across industry and university boundaries assisted in reducing search and bargaining costs (Kodama, 2008) as well as in bridging differences in logics (Villani et al, 2017).

### 1.7 Structure of the thesis

This thesis is comprised of six chapters. An overview of the study is provided in the current chapter (Chapter 1) providing the background and outlining the broad field discussed in the study. It sets out the main concepts of the research problem and highlights the significance of the study, the study's research

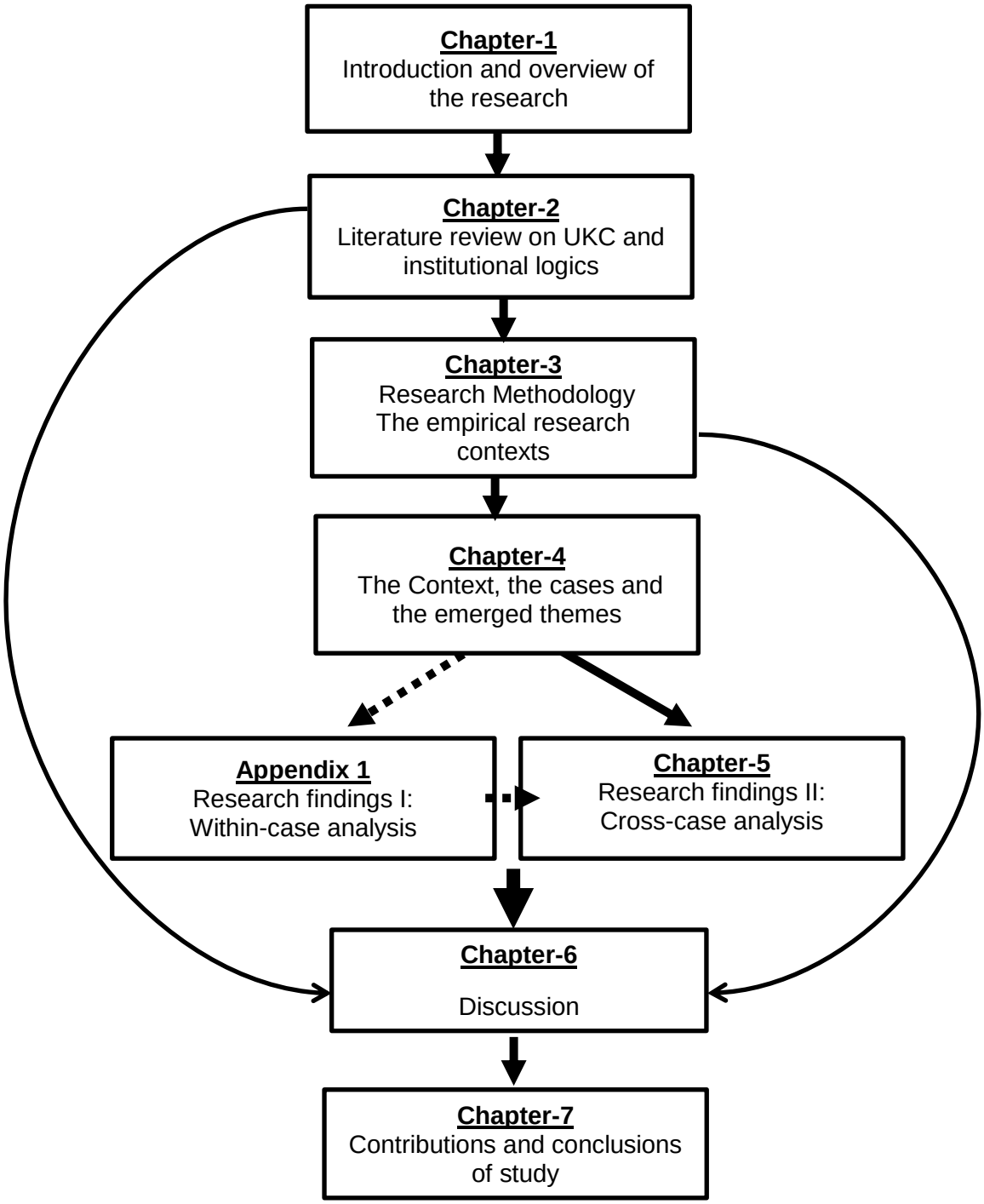
questions, the research process, the findings as, well as contributions to knowledge. Chapter two presents a critical review of academic literature pertaining to Sociological Institutionalism (SI) and its relevance for the study and understanding of UKC (Chapter 2). The review also presents, in detail, the Institutional Logics Perspective (ILP) as the proposed conceptual framework to underpin the study. It highlights and explains the main elements supporting the need to understand the effect of differences in logics on KC from theoretical and conceptual perspective. Moreover, the review captures theories and research streams relevant to UKC, which led to the identification of critical knowledge gaps and consequently, the formulation of the research questions. Building on the research questions discussed previously, the next chapter provides an explanation of the research methodology adopted for this study (Chapter 3), illustrating the research paradigm and the multiple case study research design. It discusses related issues concerning data gathering and collection and sample choices. This chapter also incorporates an explanation of the empirical research context that underpins the analysis of this work. The chapter is followed by within-case analysis, which depicts the findings of the study at the level of individual cases (given the size of the thesis, it was decided to include the findings of the within-case analysis in appendix 1 of the thesis). The next chapter is the study's context, cases and the emergent themes (Chapter 4). It explains the institutional contexts of the key actors of UKC in which the Omani innovation system functions. It also provides a summary of each individual case that detailed in Appendix-1. Additionally, it presents tables of themes explaining how the study's themes were driven and emerged from the data within the individual cases. Following this chapter is the cross-case analysis, drawing on both Chapter 4 and Appendix 1, which presents the within-case analysis, where the findings of individual cases are compared and contrasted to generate patterns of outcomes which then led to higher summative results (Chapter 5). The chapter clarifies the links between analysis and research questions by providing a critical discussion of the implication of the emergent, potential mechanisms during the comparison of commonalities and differences in actors'

logics on the events and activities within UKC processes. Following this chapter is the discussion, where results of the cross-case are further interpreted and linked to theories and constructs from the literature review with the aims of addressing the research questions posed leading to higher summative findings (Chapter 6). The final chapter provides syntheses, conclusions, and implications of the thesis' ultimate findings, in addition to empirical and theoretical contributions and managerial and policy implications for Oman proposed by the research (Chapter 7). The chapter also acknowledges the study's limitations of applicability and suggests further research directions/possibilities. Figure 1.7, next page, presents an outline of the thesis chapters.

## 1.8 Chapter conclusion

This chapter has provided an overview of the entire thesis. The discussion of the research background highlighted the significance of the research and showed why it is important to investigate the potential mechanisms in bridging differences in the institutional logics of University Knowledge Commercialisation in an emerging institutional environment. Specific knowledge gaps in the literature were illustrated to justify the research focus and questions. This chapter has also outlined the research methodology and the unit of analysis as well as providing a summary of the research process. Moreover, the main findings and contributions of the research were highlighted.

**Figure 1.7: Thesis outline and structure**



# Chapter 2: Literature Review

Chapter one provided the research background and explained the significance of the study. This chapter reviews the literature related to the main concepts and constructs that underpin the study. These are Sociological Institutionalism, the Institutional Logics Perspective, theoretical perspectives of University Knowledge Commercialisation, Intermediating, and networking, respectively.

## 2.0 Introduction

This chapter presents the relevant literature on university knowledge commercilisation through the lens of the instituional logics perspective. A review of the literature is important for understanding the research topic (Hair, 2003, 2015, Baker, 2016) as well as identifying unexplored issues (Perry, 1998). Consequently, this literature review serves two purposes; first, to learn about the subject, and second, to facilitate the thesis' argument (Booth et al., 2016).

The chapter is organized into five main sections. The first section delves into sociological institutionalism and carries out a brief review of its analysis of understanding how the actions of multiple actors are shaped and influenced by institutions. The second section conducts a systematic review of the Institutional Logic Perspective (ILP) and looks at all its ramifications. It examines, in detail, the intellectual root that guides the conceptual development of the ILP, consequently, allowing clear justification for its selection as a conceptual framework underpinning this study. The third section, attempts to gain an overall appreciation of the fundamental concepts and constructs that underpin this research study. As such, the section undertakes an examination of two theoretical perspectives used in these fields of enquiry through the lens of ILP. This allows for a nuanced approach to examining the role of actors, institutions, mechanisms, and conflicting logics. The fourth section looks at the mechanism of intermediaries. It explains how the role of intermediaries enables bridging different logics at the micro-level of interaction. The last and final

section delves into the importance of informal and formal networking in facilitating knowledge commercialisation.

Through the process of conducting this literature review, important knowledge gaps were identified which merit urgent attention. These identified knowledge gaps were instrumental in the development of arguments in this thesis and, fundamentally, they informed the formulation of the research questions that will be laid out at the end of this chapter.

## 2.1 Sociological Institutionalism

Sociological institutionalism (SI) has its roots in sociology and organisational theory. It emerged in the 1970s mainly within the sub-field of organisational theory and in parallel with the advancement of the concept of institutionalism across social sciences (Hall and Taylor, 1996). It has emerged as a response to behaviourism, in which sociologists focus on explaining behaviour in an objective and quantified way. Rather than focusing on ‘’the sum of individual interests’’, SI begins with the society and the perception that ‘’institutions are collective outcomes’’ (Thelen, 1999, p. 386). Hence, institutions provide frameworks for actions (Brinton and Nee, 1998). In this respect, sociological institutionalists focus on both the micro and macro-level of interactions, arguing that actors and institutions are co-constitutively related (DiMaggio and Powell 1991). Therefore, they draw attention to understanding the relationship between institutions and individual action (Hall and Taylor, 1996, Lowndes, 2010), and they presume and focus on the consequences of institutions for individual actions. The earlier sociological analysis solved the issue of identifying the relation between institutions and actions through connecting ‘’institutions with roles to which prescriptive norms of behaviour were attached” (Mackay et al., 2010). Through this view, “individuals who have been socialised into particular institutional roles internalise the norms associated with these roles, and in this way institutions are said to affect behaviour’’ (Hall and Taylor, 1996, p. 950). Thus, sociological institutionalists are interested in highlighting both the high-interactive and mutual-constitutive nature of the relationship

between institutions and individual actions. Individuals constitute themselves as social actors when they act as a social convention. They engage in socially constructed acts and support the convention that they are adhering to and following. However, this doesn't imply that individuals are not rational or purposive. Sociologists argue that individuals perceive actions as rational when these actions are socially constituted. Institutional actors are perceived to be basically social and act in habitual and customary ways, guided by the ''logic of appropriateness that both prescribes and proscribes certain types of behaviour'' (Mackay et al., 2010, p. 575). In support of this statement, Steimno (2008) found that individuals are not self-interested, but rather follow a ''logic of appropriateness'' (p. 163). Thus, institutions within SI influence the way individuals view the world and the way they act within it. Sociologists often conceptualise and analyse the goals and interests that actors are working to achieve. They conceptualise a world of institutional actors striving towards defining and articulating their identity in more socially appropriate means or ways (Hall and Taylor, 1996).

Moreover, unlike the earlier SI of Parsons (1995), the new SI explains institutions instead of assuming their existence. Rather than highlighting the structural aspects and constraining institutions, SI emphasizes the social characteristics of institutions, in particular, the way institutions interact and the way they influence society. Institutions are viewed outside the conventional perspective of economics through describing both how and why institutions emerge in a particular way within a given context. This is because the SI perspective is grounded in the view that institutions are socially constructed. Institutions are seen as reflecting a shared understanding of world reality (Scott, 1995) and ''the way the world works'' (Thelen, 1999, p. 386). Sociologists draw inspiration from the notion of phenomenological and cultural traditions (Goffman, 1974) around the socially constructed nature of reality, which emphasize the extent to which the social actors' behaviour reflects and reproduces the enactment of socially appropriated frames within a context. Thus, sociologists emphasize the impact of the social context that shapes and 'constitutes' social

actors, describing their identities and goals (DiMaggio and Powell 1983, Meyer and Rowan, 1977). They imply that social actors are deeply shaped by their environment, which guides their actions as well as providing them with interests, identities, and actorhood.

Drawing on the above, this study is also concerned with how and why institutions matter within the context of knowledge commercialisation. In particular, it is about how the actions of multiple actors are shaped and influenced by institutions. This question defines the key concern of sociological institutionalism in analysis.

There are dimensions to the relationship between institutions and actions, within this study, that can be elucidated by sociological institutionalism. As it studies institutions and individual actions as part of social structure, SI gives emphasis to the context within which actors are embedded. Hence, it implies the code of appropriate actions that imbue actors within a context. Actors act according to their view of what is an acceptable code of action and resist changes that challenge their understanding of appropriate actions. SI, hence, frames institutions as consequences of actors' belief systems, since actors are considered as members of specific professions or groups. Its underlying assumption is that actors are conservative when it comes to change and are more inclined to defend their own interests. Additionally, as SI explains that actors might choose specific actions, a new aspect can be identified, highlighting that the institutional environment might affect the actions taken by actors. Given this, there is potential that sociological institutionalists can describe aspects of institutional impact that might be crucial backgrounds to instrumental or powerful actions (Hall and Taylor, 1996).

As institutions matter, the following section discusses how this study conceptualises institutions.

### 2.1.2 The concept of 'institutions'

Institutions are ''the rules of the game and consist of written and unwritten codes with enforcement mechanisms'' (Friel, 2017, p. 213). In this respect, institutions are ''rules, either formal or informal, backed by surveillance and sanctioning

power" (Scott, 2008, p. 54). More precisely, it involves the setting of rules and policies in order to monitor and assert authority over the conduct of activities to influence the behaviour of people. Institutions are also defined as norms ''that structure choices, emphasizing how things should be done and defining legitimate means to accomplish them'' (Friel, 2017, p. 213). These can, basically, be referred to as the concept of 'culture' as they shape, on the one hand, what becomes an objective, and on the other hand, the appropriate way to achieve such objective (Scott, 2008). Therefore, university knowledge commercialisation is affected directly by the rules and norms governing the actions of actors. These rules and norms are social facts, which actors take into consideration when deciding appropriate actions (Zucker, 1977; Meyer and Rowan, 1983).

Nevertheless, there is a lack of consensus on content and boundaries of institutions. There is no consensus on the definition of institutions, which has generated difficulty in empirical studies (Hollingsworth, 2000). Conflicting assumptions over what constitutes the term 'institutions' have limited scholarly discourses (Scott, 2001), as the term means different things to different scholars (Peter, 2000). Hall and Taylor (1996) wrote that the varying conceptions have resulted in contradictions in how institutions are understood. Clarifications as to what constitutes these rules and norms are often ambiguous. Hence, some scholars (e.g. Schmidt, 1987, Aoki, 2001) argue that the term of institutions can only be sufficiently described by the subject matter of the analysis as a whole. Aoki (2001) pointed out: "which definition of an institution to adopt is not an issue of right or wrong, it depends on the purpose of the analysis." (p. 10). Therefore, the understanding of institutions might depend on which scholarly approach strengthens the use of a phenomenon. In this respect, some sociologists (i.e. Thornton et al., 2012, Friedland and Alford, 1985, 1991) developed a more nuanced approach to institutional analysis, termed 'institutional logics'. This study uses such an approach as it explains and defines the content and meaning of institutions that shape the behaviour of actors (Thornton et al., 2012). In logics the rules and norms are perceived as

standards of appropriate behaviour for actors within a given identity. Their emergence is linked to the action of actors who suggest ideas and models they consider to be appropriate, to interpret the surrounding environmental events. They become institutions whenever they are perceived by actors to be neutral, expected, appropriate, and legitimate. Hence, institutional logics matters.

Considering this, the following sections examine, in detail, the intellectual root that guided the conceptual development of the institutional logics perspective. This helps in giving a clear justification for its selection as a conceptual framework underpinning this study.

## 2.2 The Institutional Logics Perspective (ILP)

The concept of institutional logic was first introduced by Alford and Friedland (1985) as a way to describe how conflicting beliefs and practices, intrinsic in Western societies, shape human actions within the political field. The concept was developed further by the same scholar in 1991 as an explanatory tool for institutional change, where it is claimed that Western societies have central, dominant institutions with probably incompatible and conflicting institutional logics. Whilst a fair amount of earlier empirical work showed ambiguity as a consequence of multiple and conflicting institutional logics at the societal and individual level of analysis (Boltanski and Thevenot, 1991, 1986), Friedland and Alford (1991) detailed theoretically, multiple conflicting and competing logics at the macro-societal level of analysis. They defined central logics as ‘’a set of material practices and symbolic constructions – which constitutes its organizing principles and which is available to organisations and individuals to elaborate… These institutional logics are symbolically grounded, organizationally structured, politically defended, and technically and materially constrained’’ (Friedland and Alford 1991, p. 232). Their institutional logics’ conception relies on considering society as an inter-institutional system, and involves many diverse institutions’ subsystems, such as a capitalist market, bureaucratic state, democracy, religion, and family. They considered these subsystems as the dominant institutions and examined their role in shaping both interests and actions, as

each are guided by distinct, conflicting institutional logics. Since these subsystems, or institutional orders, hold different definitions of logics, there is potential for conflict. This study follows Friedland and Alford's (1991) conception and considers university knowledge commercialisation as an inter-institutional system, involving three diverse institutions' subsystems, namely, academia, market, and the state.

Since the concept of institutional logics was first coined by Friedland and Alford (1991), it has become the focus in analyses of responses to institutional tensions and forces, and over the past decade, more attention has been given to institutional logics. In the early years, many empirical studies (e.g. Haveman and Rao, 1997, Thornton and Ocasio, 1999, Lounsbury, 2002, Thornton, 2002, Greenwood and Suddaby, 2006) in institutional logics focused on the impact of institutional logics, focusing on the significance of dominant institutional logics and the shift from one logic to another. Haveman and Rao (1997) analysed how the emergence of 'progressive' thinking enabled the change in savings and loans organisational procedures. Thornton and Ocasio (1999) examined how the shift in logics influenced the academic publishing industry. The shift from professional, editorial, to market logic within higher education publishing was perceived to manifest itself in changes related to organisational power and causes of executive progression and succession. In their study, they highlight logics as "socially constructed, historical patterns of material practices, assumptions, values, beliefs, and rules by which individuals produce and reproduce their material subsistence, organize time and space, and provide meaning to their social reality" (Thornton and Ocasio, 1999, p.804). Basically, logics can be perceived as sets of norms and rules that frame how individuals make sense of the world around them and subsequently know how to act. The impact of logics can be further evidenced by other studies (e.g. Scott, 2000, Glynn and Lounsbury, 2005, Lounsbury, 2007). Scott (2000) described how logic changes within the healthcare sector resulted in the acknowledgement of the diversity of actors, behaviours, and governance structures. Glynn and Lounsbury (2005) found that the shifting logics in an orchestra occurred rapidly

because of the exogenous shock with impact on organisational evaluation criteria and practices, in this respect external stakeholders (i.e. critics) shifting criteria for evaluating appropriateness and quality of orchestral performance.

However, these studies focused on macro-level, larger societal logics (e.g. market or growth logic) rather than on the micro-level – consisting of the specific logics represented by institutional actors that interact with each other. In response, more attention has been given to studying how logics are carried into the micro-level or micro-interactions by individual human actors, often in situations with co-existing, potentially conflicting logics. In this respect, many empirical studies (e.g. Thornton and Ocasio, 2008, Marquis and Lounsbury, 2007, Lok, 2010, Reay and Hinings, 2009, Purdy and Gray, 2009, Battilana and Dorado, 2010, etc.) investigated the micro-level, taken-for-granted logics that direct actions. Scholars argue there is potential for field-level beliefs, norms, and practices being simultaneously affected by more than one logic. During the transitional phase, co-existing logics predictably arise between shifting logics within either a mature field (in which a dominant logic is already institutionalised), or the initial phases of an emerging field (in which dominant logic is still to be institutionalised). It is during this transitional phase that institutional contestation and conflicts become salient or prominent as different groups of actors attempt to force their own and preferred logics, which are often incompatible, onto the field. In this regard, scholars become interested in studying both the processes where a single logic is dominant and the processes that enable multiple logics to co-exist. This assists in understanding the reasons why the dominance of a single logic continues to evade some fields. In this vein, some empirical studies (e.g. Marquis and Lounsbury, 2007, Lok, 2010) showed how competing logics hindered the development of a dominant logic, hence, allowing multiple logics to co-exist within the studied fields. These studies also helped in understanding the reasons why behaviours and actions, resulting from previously dominant logics, are persistently elusive, even after the dominant logics were shifted. Other scholars (e.g. Reay and Hinings, 2009, Purdy and Gray, 2009, Battilana and Dorado, 2010) explored the mechanisms

that allow the preservation/continuance of both multiple and conflicting logics within a field, consequently invalidating and challenging former assumptions that a stabilised field is only dominated by one logic.

Acknowledging the co-existence of multiple logics within a field has shifted scholars' attention to the concept of multiplicity. Many studies that explored multiple logics had the tendency to differentiate two logics in opposition to each other (Greenwood et al., 2011). However, by reducing reality into one or two logics, the field became reductive. This is in accordance with the effect of social movement pressures (Lounsbury et al., 2003) and the concept that actors are exposed to multiple worldviews (Greenwood et al, 2002, Binder, 2007), which made other scholars question if this was, empirically, the reality in which actors truly found themselves (Stryker, 2000, Cloutier and Langley, 2013). They claimed that, in any field, pluralism is a norm. Consequently, recent discussions on institutional logics have called for analysing institutional pluralism or multiplicity explicitly and more systematically within institutional studies (Kraatz and Block, 2008, Greenwood et al., 2010). This notion of institutional pluralism was discussed further by Greenwood et al. (2011), who claimed that some fields are more complex than the others, according to how centralised and fragmented they are, they also considered institutional pluralism to be a source of institutional complexity within organisational environments. Institutional pluralism and multiplicity have also been considered recently in some empirical studies**.** For example, Greenwood et al. (2010) studied the interaction between the state, the family, and the market in Spain.

Considering the above review of empirical studies, the understanding of institutional logics has significantly developed since the concept was first coined by Friedland and Alford's (1991) seminal work. More significantly, and in relation to this study, it can be argued that the perspective of institutional logics can be considered as an analysis tool that is beneficial for studying multiple logics (institutional multiplicity) both in conflict and in consensus (Thornton et al. 2012). This study attempts to dig deep into the inner workings of institutional

conflict and consensus and open the “black box” of institutional processes under conditions of multiplicity. As the institutional logics perspective provides the necessary conceptual tools to help effectively untangle how conflicts and consensus merge, the objective of this study is to contribute to a more nuanced understanding of the impact of institutional logics in shaping actors’ actions within the micro-level interactions of knowledge commercialisation - a situation with multiple, co-existing, and potentially conflicting logics. Such issue was addressed by some scholars (e.g. Bjerregaard, 2010, Lind et al, 2013). Bjerregaard (2010) examined the way in which institutional logics enable and constrain the process of R&D between university researchers and SMEs. His study contributed to understanding the complexities of institutional logics in shaping University Knowledge Commercialisation at the micro-level of collaborative research sponsored by governmental funding programs. This study takes the same approach and extends Bjerregaard’s work by showing how the logics of diverse actors, including not only university and industry but also public sector and government, enable and constrain the actual processes (knowledge production and appropriation) of contracted R&D projects.

From the above, it can be concluded that the perspective of institutional logics can be considered as an analysis tool that is beneficial for studying logics at the micro-level. Thus, the following sections provide a detailed discussion about its role in the micro-level of knowledge commercialisation process.

However, before that, it is important to point out how institutional logics perspective has been criticised and the ways in which my study addresses those concerns.

### 2.2.1 Critical Issues of Institutional Logics Perspective

General criticism can be drawn on the concept of the ideal-type model within institutional logics studies (Freidson, 2001, Light, 1989, Rao et al., 2003, Thornton, 2004, Thornton and Ocasio, 2008). Scholars were influenced by Weberian thought. They overlooked the impossibility of ideal types being found empirically as they were more inclined towards ‘verificationism’ and

'prescriptivism'. They presume similarity of the ideal type with reality and verifying the extent to which such ideal types are similar in reality (Cruz, 2016). Moreover, they tended to identify the ideal type as an example and a reference point to be reached and accomplished by social actors. For instance, Thornton and Ocasio (1999) and Goodrick and Reay (2011) built their ideal types from reality, yet never distinguished the developed types in different ways. The authors made no attempts to move the developed type away from what was noticed in reality, nor did they think about reconsidering the understanding about the used ideal type of institutional logics and the context within which actors are situated. Thus, and as a long stream of work implies, these ideal types don't clearly map to institutional realities of sectors (i.e. academic and industrial sectors), this study takes a different approach by reflecting and interpreting realistic (not-ideal type) academic, industrial, governmental logics.

The most relevant criticisms for this study are that the institutional logics perspective doesn't sufficiently address power and the micro, macro-levels of context. First, although the institutional logics perspective presumes that the action of an actor within an organisational field is guided by institutions (Thornton et al, 2012, Lauren, 2016); it overlooks the link between power and institutions. As will be explained in the following sections, this study rectifies this issue by calling for the need to integrate power with institutions, viewing their causal sequencing. Second, as aforementioned, most of the earlier studies in institutional logics focused on macro-level, larger societal logics, rather than on the micro interaction level. Although some studies (Zilber, 2002, Reay and Hinings, 2009, Battilana and Dorado, 2010) attempted to fill this gap, many empirical studies in institutional multiplicity (or multiple institutional logics) have focused more on the macro-level (Cloutier and Langley, 2013). The micro-level processes within which institutional logics might emerge and interact are largely overlooked (Barley, 2008, Hallett and Ventresca, 2006, Powell and Colyvas, 2008). Therefore, this study gives emphasis on micro-level processes, and particularly, the way in which multiple actors draw on the institutions associated with interactions involving different institutional worlds. It argues that different

types of actors may bring distinct institutional logics in their interactions, leading to differences in actions in response. Third, this study follows Friedland and Alford's (1991) concept and considers university knowledge commercialisation as an inter-institutional system. However, their work of determining central institutions at the macro-societal level has been criticised for its Western focus on democracy and religion (Greenwood et al., 2002, Thornton and Casio, 2008). This study aims to rectify this issue by exploring the logics of the three subsystems within a non-western context, that is, a country with a developing institutional context.

### 2.2.2 ILP and the micro-level of KC: *Institutional logics in comparison to Isomorphism*

In order to examine the role of institutional logics at the micro-level of university knowledge commercialisation, this study draws inspiration from Thornton and her colleagues' conception of heterogeneity, conflicting logics in comparison to homogeneity, and the Mimetic Isomorphism (M.I) concept of old sociologists. These are discussed next.

Institutional isomorphism was first coined by Meyer and Rowan (1977) and Zucker (1977) who emphasised the significance of the role of culture in institutional analysis. From a macro viewpoint, Meyer and Rowan (1977) highlighted the role of modernisation in rationalising taken-for-granted rules, resulting in isomorphism in organisations' formal structures. Organisations seek legitimacy by conforming to external environments. Meyer and his colleagues were interested in studying rationality that occurred from culture, and considered the development of the formal structures of organisations as an element of the social world and its cultural systems (Meyer et al., 1997). Meyer and Rowan's (1977) theory was extended by DiMaggio and Powell (1983) through focusing on isomorphism from the societal level to the organisational fields level. With their focus on the coercive, normative, and mimetic as sources or bases of isomorphism, DiMaggio and Powell's approach has taken hold in empirical

analysis. From DiMaggio's and Powell's (1983) perspective, mimetic isomorphism is a mechanism resulting from an organisational response to uncertainty. They argue that organisations tend to copy each other's structure "when there is new technology that is poorly understood, when goals are ambiguous, or when the environment creates symbolic uncertainty" (p. 151). This occurs when an organisation "consciously models itself after another that it believes to represent a high level of success and achievement in the public eye" (Hanson, 2001, p. 649). Hence, mimetic reinforcement and support influence organisational isomorphism through organisational copying generated by the force and pressure to establish organisational legitimacy. Ashworth et al. (2005) emphasize that the practice of 'copying' becomes dominant when actors are not sure about the "outcomes of the adoption of different processes or systems will be"' (p. 3). In support, Selznick (1996) argues that 'copying' is reflected and deliberated from the response to uncertainty, apparently "deeply rooted in anxiety than in rational efforts to avoid reinventing the wheel" (p. 273). Considering this, it becomes normal for organisations to imitate well-developed organisations in order to avoid loss.

This study challenges such an approach. It believes that institutions are shaped within a specific knowledge commercialisation context as a response to heterogeneity and institutional diversity. However, the focus of mimetic isomorphism places more attention on homogeneity across organisations, besides deliberate legitimization activities and practices without consideration of contextual differences. Thus, this study adopts institutional logics as a new approach to institutional analysis by positing logics as defining the content and meaning of institutions (Friedland and Alford, 1991, Haveman and Rao, 1997, Thornton and Ocasio, 1999, Scott et al. 2000). Although the approach of institutional logics shares with Meyer and Rowan (1977), Zucker (1977), and DiMaggio and Powell (1983, 1991) the interest in understanding how cognitive structures and cultural rules shape organisational structures, it holds an opposite view. Their perspective of multiple institutional logics differentiates new institutionalism in that the emphasis and attention is no more on

isomorphism, neither in organisational fields nor the world system society, instead the emphasis is on the implications ‘’of differentiated institutional logics on individuals and organisations in a larger variety of contexts, including markets, industries, and populations of organisational forms. Institutional logics shape rational, mindful behaviour, and individual and organisational actors have some hand in shaping and changing institutional logics’’ (Thornton et al., 2008, p. 101). More explicitly, and as per this study, the behaviour of actors within the micro-level interaction (i.e. contract R&D mechanism) is guided by institutions, which are defined by logics governing the interactions of actors located in different organisational fields (i.e. university, industry, and government). In comparison to mimetic isomorphism, Thornton et al. (2008) view society as an inter-institutional system that allows sources of heterogeneity and agency (actors) to be both theorized and examined from contradictions between the logics of different organisational fields. Rather than there being one source of rationality, as in global systems approaches (Meyer et al., 1997), there are multiple sources. Hence, instead of suggesting homogeneity and isomorphism, the institutional logics perspective considers a context as theoretically and “potentially influenced by contending logics of different societal sectors” (Thornton et al., 2008, p. 104). For instance, a healthcare system is shaped by the professional logic of medical care, the logic of democratic state, and the market logic (Scott et al., 2000). Thus, institutional logics are the belief systems, or cognitive maps, that are supporting individuals situated within a particular organisational field, to establish meaning to their activities. Hence, institutional logics may be perceived as governing interactions by both enabling and constraining behaviour through systems of incentives and sanctions (Thornton, 2004). In this study, the process of University Knowledge Commercialisation is considered as an inter-institutional system, and is therefore infused with institutional logics that exemplify the organizing principles that highlight how diverse fields’ actors achieve their work. The long persistent traditions and practices within the three institutional spheres (or organisational fields) describe the historically constituted differences in the institutional cultures

of scientific community, industry, and government, exemplifying three different sets of institutional logics.

## 2.3 Theoretical Perspectives of UKC

The aim of this section is to examine the impact of interaction within the university knowledge commercialisation context by introducing two theoretical perspectives of Academics Capitalism (AC) and Triple Helix Model (THM). To allow for a nuanced approach to the role of actors and institutions, the main arguments of both perspectives are interpreted through the lens of the institutional logics approach, where conflicts between logics are identified.

### 2.3.1 Academic Capitalism (AC)

#### Background

The term Academic Capitalism (AC) is directly used from the 'Academic Capitalism: Politics, Policies and the Entrepreneurial University' book of Slaughter and Leslie, 1997. Their main theme is concerned with the "on-going changes in the nature of academic labour" (ibid, p. 1). The study focuses on the transformations within the period 1980s-1990s. They found that a transformation in the "nature of academic labour: changes in what academics do, how they allocate their time" (ibid, p. 60) was caused by the transformations in financial structures and growing relations and linkages with industry. This makes academics shift further towards the market and away from their traditional positions within a "state subsidized shelter from pure market forces" (Bullard, 2007, p. 15). In order to maintain professionalism, universities have traditionally discouraged their academics from the market and have kept them protected from it in order to sustain the academic freedom in pursuing basic knowledge. However, this is now no longer the case., and Slaughter and Leslie, 2001 have developed the concept of academic capitalism as a theoretical basis for better explaining the shifts towards the market by public universities.

Slaughter and Leslie (1997) define academic capitalism as "institutional and professional market or market-like efforts on the part of universities and faculty" (p. 11), in order to "secure external funds" (p. 209). Market relates to for-profit activities, while the external funds include research grants and contracts with government and industry (Bullard, 2007). From this perspective, the conceptual focus of scholars was emphasized by the "encroachment for profit motive" in the academia environment (Slaughter and Leslie, 1997, p. 210). Therefore, academic capitalism encourages profit-making activities which bring about research products "close to the market" (ibid). In this context, research is being commercialised in applied fields, making a new era in higher education as an entrepreneurial institution.

Afterwards, the conceptual focus of Academic Capitalism has been shifted to the "internal embeddedness of profit-oriented activities" by universities and their academic staff (Slaughter and Rhoades, 2004, p. 11). This can be clarified by the theory of resource dependence (utility maximization) by Pfeffer (1992) from which the concept of academic capitalism is derived theoretically. This theory assumes that the motivation of academic entrepreneurial activities depends on the importance of securing funds for conducting research. Universities rely on key resources in order to support their research operations. If these resources are scarce, the academics should engage themselves in industrial activities in order to get alternative resources. Therefore, academic capitalism can also be referred to as "a situation in which the academics and universities operate in an increasingly competitive environment, deploying their academic capital, which may comprise teaching, research, consultancy skills, or other applications or forms of academic knowledge" (Deem, 2001, p. 14). Specifically, academic capitalism involves the efforts of academics in securing "external moneys" (Awbery, 2002, p. 2). Academics who engage in market and market-like, activities have been named 'academic capitalists' (Slaughter and Leslie, 1997). These academics enter into the context of academic capitalism mainly through commercialising their technology by gaining licenses and patents for their research outcomes (Park, 2011). Universities are "pushed and pulled" in the

direction of academic capitalism (Slaughter and Leslie, 1997, p. 211), as a response to the external pressures arising from the characteristics of their resources providers (i.e. industry and government). Therefore, universities encounter difficulties in maintaining 'autonomy' (Zheng, 2010, p. 39). Hence, a university is considered as a state-funded entrepreneur that initiates capitalism (Slaughter and Rhoades, 2004), where profit-motivation behaviours of academics tend to be aggressive and embedded within their university's community

However, the literature on academic capitalism focuses on universities in Western countries (Hershberg et al, 2007, Kwon, 2010, Back, 2016). Most of the early studies were situated in Australia (Slaughter and Leslie, 1997) and the US (Slaughter and Rhoades 2004), with more recent studies in Europe (Kauppinen, 2012), and many of these studies involve universities' entrepreneurial practices. Little attention has been paid to exploring this phenomenon in countries with developing institutional environments, where lack of resources is a much starker reality for universities (Back, 2016). The role of the university in such countries is different from those in countries with developed institutional environments. Although countries with developing institutional environments have witnessed a policy orientation towards strengthening the interaction between academia and industrial application (Etzkowitz et al, 2000), the main mission of universities within these countries remains elite teaching since research and market oriented activities are not established strongly due to the lack of sufficient resources (i.e. research capacity and funding) (Kwon, 2010).

Furthermore, although it captures the multitude/variety of actors involved in the relationship and despite its recognition of the positive economic possibilities of collaboration between universities, industry, and government, the theory of academic capitalism does not interpret this relationship as a natural rule governing knowledge commercialisation interaction (McClure, 2014). Rather, it adopts a narrow approach and remains squarely focused on understanding the nature of change in universities. Universities remain at the heart of the research

that is taking place, admittedly using a more critical perspective of the academic capitalist knowledge regime. Scholars tend to only emphasize the role of universities in encouraging market-like behaviour, and much of the inquiry into academic capitalism has focused on the activities of individuals—students, faculty, and administrators—in promoting and undertaking entrepreneurial activities.

Given this, research on academic capitalism focus primarily on the implications of market logics on the university's institutional setting, without considering the effect of different, multiple logics governing the micro-level interactions. It overlooks the exploration of the implications of the existence of multiple actors often holding different logics, which ultimately offers little explanation for how conflicts occur. In other words, it obscures the implications of potential conflicts of different logics between diverse actors in university knowledge commercialisation. More importantly, with exceptions (Mars and Lounsbury, 2009, Lauren, 2016), the perspective of institutional logics and academic capitalism theory have rarely been combined in research studies . This study fills this gap and pays attention to not just how market logics of academic capitalism are perceived and applied by academia, but also to the implications of industrial and government logics on the processes of knowledge commercialisation.

By drawing from the institutional logics perspective, the following section discusses how market logics shape behaviour and actions in academia.

#### 2.3.1.1 Academic Capitalism through the lens of ILP

From the institutional logics perspective, academic capitalism can be referred to as the characteristics of the broader professional and market logics associated with university knowledge commercialisation systems at the societal level. Hence, the logics of market and profession merit further detail. The professional logic has been defined in both the work of sociology (e.g. Light 2000, Abbott 1988) and studies applying the institutional logics framework (e.g. Thornton 2004, Thornton and Ocasio 1999), as the ideology of arranged and organized

professionals who have expertise and knowledge and whose status is safeguarded by the condition in return for social benefit. Some studies provide important inferences to the study of the institutional logic of professionals. For example, in the examination of changes in institutional logics within universities publishing, Thornton (2004) finds that universities' publishing shifts from an independent culture of local publishers concentrated on generating markets for books based on personal, relational networks towards a culture of international, conglomerated corporations that generate markets from corporate hierarchies.

The market logic draws from the field of sociology within both the institutional logics theory (e.g. Thornton 2004, Thornton and Ocasio, 1999), without explicitly applying an institutional logics framework (e.g. Fligstein 1993, Scott, 2000). The inter-institutional system of the market is guided by rational self-interest, profit, and conceptualising interaction within society as market transactions (Thornton, 2004). Gumport (2000), for example, uses 'industrial logic' as a label to study the impact of the rapid expansion of knowledge on university culture. She argues that the conceptual understanding dominating universities has shifted due to the great growth of information. In the examination of three universities (UC Berkeley, SUNY Stony Brook, and the University of Illinois at Chicago), she determined that the earlier conception of social-institutional logic within those universities is being replaced by industrial logic. The social institutional logic acts in response to societal expectations, the ideal inherent values, and to comprehensive and multidisciplinary scholarship. While industrial logic reacts to market forces through admiring and recognizing commercialisation and revenue-generating knowledge that supports market demand and contributes to the development of the economy. The legitimization of industrial logic implies that academics and other university actors act within a competitive enterprise. It explains how universities have reacted positively to market logic, which denotes academics' acceptance to select a different environment for business and market-oriented stakeholders, such as firms.

The new logic of industry, as labelled by Gumport (2002), is remarkably similar to what is meant by academic capitalism, as there was a shift from the academic dominant societal logics to market logics through knowledge capitalism. In accordance with the work of Slaughter and Leslie (1997), Gumport's (2002) work describes how institutions of universities are being modified and restructured as a result of fund reduction which necessitates a more industrial approach. This is consistent with the notion of different institutional logics, which offers a powerful lens for researchers to speculate and conceptualise how actors' logics are held in the broader environment and acted out locally in organisations in order to get legitimacy. Gumport (2002) clearly pointed out that one logic has not completely replaced and dominated the other. Rather, the two logics of academics and industry co-exist with one another, but sometimes with tensions (Ylijoki, 2003).

However, although many scholars have argued for the benefits of shifting towards market logics (e.g. Clark, 1998, Wang, 2001, Embree, 2001, Marginson and Considine, 2000, Awbery, 2002, Brint, 2002, Ylijoki, 2003, Mendoza and Berger, 2008), others, especially those who joined the development of the new economics of science, have pointed out its intrinsic danger (Giroux, 2002). The overall argument is that academic capitalism is considered an intruder with dissimilar logics that are not appropriate to the academic institutional setting.

The opponents put out a general critique on the theory of neo-liberalism. Universities have begun to adopt the logics of (neo-liberal) markets as this enables them to access new streams of funding, through the establishment of new networks linking universities with industry to generate a new flow of knowledge and capital (Salughter and Rohades, 2004). However, this encourages market power and considers academic choice as the basis for economic power (Aronowitz, 2000). The interference of (neo-liberal) market logic with the process of research science is a long held fear in academia. Those opposing what may possibly be perceived as market logics' interference, encourage what others perceive as the excessively idealistic logic of academia.

The claim that entrepreneurialism within academia undermines academic logics can turn into a heated matter and those who oppose it describe the revolutionary, or 'iconoclastic', logics of market as a danger to the fundamentals and traditions of universities. Young (2005), for instance, found that as academics become aware of the growing financial cuts or income gap, they are becoming increasingly dependent on market logic, trying to strike their own 'Faustian bargains with capital' (p. 6), in other words, willing to sacrifice their own academic logics to satisfy the limitless desire for gaining more money.

This can be explained more by the (neo-liberal) markets logic of knowledge commercialisation. The problem becomes a concern when the resources for academic research are allocated according to their usefulness to the market rather than their scientific importance. This has changed the reward system for academics, which used to focus mainly on discovery and quality research, but now focuses on results in producing deals for patents and licenses that may or may not agree with the results of scientific research (Galston, 2004). Academic researchers aggressively take part in capitalising knowledge and exploiting resources to make use of existing economic opportunities (Slaughter and Rhoades, 2004). From this perspective, there is a concern that academia continues to experience pressures from capitalists (Bullard, 2007), and therefore, knowledge becomes a commodity to be manufactured, packaged, bought, and sold (Bertelsen, 2002) - the intellectual work of academics becomes a product that is cost-effectively produced at a production line. In this context, universities replace the knowledge logic of public good with market logic of private good, which consequently highlights the privatization of knowledge through commercialisation.

This has raised more concerns in academia. The (neo-liberal) markets logics, championing competitiveness, truly confront the university's logics of open and free exchange of scientific inquiry that involves colleagues validating and replicating each other's research work (Bullard, 2007). The process of the scientific community within universities is mainly influenced by the logic of

'communalism' (Merton, 1973, David, 2000). Communalism relates to the common ownership of ideas, thoughts, and knowledge (Merton, 1973). It ensures the free flow of knowledge by disseminating information across the required areas (ibid). In this perspective, the academic research depends on a 'social process' (collective-action) more than 'an individual program' (individual-action) (David, 2000). Thus, and from the context of the community of 'open science', privatizing the outcomes of research hinders the open access of the members of society to the 'academic commons' (ibid). However, universities engaging in commercialising their intellectual properties endanger the academic logics of open science (Bok, 2009). Many scholars who present research papers at any scholarly meeting might neglect and exclude important information on the basis of patent, hence “closing intellectual communication” (Aronowitz, 2000, p. 48). From this perspective, universities' activities, along with academic logics, can be dominated by neo-liberal market logics.

In short, the main challenge here is the need to merge and balance market logics with the professional logics of academia. Thus, it remains an open question, how these conflicting professional and market logics inform knowledge commercialisation processes between different actors, and with the growth of University Knowledge Commercialisation phenomenon, how the fear that ‘’irreplaceable values may get lost in the relentless growth of knowledge commercialisation’’ in academia has been managed and governed (Bok, 2009, p.17)**.**

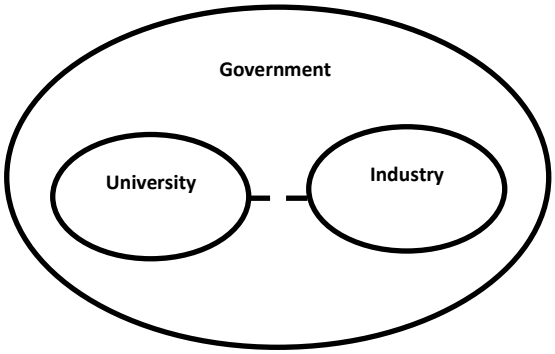
### 2.3.2 Triple Helix Model (THM)

#### Background

The Triple-Helix Model (THM) was proposed by Leydesdorff and Etzkowitz (1997), in which they highlight the role of the university in the context of knowledge-based economy as a central partner to industry and government. The triple-helix model is rooted in the traditional linear model, by integrating the

factors of interactive and recursive within it (Etzkowitz and Webster, 1998). The linear model is based on separating the institutional areas in such a way that creates a one way stream of knowledge flow across clearly defined boundaries from basic research to applied research towards a product. This can be clarified further by explaining the evolution of this model over time. Etzkowitz and Leydesdroff started by describing the development and progress of the systems of innovation. They also explained the conflicts upon which the path should be considered in the relationships between university and industry. These conflicts are caused by the different institutional arrangements of the relations of University-Industry-Government (U-I-G). First, a historical situation can be distinguished by the first 'Triple-Helix Statist Model'. As shown in figure 2.3.2, Government controls both academia and industry.

**Figure 2.3.1: Triple Helix Statist Model**

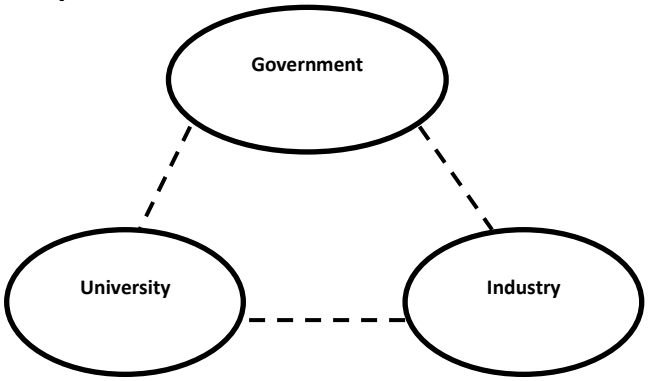



Source: Etzkowitz and Leydesdorff (2000)

In this respect, the dominated institutional sphere is 'government'. It is expected to take the lead in developing projects and providing the resources for new initiatives. The government plays the role of coordinator whenever relations are established between academia and industry. A strong form of this model exists in some Eastern European countries, which are affected by the 'existing socialism'.

Figure 2.3.3 shows the second model of Triple-Helix, which also labelled as ‘Laissez-Faire Model’.

**Figure 2.3.2: Triple Helix Laissez-Faire Model**

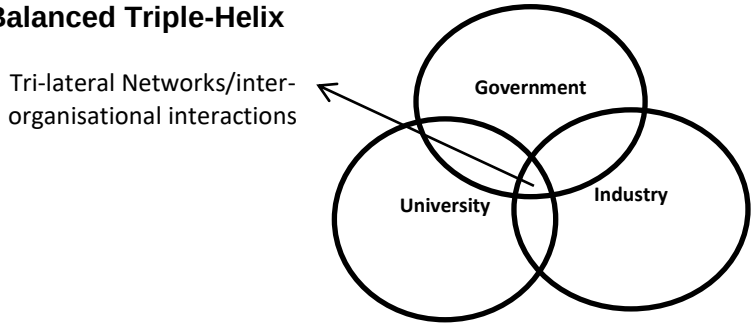



Source: Etzkowitz and Leydesdorff (2000)

In this model the separated institutional spheres are divided by strong boundaries and restricted relations. Additionally, individuals involved are more willing to compete rather than to cooperate in relation to others. The critical separation makes the role of institutions narrower with strong boundaries as well as with justifiable standards for the interactions among the different spheres. In the real world, the spheres usually have more close relationships than the ones within the model of Laissez-Faire of government-industry-university, which are working individually and without any close relationships. Etzkowitz (2002) claims, in reference to this model, that the role of the university is shifted to providing knowledge mainly through publications and qualified graduates, who commercialise their tacit-knowledge to industry. So it is the responsibility of industry to find and implement appropriate knowledge from universities without getting any support or coordination (Etzkowitz, 2003, p. 305). In addition to considering the differences of the above two models, a current concern is generated. The model of ‘Statist’ is globally considered as an unsuccessful model, since the bottom-up initiatives rarely happen. The second model encourages a policy of ‘Laissez-Faire’, in which the role of government is reduced suddenly in comparison to its role in Statist model (Etzkowitz and Leydesdorff, 2000). Therefore, there was a need to develop a model that

integrates the interactive and recursive factors within it (ibid). The global tendency is a move towards a balanced model, figure 2.3.4, in which the three institutional spheres overlap and collaborate. The model assumes the flow of knowledge to be into two ways. The development of this model entails several steps (Etzkowitz, 2002, 2003, 2008; Etzkowitz & Leydesdorff, 1997, 2000, Leydesdorff, 2012; Leydesdorff and Etzkowitz, 1998). Etzkowitz (2008) has explicitly distinguished three steps, namely Triple Helix imputes, taking the role of the other, moving from bilateral to trilateral networks or inter-organisational interactions. The following gives a detailed discussion about main arguments within these steps.

**Figure 2.3.3: A Balanced Triple-Helix**




Source: Etzkowitz and Leydesdorff (2000)

Within THM imputes, ‘’a Triple Helix regime typically begins as university, industry, and government enter into a reciprocal relationship with each other in which each attempts to enhance the performance of the other’’ (Etzkowitz, 2008, p. 8)**.** The rationality aligned with this argument is the social belief, shared by government and industry, that knowledge production is central to economic growth and development. As government and industry are motivated by this belief, the university’s involvement in knowledge commercialisation is driven initially, and mainly, by public policies and financial incentives. Under such argument, the THM interaction starts, in which three institutional spheres realise the need for developing a reciprocal relationship.

As demands for cooperation with each other arise, challenges might emerge that gradually lead to a stage where internal transformation is characterized by

‘taking the role of the other’ (Etzkowitz, 2008, p. 9, Etzkowitz and Klofsten, 2005). (Dzisah and Etzkowitz, 2011) claim that "university, government and industry that were differentiated with each other as a condition for the constitution of modernity are now intersecting with each other to create unique institutional configuration" (p. 38). The three actors take the role of the other to blur the boundaries between them within the interaction process. They are joined together, but remain independent from each other. The actors, in addition to performing their traditional and primary activities, each take the role of the other as additional secondary activities, while maintaining their own/individual primary roles and different identities. Therefore, changes emerge within and between the different institutional spheres of the three players, which deal with each other recursively, as one is linked to the other two. In this respect, the university preserves its traditional roles of teaching and research, while taking the role of industry, becoming more entrepreneurial oriented - acting as consultants, and giving attention to knowledge capitalisation, such as patents and licensing (Etzkowitz, 2008). Industry maintains its focus on the production of products and services, while engaging in R&D, such as involvement in research of new technology development. Government retains its responsibility of solving failures through regulating and amending public policies and establishing rules, while at the same time promoting interactions among universities and industries by establishing and implementing programs of innovation and acting as coordinator to make the interactions more successful (Etzkowitz and Leydesdorff, 2002). In a nut shell, as universities and users are assumed to possess complementary knowledge, government “changes the rules of the game” (Etzkowitz and Leydesdorff, 2000, p. 114), in addition to encouraging interaction between the other institutional spheres (Etzkowitz and Klofsten, 2005).

As they take the role of the other, the actors from the three spheres realise the necessity of engaging with the others’ fields, yet their resources are insufficient to accomplish their desired goals (Cai, 2015). Also, new challenges and demands might potentially surface between spheres, which raise the need for

closer cooperation and interaction through the evolution of trilateral interactions (Etzkowitz, 2008). In this respect, interactive networks are established between the three institutional areas in common research focusing on developing knowledge-based economies (Etzkowitz, 2004). New technologies and innovation can be produced by the new initiatives that take place within these networks. Additionally, the new channels of interactions and organisational arrangements grow to be as essential as the production of physical devices in accelerating the growth of innovation (Etzkowitz and Leydesdorff, 2001, Etzkowitz, 2003). As these institutional areas overlap, the communication of knowledge is built with an assumption. So, the model offers a 'heuristic method' to study the different interactions between actors in relation to changes in their institutional networks (Leydesdorff and Meyer, 2006). In this respect, trilateral, as opposed to bilateral, networks are the three players that are considered as the main institutions of knowledge communication (ibid). Such networks are characterized by increasing interdependency between the three spheres. One sphere has a considerable influence on the other actors' actions, and throughout the interaction, actors within each sphere are able to adopt new ideas from the others to resolve issues and meet new demands or needs. For example, academics within a university cannot carry out knowledge production without industry. In addition to being a source for research, academics need industry as a strong partner in knowledge production. In the interim, knowledge commercialisation mainly relies on the environments and conditions established by the government. Industry, such as the case with SMEs, becomes a unit of related entities related to other enterprises through the market rather than being a competitive unit, thus becoming a THM entity based on the relation with academia and government (Etzkowitz, 2008).

Additionally, a dual-layered network is implied - the layer of institutional relations and the layer of functional relations. The theoretical specification becomes more complex when the "institutional differentiation is added to the functional differentiation" (Leydesdorff, 2005, p. 10). In the innovation systems of knowledge economy, for instance, the triple-helix lowers this complexity by

providing a tool to link the different perspectives of actors. The assumption of functional differentiation and structural integration explains the changes at the interactions level among university, government and industry, in addition to the internal changes within each institution. According to the triple-helix model, the involved institutions are changing and restructuring continuously as they widen their functions. Some scholars may see the changes caused by the influence of emerging networks as a threat to the traditional identity of universities. However, and according to Leydesdorff, these changes can be considered as "creative destruction which entails the option of increasing development" (Leydesdorff, 2005, p. 13). In this respect, Etzkowitz (1998) considers 'entrepreneurial university' as the latest stage of advancement of universities, in which the new mission is cantered towards capitalising knowledge, where a university becomes closer to users of knowledge and a main economic player in its own right. "The capitalisation of knowledge becomes the basis for economic and social development and, thus, of an enhanced role for the university in the society" (Etzkowitz, 2004, p. 66). The knowledge is created and commercialised for practical application and for progresses in the basic theoretical disciplines. To become more entrepreneurial, universities should carry on interdependent relationships with other involved sectors, but at the same time sustain their independency. The need to balance between interdependency and independency has resulted in the appearance of cross-organisational formats that focus on dual goals. By blurring the boundaries between universities and industry, a two-way flow of influence exists. As universities' relations with government and industry transform, their structures also go through reconstruction.

#### 2.3.2.1 THM through the lens of the ILP

From the above, the classic literature of TH suggests an overlap between the three spheres (university, industry, and government). Etzkowitz (2008) argues that within the balanced model of TH, the three spheres all share similar views about their collaboration. It addresses the commodification and capitalisation of scientific knowledge as well as the associated institutional and normative

convergence between academia, industry, and government (Etzkowitz, 2003, Etzkowitz and Leydesdroff, 2000). Hence, the success of knowledge-based economy depends on the cooperation between the three actors. Useful knowledge is produced and developed from the permanent interactions and networks among the three actors.

Thus, from the THM perspective, university-industry-government collaboration becomes a new institutional order - a new institutional field in the context of sociological institutionalism when there is an interaction between the three spheres' interests, which is later institutionalised and taken for granted by time (Benner and Sandström, 2000). This is similar to the mimetic isomorphism concept by which, and as mentioned in section 2.2.2 above, the concept of TH and its related activities have come to be the templates for action which generated unified or monolithic responses to uncertainty that led to isomorphism - a commonality in function and form (DiMaggio and Powell, 1983). THM and its activities have come to be the practices and routines that are repeated and reproduced through time and aim to function as a rational framework constructing the actions of the three involved actors. Nevertheless, such perception tends to give a naïve and modest view of the institutional environment, as it portrays THM culture as the only institutional order and institutional field surrounding all three spheres. This is contrary to the institutional logics perspective of organisations' embeddedness within different, conflicting institutional orders or inter-institutional systems (Thornton et al., 2012).

Although THM emphasizes the coexisting of diverse institutional logics in the context of knowledge commercialisation, the authors rarely address the tensions and conflicts between actors on the micro-level of interactions (Lu, 2007, Tuunainen, 2002, Viale and Pozzali, 2010, Fogelberg and Thorpenberg, 2012). In particular, the proposition of common interests, underlying assumptions of the necessity of pre-existing cooperative relations and the automatic flow of knowledge among the three institutional spheres. Actors from different

institutional spheres draw on various institutions to direct their actions, and the concept of 'institutional logics' offers a link between institutions and actions (Thornton and Ocasio, 2008). Institutional actors have their own institutional logic-guiding principles, assumptions, and symbolic constructions which they draw upon to guide their actions and form their own identities (Friedland and Alford, 1991). Institutions are continuously being reshaped by individual human actions, which in turn, are reflected in their interactive activities with other actors. Hence, institutional conflict may exist between university, industry, and government, though government can be considered as an active participant in university-industry linkages (Sohn et al., 2009), resulting in incongruence in goals and interests. The empirical evidence underpins university knowledge commercialisation involving studies focusing either on universities (primarily) or enterprises, infrequently both, (Ankrah et al., 2013) and hardly ever explores the implication of the existence of multiple actors, often possessing different goals and interests. This may obscure the potential for conflict of different logics between multiple actors and its implications on the effectiveness of university knowledge commercialisation.

From the above, the validity of any theory depends on the context sensitivity in which actors are embedded (Whetten, 2009). A theory must not just focus on the relationship between X and Y, yet must also involve explanatory factors that are related to a great intensity of contextual analysis. However, Triple-Helix does not provide proper justifications that can be used as methodically structured criteria and guides for exploring the implication of conflicting logics. This demonstrates that THM provides no means, or practical directions, on how to bridge differences and nurture cooperation between actors. For example, THM doesn't pay sufficient attention to the role and effect of different mechanisms that surround and exert direct, or indirect, influence on the knowledge commercialisation phenomenon. Therefore, this study adopted the institutional logics perspective as an analysis tool to explore the impact of the potential mechanisms that can be used in bridging the differences in institutional logics within the micro-level interactions of knowledge commercialisation.

Moreover, the development of the THM is a consequence of inductive theorizing founded on successful innovation stories within the context of Western countries. Although the founders of THM (Etzkowitz and Leydesdorff, 1995, 1997; Leydesdorff and Meyer, 2003) acknowledged the differences between Western and non-western countries, and even though many followers have empirically examined THM in different national contexts (e.g. da Silva et al., 2012, Saad et al., 2008, Saad and Zawdie, 2011a, Zhou and Peng, 2008), these studies have attempted to employ the THM in their studies on developing or emerging economies regardless of institutional differences (Pugh, 2014, Cai, 2015). Though not specifically referring to the THM, Edquist (2001) expressed criticism that, in general, innovation system approaches overemphasize the interplay between interacted actors while paying little attention to the institutional environments in which those actors are situated and in which their actions take place**.** Sotarauta and Kosonen (2013) promote this point by arguing that innovation policies are context sensitive and therefore must be customized according to local conditions. Therefore, this study aims to rectify this issue by exploring the logics of the three institutional spheres within a non-western context, that is, a developing country.

Furthermore, THM ignores incentives and power relations among actors (Hira, 2013). It is argued that the three actors, i.e. university, industry, and government, can be expected to have different incentives (Siegel et al., 2003). Academics are primarily driven by publication pressures. Industry is driven by commercialisation possibilities through gaining proprietary control over the resulting knowledge. Government is made of bureaucrats who drive policies within the political agendas. The difference in incentives indicates that easy bridging and agreement between the three institutional spheres might not work in practice. Cooperation means different things to different actors, depending on their view of dependence and status of power. This can be explained more by the recent conception of the institutional logics perspective, specifically with respect to mechanisms of power (Thornton et al, 2012). Power is shaped by opportunities provided for actors to challenge conflicting logics (Thornton et al,

2012). For instance, the actors who are in power often regard cooperation within U-I interaction as valuable in addressing what has to be done in a changing world. While those without power, perceive it as a way of distracting attention from achieving their interests. Thus, achieving synergistic cooperation is difficult as it requires bridging the gap between different logics. Hence, the implication of logics is explained by the mechanism of power. However, there are a very limited number of studies on UKC and how power differences can be bridged between institutional logics. This is addressed in this study by providing mechanisms of multiple, conflicting logics of different institutional actors, which determine and shape the meaning of power guiding attention and decision-making.

Before discussing, empirically, the impact of the power mechanism, the following section discusses how this study conceptualises power within the context of THM.

#### 2.3.2.2 THM, Institutional Logics, and Power Mechanism

To a great extent, the Triple Helix relationship of university, industry, and government involves cooperation and power redistribution (Cai, 2015). According to Thornton et al. (2012), the meaning of power differs by actors' institutional logics. Actors' interests cannot be understood independently of their understandings. Thus, institutional logics assume interdependency between institutional meanings, actors' interests, and powers. However, although the institutional logics perspective deals with power, it doesn't integrate power with institutions. From its scholars' perspective, ''power is rarely; if ever, free from culture, and thus power's effects in a situation carry the force of an institutional logic (Friedland, 2012, p. 586). This study rectifies such issue by calling for the need to integrate power with institutions, viewing their causal sequencing. The argument is that if power is theorized as independent from institutional fields, a problem needs to be addressed, which is that power is created in the course of action and doesn't exist before the action that explains it. Given this, despite the fact that the institutional logics perspective presumes

that the action of an actor within an organisational field is guided by institutions, it overlooks the link between power and institutions. Thus, this study adopts arguments from general institutional scholars, particularly Schmid (1987) and Samuels (1971). Although these scholars are not approaching the issue from an institutional logics literature perspective (they have also taken the institutionalist perspective) their arguments explicitly explain the link between power and institutions, which provide a good tool for this study's analysis.

Within the setting of institutions governance, Samuels (1971) suggests two dimensions to link between institutions and power. The first dimension is the consideration of institutions as a form of power, which has received limited attention in the existing university knowledge commercialisation literature. A relevant argument for this dimension is implied by Schmidt (1987), through establishing rules that define who may do what to whom, with what, when, how, and under what conditions, in other words, socially granted power. Schmidt (1987) also argues that power to the people is a demagogic slogan and that when there is a conflict of interest, the issue always becomes which people are to be favoured. Hence, power is inevitable if interests conflict. He states that ''if everyone cannot have what they want simultaneously, the choice is not power or no power, but who has the power. Power is the ability to implement one's interests when they conflict with those of others'' (Schmidt, 1987, p. 9). The second dimension is relevant to policymaking, particularly, the creation of rules through the exercise of power (Samuels, 1971). Such dimension remains unexplored in the existing literature and research. The process of rule creation or policy-making involves the exercise of power, since rules arise from the interaction of actors. Even if rules are stemmed from legislative forces and enforced by the government, the essential assignment of rights to individuals is the result of contestation, mediated through power.

The notion of power exercise that stems from the conflict of institutional logics and rule creation is one of this study's central reasons for analysis. The study conceptualises the micro-level of interaction as field of power relations (Hira,

2013, Brin and Karabel, 1991). This considers the institutional setting power of the micro-level field, specifically, the power of logics governing the interaction within contracted R&D projects. Projects comprise the universe debates and discussions. Logics act as a set of rules and norms in that they serve to limit the actions and the thoughts of those on the project. When the rules and norms of a project are established through processes of structuration appropriating one logic over another, actors supporting that logic become more powerful. They have more control over decision making and their logics will come to be reflected as dominant (DiMaggio and Powell, 1983). The logics that are supported by powerful actors contribute to preserving the 'status quo' as they provide the institutions (i.e. rules and norms) of action and interaction that guide actors in decision making (Thornton and Ocasio, 1999). Hence, actors' logics and their exercise of power matter in this study. The following two sections give more details.

#### 2.3.2.3 Actors' and Logics' Differences

Universities and users are governed by different logics. Thornton (2012) claims that the meaning and legitimacy of different sources of organisational identity, strategy, and structure are shaped by a prevailing institutional logic. Otherwise stated, there are different institutional logics at the university than in industry (Lind et al., 2013). This is significant because institutional logics are embodied in practices and ideas, which shape the rules of the game (Dunn and Jones, 2010). Within the literature of university knowledge commercialisation, the differences of logics between firms and academia are often described as a constraining factor on the commercialisation of knowledge (Bjerregaard, 2010, Siegel et al, 2003, Gassol, 2007). Bjerregaards (2010, p. 100) argues that the institutional logics within firms and universities tend to give rise to differences in goals, interests, and time horizons informing R&D behaviour. This, in turn, might act as an obstacle to knowledge commercialisation. Different institutional assumptions for knowledge production and appropriation in academia and SMEs may affect the process of knowledge commercialisation. Thus, the literature (e.g. Bloden and Stokes, 1994, Davenport, 1999) indicates how

institutional logics between academia and firms are likely to result in differences in interests and goals informing the behaviour within knowledge production and appropriation.

A growing body of empirical studies provides evidence that academia and users are characterized by conflicting institutional logics. However, all of these studies are around commercial users (i.e. SMEs and large companies) without referencing to non-commercial users (e.g. government and other public bodies, as well as third sector organisations).

The explanation of the 'academic logics' draws mainly on Polanyi's (1962) and Merton's (1959) model of science, highlighting the search for fundamental and basic knowledge, freedom in research conduct, rewards in the arrangement of peer recognition, and the open science disclosure of research outcomes. Industry, on the other hand, is perceived as following 'commercial logics', concentrating on applied researches within a situation shaped by restricted disclosure and the private appropriation of returns from research outcomes (Aghion et al. 2008, Fini and Lacetera 2010, Lacetera 2009, Murray 2010, Vallas and Kleinman 2008). In the conflicting logics view, there is a clear division of work between academic and industry. The research mission of academia is to increase and enhance public knowledge through conducting basic research, for example, research bringing about fundamental insight (Argyres and Liebeskind 1998, Bentley et al., 2015). The focus of industry, on the other hand, is on applied research with the purpose of solving real issues that are valued in the market place (Aghion et al. 2008, Lacetera 2009, da Silva Campos, 2015).

Researchers are often given freedom in choosing what research to pursue and how to approach it. From the conventional point of view, academic norms permit researchers to freely choose research projects as per their personal interests or the perceived meaning for the advancement of science. The commercial logic, on the contrary, restrains freedom and academics' choices to the needs and requirements of industrial firms (Vallas and Kleinman 2008, da

Silva Campose, 2015). Even if the research is initiated by industry or another body, there remains a high probability that the academic logic supports research freedom, particularly, if the mission of academia is to advance the existing, public knowledge. Firms, in contrast, are less concerned with new knowledge, but rather care about knowledge that complements their existing product lines and services and maximizes their profits, expectedly directing them towards limiting academics' choice of projects (Aghion et al. 2008, Lacetera 2009, Calcagini et al. 2016).

Industrial and academic logics differ with respect to appropriation of the values from the research (Sauermann and Stephan, 2013). The conventional view of academic logic holds the perception that knowledge should be exposed for free to the broader community and that academics' key reward from research derives from peer recognition, status in the scientific community, or the desire to work in interesting projects of their own choice (Aghion et al. 2008, Murray 2010, Calcagini et al. 2016). On the other hand, the commercial logic holds that firms should aim to maximize their profit or financial returns from research, which naturally necessitates that academics should limit disclosure and waive, or sacrifice, some of the nonfinancial rewards provided by academia (Sauermann and Roach 2011, Sauermann and Stephan, 2013). Perkmann and Walsh (2007) refer to such institutional norms as likely sources of incentive misalignment between reputation-based reward systems of open science and commercial requirements. Within the context of knowledge production, it is significant to know how, and whether, research outcomes are disclosed to the wider scientific community. Certainly, the openness or open-disclosure of research outcomes in the form of publication is most often perceived as the major characteristic of the academic logic, while secrecy/data-withholding or disclosure in the form of patents are the main characteristics of commercial logic (Murray 2010, Fini and Toschi, 2016). Moreover, although there is an increase in patenting in academia, academic conventional/traditional norms of openness remain strong, and some academics perceive patenting as inappropriate (Gans and Stern 2010, Murray 2010, Fini and Toschi, 2016).

#### 2.3.2.4 Actors, logics, and Power

Some empirical studies highlight how the logics of powerful actors within the context of university knowledge commercialisation shape both action-taking and decision-making. They argue that rarely does everyone around the table have equal power. Actors exert their power as per their ability to make decisions and status/position as either knowledge producer (university), or knowledge user (industry), or knowledge manager (government). Hence, power is socially granted (Schmidt, 1987).

For instance, industry as a knowledge user exerts its power over IP. As firms use knowledge generated in universities to secure financial gains, their primary goal is to gain propriety control over the resulting knowledge. Some scholars argue that universities are forced by industry to make academics file disclosures for their contracted research whenever they have inventions with commercial possibility (Gerbin and Drnovsek, 2016). Firms' logic of profit maximization is identified by their norm of data-withholding. Pressure is exerted on academics to keep confidentiality by not disclosing the outcomes to other academics as a way of protecting the results of their research from being copied by their competitors. Thursby and Thursby (2007) found that firms include delay-of-publication clauses in at least 90% of their contracts with universities. Hence, the power that is stemmed from their status as knowledge funder, gives firms the ability to shape the action-taking and decision-making, which constrains academics' ability to publish. Firms' decision power is examined explicitly by Lacetera (2009) who examined contractual differences between academia and firm agreements in terms of the allocation of decision power. The study shows evidence of the implications of the allocation of decision power in research knowledge commercialisation. In one respect, the study examined the degree of control by sponsoring that was exerted by companies for different projects contracted with academia. Four major control rights given to the sponsoring company: termination without cause, change to the research program, extension of the duration of the research, and duties of the research partner to periodically submit research proposals and budget, subject to the approval of

the company. The findings show that the proportion of contracts giving stronger power to the firms is significantly high.

Given these studies, the dominance of commercial logics (e.g. data-withholding to increase financial returns) is a function of power which firms exercise with academia. However, it is found that the requirement of delay in publication is hard to put into effect as some academics refuse to disclose. This is not due to their lack of awareness that their inventions are commercially viable, but rather to their unwillingness to risk delaying publication (Gerbin and Dmovsek, 2016)**.** In this respect, some studies show the dominance of professional logics (e.g. open science and publication) as a function of the power exercised by academics. Vallas et al (2007), for instance, found tension between commercial and collegial/professional logics to be evident within research universities where faculty members have relatively greater power, as their professional orientations are relevant to the entrepreneurial changes that their universities seek to pursue. In support, some studies (e.g. Van Looy et al., 2011, Hewitt-Dundas, 2012, Miller et al. 2016) found that the academics' need to publish conflicts with the priorities and objectives of industry during collaborative research projects. Academics were found to still be in doubt as to whether knowledge commercialisation is part of their responsibilities. They agree that the extension to their traditional job role is forced upon them due to the changing university business model. Thus, academics exert their power by withholding knowledge that could be potentially be commercialised.

In view of the above, the difference between academic logics and commercial logics results in power asymmetry. As an actor has the ability to make decisions as either a knowledge producer or knowledge user, he/she attempts to exert power in order to maintain the achievement of their interest and goals. Hence, the role of knowledge manager (government) in balancing between academic and commercial logics is instrumental in avoiding conflicts. The following section gives more details.

#### 2.3.2.5 Government Role and Power

Government plays a big role in supporting the process of university-industry linkages (Mathieu, 2011). Within this context, the normative governance role of government is to design incentive structures to encourage firms and universities to engage in a dialogue whereby commercially beneficial knowledge may be developed and exploited (Etzkowitz and Leydesdorff, 1997). Hence, dialogue at the local level involving government, universities, and industry is prioritized. Sohn et al. (2009) found that government policies are the main determinant in establishing such dialogue. Through the establishment of many organisations (i.e. techno parks, regional innovation agencies, etc.), the government could bring both academia and industry together through executing different innovation programs including capacity building of local firms and networking among innovation actors. Especially, it has fuelled/powered universities, which are distanced from industry, to take a role as knowledge providers for local industrial innovation, while government policies have focused on innovation generated through networking. The positive effects of these diverse policies are reflected in practice. Many firms interacted with universities under sponsorship of techno park programs. Also, universities' interaction with local firms was prompted through the research centre innovation program.

More importantly, many studies show that the engagement of universities and industry in local governance is promoted by the government through providing financial and political incentives. This role is institutionalised through universities and industry representation in local economic partnerships, and on the boards of regional development agencies and science councils which were established to protect each region's interests by strengthening scientific and technological research (Charles, 2003, Lawton, 2007). Universities, for instance, have joined forces with national authorities in order to produce holistic strategies for development, ranging from developing programmes targeted to improve the level of innovation within the economy and tackle issues. Some scholars (e.g. Shapira, 2004, MacAdam et al., 2012) found that a research alliance was established jointly as part of the country's strategy of technology

promotion, which aims to exploit research infrastructure to produce business and economic development within specific local industries. Pugh et al. (2016) also found that a particular university can be engaged in regional economic development through providing programmes and actions to support local industry in its home region and increasingly on a national level. The university is engaged more directly in governance boards with the central government by developing and delivering various programmes funded by and in partnership with government. Through participating in governance activities, the university secured additional revenue of funding beneficial for engaging in further research activities with industry. It also assisted its researchers in securing access to data and informants, such as industry and policymakers, which they may not otherwise be able to do. In sequence, researchers could communicate their research outcomes easily back to developing programmes, thus increasing the impact of their interactions with industry and providing a win-win situation.

However, weaknesses are present in the local system of governance. By considering them as a central actor in governing linkages, universities could exert some power. Charles and Conway (2001) found that the engagement in the regional development agencies focuses on coordination and institution building instead of supporting science and technology commercialisation. Similarly, Shapira (2004) found that the research alliance targeted advanced research rather than diffusion and knowledge commercialisation. In support, Miller et al. (2014) found that although government assisted universities to establish different innovation programs, the support for universities in relation to embedding university knowledge commercialisation and entrepreneurial activities into their core responsibility is limited. This is due to organisational passiveness, which made it difficult to try to change the internal culture, and is also due to academics' mind-sets being accustomed to hoarding knowledge with the main focus of publishing.

Other studies point out the negative effects of government-exercised power on knowledge commercialisation effectiveness. They show that the established

programs do not have delegated powers for science and technology policies. Universities appear to be increasingly determined and controlled by the central government and have far fewer powers of initiative (Charles and Benneworth, 2001, Arbo and Benneworth, 2007). McAdam et al. (2012) found that although a university's management may appear to be the most salient actors, government has more power in affecting and shaping the strategic direction of the university due to its power (i.e. ability to influence organisational action). In order to receive funding for knowledge commercialisation activities, universities have to follow a set of rules developed by government. Similarly, Miller et al. (2014) found that government doesn't fully understand the challenges involved in knowledge commercialisation between universities and industry in the pursuit of innovation. There was much bureaucracy governing knowledge commercialisation. The government was trying to exert its power to influence how interactions should progress by aligning funding for particular activities in innovation. Hence, the government appeared to have power as it has control over withholding/withdrawing funding. Moreover, although government policies have been important in setting agendas for promoting university-industry cooperation, such policies do not take into consideration the potential conflicts within the THM (Lawton, 2007). Recently, Pugh et al (2016) found a fundamental challenge, that is meeting the right balance between providing value-added outcomes and taking participants away from their comfort zone. Some participants from universities highlighted the high degree of difficulty in meeting this balance between stability and change as they already have other missions to achieve (i.e. teaching and research). This was evidenced from private sector participants, who perceived governance activities as going too far in the academic sphere. Hence the challenge was to balance between the three spheres, academia, market, and governance (Stachowiak, 2013, Charles et al, 2014).

In short, the impact of power relationship is found to considerably influence knowledge commercialisation, where a dominant actor can exert its power, which has the potential to impact behaviours. A defining characteristic of a

dynamic knowledge commercialisation is mutual interdependence. However, the above studies evidence that the different actors often tried to exert their salience, creating an asymmetric power. This competition of power had the ability to influence actors' willingness and behaviours in all stages of the knowledge commercialisation process. Therefore, this study addresses power relations in contracted research projects involving three actors.

### 2.3.2.6 THM, Fragmentation, and Bureaucracy

As aforementioned, THM assumes a final convergence of the three actors. Etzkowitz and Leydesdorff (2001) state that one of the sources of contextual transformation is the transition from vertical to lateral modes of coordination and interaction through creating horizontal networks and shrinking bureaucratic layers. Correspondingly, this transformative change requires a structural change in the institutional settings of the three spheres. However, as discussed hereafter, many empirical studies provide evidence that the scope of university knowledge commercialisation is constrained by the issue of fragmentation associated with bureaucracy**.** This consequently causes rigid boundaries, hierarchy, and limits the scope for consensus, which is indicated as one of the main prerequisites for innovation development (Etzkowitz and Carvalho de Mello, 2004).

Some scholars (e.g. Saad et al. 2008, Intarakumnerd and Cristina, 2007, Saad and Zawdie, 2005, Intarakumnerd, et.al. 2002) pointed out the emergence of such issues within developing countries. They argue that although some countries have been successful in broadening the scope of their science and technology policy to cover 'innovation', through having/applying selective intervention policies from the West for particular sectors/clusters, they faced several obstructions in transferring policies into practice. This is mainly due to the deep-rooted fragmentation of these countries' innovation systems. Fragmentation can be related to bureaucracy. Saad and Zawdie (2005), for instance, identify that institutional and organisational fragmentation has been a problem, militating against the process of transferring the THM in developing countries. They claim that there are a lot of improvements to be made before

TH can be considered to be effective as a strategy of innovation. The countries still lack a well-articulated relationship between university–industry–government. A major factor behind this is the persistence of bureaucracy, which, by drawing rigid boundaries between different organisations, accounts for institutional spheres operating in relative isolation and sometimes competing against each other. In the same vein, Saad et al. (2008) found that fragmentation associated with bureaucratic character is one of the key factors that constrained the knowledge commercialisation process from translating into the development of innovation initiatives. It prevents interaction within and between the three institutional spheres and perceives these spheres as something to be relegated to a passive role in the processes of knowledge commercialisation. Moreover, decision-making at the level of an organisation depends on directives and instructions coming from the top. Initiatives aimed at establishing interactive linkages with external agencies are not considered to be an important part of most organisations. Thus, the traditional approach followed by actors within organisations is inadequate in resolving problems. In general, within the knowledge commercialisation system, and without specifically referring to the THM, a similar notion is expressed by Inatrakumerd and Cristina (2007), who found that fragmentation, is caused by network problems. The poor linkages between institutional spheres caused a lack of a clear and shared vision of policies, as well as inactivity in the process of policy formulation, due to the problem of locking in old logics. Their mind-sets are very much preoccupied by the deep rooted concepts of the linear, hierarchical rigid models of interaction (Chaminade and Vang, 2006). The outcome is a policy that, although is moving in the right direction, hardly tackles the identified systematic, micro-level problems in practice. Van Buren et al (2003) argue that as long as there is a lack of interaction, actors' actions are fragmented and problems will only be solved independently. In reality, what actors face are 'joined-up' problems which cannot be simply separated and divided. These problems are often 'cross-boundary' and cannot be solved by one sphere independently. Thus, the

nature of bureaucratic structure falls short when facing cross-boundary problems.

Given the above, it can be argued that fragmentation is rooted in the internal characteristics of bureaucracy. Central to the THM is the commercialisation and use of knowledge through networking within and between organisational and institutional spheres with the view to establish common purposes and goals. However, some studies identified that the activities undertaken within the University-Industry-Government link system have been affected by institutional bureaucracy. The organisational character of most institutions, even industry and universities, bears the features of bureaucratic culture. In this respect, many scholars have pointed out the bureaucracy issue within universities (e.g. Valentin, 2000, Siegel et al., 2003, 2004, Litan et al., 2007, Arvanitis et al. 2008, Philibin, 2008, Huges. 2011, Kaymaz and Eryigit, 2011, Dezhina, 2012, Bradley et al, 2013). Siegel et al. (2003, 2004), for instance, conducted research on problems arising out of university knowledge commercialisation and defined several problems. They interviewed participants from five US, non-top-tier group, universities. The scholars define several problems and one of them is ‘’bureaucracy and inflexibility of university administrators’’ (Siegel, et al., 2003, p.118). Bureaucracy and inflexibility is defined as a serious barrier to knowledge commercialisation by both industry (80%) and academic scientists (70%) (Siegel et al., 2004). The same issue was highlighted by Hughes (2011). He found that due to bureaucratic structure, technical exchange did not take place in the most analysed interactions. In this respect, Litan et al. (2007) found that although the Bayh-Dole Act of 1980 was a constructive step forward, giving the new rights to universities has given rise to new layers of administration and often bureaucracies. Instead of implementing broad commercialisation strategies, many universities have channelled their knowledge commercialisation activities through a centralised Technology Transfer Office (TTO). This explains the bureaucratic inclination to achieve order and control. A similar notion is expressed by Kaymaz and Eryiğit (2011) who identified bureaucracy and the inflexibility of universities’ processes and policies as a

barrier to knowledge commercialisation between academia and industry. They found that the bureaucratic structures of public universities seriously slow down the decision-making process. Bureaucratic hindrances experienced and faced in the mutual relationship with industry slowed down the rate of knowledge commercialisation and increased the time taken to complete the projects.

Although some scholars (see Weber, 1947, 2009, Van den Belt and Rip, 1987, Ozlos, 2013) pointed out the positive effect of bureaucracy, in which they emphasized the role of government in constructing and controlling the growth of innovation, many empirical studies pointed out its negative impact on U-I-G interactions. Decision-making, at the level of organisations characterised by bureaucratic structure, is dependent upon directives coming from the top. Initiatives aimed at creating interactive links with external agencies are not considered to be an important part of the culture of those organisations. In this vein, Saad and Zawdie (2005), for instance, found that knowledge commercialisation can be supported strongly by the active role of university and industry, but the issue is that they themselves still perform less, lack autonomy, and remain reliant on the central government. The range of activities generated by U-I linkages and the benefits resulting from these linkages are constrained by the fact that both actors are distant due to being independent players. They operated under government control and relied on decisions made for them at the centre. Despite that, many U-I linkages were created, largely, these linkages proved to be an extension of government bureaucracy, rather than the dynamic institutional mechanism envisioned/predicted by the THM for stimulating the process of knowledge commercialisation. A similar notion is expressed by Chaykina (2012) who found that the control of government and the oversized bureaucracy mechanism of interaction unbalanced U-I-G linkages. The interaction was not correlated with other policies that created difficulty in their implementation. Policies struggled with abridged approaches and were constrained by bureaucratic, institutional barriers. This created obstructions and a high level of resistance by the interacted organisations, as all transformations were top-down. As U-I-G interactions are organized by the central government,

these two studies explain the statist model of Triple Helix since the bureaucracy of state is still dominating.

From the above, the context with highly bureaucratized structures of actors, especially university and government, results in fragmented governance of knowledge commercialisation. This constrains transferring the adopted successful policies from the West into practice. This also makes the actors' networks strive to be undertaken in a context of undefined roles and relations. Additionally, because of insufficiency of communication channels and cooperative frameworks, the involved partners are not willing to come together collectively. Collective action is based on a high degree of interaction between parties. However, this is not the situation in a bureaucratic structure, in which the actions within the knowledge commercialisation process are scattered within and across organisations. Smooth interaction and joint outcomes don't occur by themselves, which makes decision-making unstructured. This study analyses and addresses this issue by presuming that bureaucracy is a logic constituting interaction that is taken for granted, since it considered as a fundamental legitimating element in practices. In other words, the logics of bureaucracy are possibly providing a pre-reflective base for enacting organizing practices. This indicates that little efforts are required to organize collective actions or activities.

### 2.4 UKC and Intermediation Mechanism

In the context of knowledge commercialisation, the intermediation mechanism can be described as the **''**co-alignment (i.e. the process of bridging, attuning, matching, bundling and, eventually, inter-braiding) of the specific research knowledge, technology, creativity and other innovation assets, as well as of the specific participatory interests, of each of the university-industry-government'' (Reich-Graefe, 2016, p. 6). It facilitates and implements the sources of cooperative and interdependent innovation processes since none of the institutional actors are self-sufficient in commercialising knowledge.

However, although the above sections discussed the potential of institutional logics contradiction between academic and capitalism and between the Triple Helix actors, as well as fragmentation, in hampering the interaction within university knowledge commercialisation, both perspectives provide modest practical directions on how to bridge differences and nurture cooperation through an intermediation mechanism. The THM, for instance, doesn't pay sufficient attention to the role of intermediaries (Howells, 2006, Pollard, 2006), though the significance of bridging organisations has been recognized (Suvinen et al., 2010). Undoubtedly, the conflicts associated with logic differences call for intermediation to connect institutional systems that otherwise would not easily come into contact with each other (Yusuf, 2008, Swan et al, 2010, Lundberg, 2013).

In spite of the acknowledgement that actors are exposed to different and potentially conflicting logics, there is still relatively little explanation about the ways of how to manage such conflict at the micro-level (Greenwood et al, 2011). Although the interest of exploring this area is growing (e.g. Reay and Hinings, 2009, Suddaby and Leca, 2009, Lawrence and Suddaby, 2006) no attention has been given to intermediating activities. Rather, these studies focused on identifying generic ways by which the bridging of logics occurs. They also do not elaborate on the micro-level interactions and justifications that bring about intermediation in specific situations. This is in part because the instituional logics perspective has not, to date, provided the conceptul tools to assist and demonstrate how conflicting logics are resolved at this level (Cloutier and Langley, 2013). Furthermore, although some scholars (e.g. Bourdieu, 1984) consider the role of intermediaries as being important for economy qualities, their work does not specify the role of intermediaries in knowledge commercialisation between organisations (Callon et al, 2002). A recent study conducted by Virani et al. (2016), in which they examined intermediaries as dynamic processes of transformation and translation. Yet, they focused on the role of culture intermediaries at the macro-level. This study addresses these issues by darwing on the literaure of innovation intermediaries. Such literaure

helps in revealing how the role of intermediaries enables bridging different logics at the micro-level.

Literature on intermediation is mostly established in the context of innovation intermediaries (e.g. Howells, 2006, Klerkx and Leeuwis, 2009, Stewart and Hyysalo, 2008, Kivima, 2014). Intermediaries can be defined generally as an "organisation or body that act as an agent or broker in any aspect of innovation process between two or more parties" (Howells, 2006, p. 720). Stewart and Hyyslao (2008), for instance, define them as "actors who create spaces and opportunities for appropriation and generation of emerging technical or cultural products by others who might be described as developers and users" (Stewart and Hyysalo, 2008, p. 296). Furthermore, more developed empirical studies tackling intermediation and intermediary organisation exist in the related research fields of innovation and knowledge commercialisation intermediation (e.g. van Lente et al., 2003; Hoppe and Ozdenoren, 2005, van der Meulen et al., 2005, Howells, 2006, Kodama, 2008, Gassmann et al., 2011, Hakanson et al., 2011, Suvinen et al., 2010, Kivimaa, 2014, Villani et al., 2017, etc.). Thus, the aim of this section is to critically review some of these empirical studies concerning the importance and effects of intermediaries in university knowledge commercialisation. The review focuses on exploring the reasons why intermediaries are necessary and the role played by them in facilitating and governing the university knowledge commercialisation process.

The effect of an intermediary is captured in Hoppe and Ozdenoren's (2005) study, in which they explore the role of intermediaries (i.e. TTOs) between producers and users of new inventions. They demonstrate that users' uncertainty about the profitability of investing in new inventions generated a basis for intermediation. An Intermediary provides a chance for users to spend less as per its expertise in evaluating the value of inventions and matching the profitable ones with potential investors. Such expertise assists users in getting the opportunity to be exposed to asymmetric information. In a similar vein, and with regards to reduction of costs, Kodama (2008) studied the way in which an

intermediary organisation has supported U-I links. Intermediation was done by reducing research costs through providing universities and industry with information about the potential partners to collaborate with, providing partners with opportunities for face-to-face meetings and, at times, coordinating joint R&D projects to bring together universities' researchers and firms that have the resources and technology necessary for the specific research topics being pursued. It was also done by reducing the bargaining costs of coordinating and negotiating activities, specifically those including asymmetric information. As the projects are coordinated by top-management of the intermediary organisation, a sense of trust was fostered in the firms participating in the projects. Additionally, the intermediary assists firms in obtaining resources that are needed but lacking to promote linkages with universities. They provide assistance in applying for government funding schemes, to recruit HR, and secure necessary research equipment. This helped in mitigating the uncertainty arising from new business activities. These two studies give evidence that by actively pursuing intermediation using different instruments, the intermediary organisation has demonstrated how much an intermediary can accomplish. They try to understand and ease the bottlenecks of U-I links; induce cooperation among universities, industry, and local authorities, in addition to winning the support of the central government.

Furthermore, and with regards to actors' conflicting logics, some studies explored brokerage activity as a form of innovation and knowledge intermediation within not-for-profit innovation intermediary organisations. Håkanson et al. (2011), for instance, found that an intermediary can assist in engaging various parties individually to obtain their inputs to ensure confidentiality for both parties, as well as assisting them in discovering more commonality in their needs and interests than they had been able to achieve among themselves. The intermediary does not only collect relevant information but also identifies new opportunities for cooperation between various parties. From the scholarly point of view, such intermediation is achieved through match-making and mediation. In 'match-making', the intermediary connects

previously unconnected individuals with one another in situations where individuals themselves are unable to identify and realise the profits and potential interactions of mutual cooperation. By its connection to different organisational groups, the intermediary generates value by bridging 'structural holes', brokering contacts between individuals who are not previously aware of one another. Connecting individuals from different organisational fields opens possibilities for 'knowledge arbitrage' through new combinations of existing knowledge (Burt, 2005). Its ability to perceive opportunities for creative knowledge exchange across unconnected agents is illustrated by the cooperation instigated between user and producer. In 'mediation', an intermediary assists partners in exploring the benefits of cooperation and information exchange without disclosing their interests and plans before a contractual agreement. This helps in avoiding the transaction costs of disclosing confidential information. The intermediary acts as a credible insider by ensuring the involvement of the right people in the discussion from the start. Match-making and mediation assist in closing the innovation holes in the context characterised by logics incongruence. Searching for a partner match across industry and disciplinary boundaries assists more effectively than individual actors acting on their own.

Similar findings are evidenced recently from Villani et al's (2017) study, in which they show the role of intermediary organisations in addressing the fundamental issue of bridging the different logics of academia and industry. Their study demonstrates that the mission of bridging both the academics and industrial worlds, and intermediating organisations such as Technology Transfer Offices (TTOs), University Incubators (UIs), and Collaborative Research Centres (CRCs) almost entirely focus on simplifying bureaucracy and investigation activities, which demonstrate distinctive activities for reducing cognitive proximity. They assist in addressing knowledge commercialisation issues during the conceptual stage of U-I collaborative research as well as in assessing the feasibility of knowledge commercialisation. In this initial stage academics and firms are usually looking for sense-making triggers and need to face new logics.

Intermediaries were found to be well situated in reducing cognitive distance as they can facilitate knowledge commercialisation activities through joining together individuals from various worlds and reconciling different logics at this initial stage. They are also very helpful in the later stages of the process through managing and monitoring more intangible and organisational activities. They assist in improving and correcting individuals' ways of understanding how to approach the entire University Knowledge Commercialisation process and provide guidelines appropriately.

Some empirical studies examined the role and benefits of intermediaries within the context of Triple Helix Model (e.g. Johnson, 2008, Lundberg, 2013, Todeva, 2013, Reich-Graefe, 2016, etc.). They argue that intermediate organisations exist primarily to support collaborative R&D between Triple Helix Model members. For instance, Johnson (2008) found that intermediates provide a unique governance structure for the management of collaborative R&D projects. One of the crucial roles played by the intermediating organisation in managing THM projects was as a mediator or arbitrator in cases of conflict and dispute where intervention is required. Such role is significant within the setting of R&D projects and innovation networks where various actors from different organisations must cooperate with one another when problems emerge. For example, the intermediating organisation assisted in saving the accomplishments of a project that technically was successful through negotiating the terms of R&D projects including IP rights with the members. This helped in mediating disputes, eventually acting as an arbitrator. Another role played is as a sponsor and distributor of funding for innovation efforts. The Intermediating organisation solicits funding from government through submitting proposals for public funding. Hence, the intermediating organisation works as a mediator between government and agents. As a sponsor, it ensures that the projects are properly managed financially and that the project's budget is spent wisely through performing periodic reporting of progress and spending. An additional role is as a technology broker by acting as a repository of information regarding knowledge producers and as a channel between actors. It helped in

bringing various players together in developing and commercialising generated knowledge (i.e. new intelligent systems technology) between and among different organisations. Hence, it acts as knowledge brokerage resources whose consortium members are able to access in order to bring people and generated knowledge together. For example, its administrative managers deal with participants of different projects that they assist to support and supervise. Hence, those managers play a key role in knowledge commercialisation. They are in a position to bring different people together whenever they think that interaction is possible. Another study (i.e. Lundberg, 2013) provides empirical evidence of how the role of an intermediary as a boundary spanner increased the inter-institutional interaction and coordination between politicians, academia, and firm managers, subsequently, achieving new interfaces and new forms of cooperation across sectorial boundaries. The intermediary acted as a catalyst, stimulating, facilitating, and coordinating the boundary spanning activities of the other actors. Such activities include: information brokerage; semantic translation; knowledge commercialisation; knowledge creation; resource pooling, and activation of interpersonal relationships. The activity of information brokerage was demonstrated through actively informing the vision and THM cooperation in meetings externally and internally at the sites of the members. This assisted in developing a common frame and increasing legitimacy among the three actors. In knowledge creation and commercialisation, the intermediary acted as a boundary spanner through smoothing, encouraging, and coordinating the practical interactions in R&D projects. It scanned, translated, and pooled ideas and converge interests in particular projects. It also facilitated knowledge co-production through building relevant networks in the member firms and universities' academics, and semantically translating domain-specific knowledge, consequently bridging the various involved cultures. In addition to creating conditions for improved cognitive closeness, the intermediary facilitated the development of interpersonal relationships between the Triple Helix actors through ensuring the interactions of all individuals and helping them to get to

know each other in various settings, such as on the governing boards and in R&D projects.

The role and benefits of intermediaries in the THM approach was also examined within the context of developing countries, in which the THM knowledge network is considered as an evolving phenomenon. Although there have been many policies established for promoting university-industry cooperation, the U-I interaction to date has been driven through personal initiatives and on an ad hoc basis due to gaps and shortfalls in the development of institutional capacity within developing countries (Saad et al 2008, Saad and Zawdie 2005, Nakwa, 2013). To mitigate such shortfall, and in order for developing countries to benefit from a combination of the activities of knowledge production and appropriation, many scholars (e.g. Intarakumnerd et al., 2010, Nakwa, 2013, Nakwa and Zawdies, 2015, 2016, Intarakumnerd, 2013, Watkins, 2014) focused their attention on the role of intermediaries in knowledge network development to mitigate the systematic failures of institutional rigidities and fragmentation of activities in the domains of knowledge production and appropriation. Intarakumnerd et al. (2010) examined the role of a successful intermediary governmental funded program in creating and strengthening Triple Helix relationships to mitigate systematic failures in developing countries. They found that the intermediary played a role in matching expectations of firms with capabilities and limitations of the universities' researchers, building trust between two actors, solving problems that emerged during collaborative projects, and fine-tuning different expectations of both sides. Nakwa and Zawdie (2015) found that the active participation of various actors in Triple Helix networks depends on the availability of intermediaries and their effectiveness as a catalyst accelerating the development of knowledge networks among all actors. They considered intermediaries as policy vehicles for network development by the bridging, and closing, of structural holes that disconnect actors in the Triple Helix network (Burt, 2000, 2001, 2004, 2005). From their point of view, structural holes, caused by the absence of well-developed networks, leave actors disconnected and assigned according to their

institutional groups, and without network safeguards, structural holes create barriers against knowledge commercialisation which add to the transaction costs of actors and make them rather reluctant to cooperate. They found that intermediaries help in transforming inter-firm networks into Triple Helix networks through bringing other institutional actors (i.e. universities and governmental agencies) together. Within this transformation process, the intermediaries enhance network development, as sponsors, through providing funds and guidelines in order to create collective actions for trust building. This way they could close internal structural holes as some firms cannot afford investments. They also bridged external structural holes by promoting the case for investment in HR development, equipment, and machinery as a strategy to reduce cognitive differences or distance between actors within different institutional spheres. Intermediaries also worked as brokers by closing and bridging structural holes that disconnect network players, in other words, through linking actors and building knowledge commercialisation mechanisms. Furthermore, they worked as boundary spanners, facilitating knowledge circulation through providing operational services, such as facilitating the exchange of tacit knowledge of actors; converting tacit knowledge shared by players into explicit knowledge through socialising; assisting in advancing technological capabilities of network players across boundaries through reducing cognitive differences and substituting them with ties, hence encouraging integration of the diverse knowledge components/elements of heterogeneous actors; and finally assisting in commercialising newly integrated knowledge, hence generating economic values via internalisation, in other words, through making individuals accept others' norms and values through socialisation.

However, these studies also pointed out some challenges. Although some network development and knowledge commercialisation was facilitated by the intermediaries, the extent of this has not been adequate enough to produce dynamic Triple Helix networks. There is still limited networking experience, weak social capital among THM actors, and a lack of trust among potential network players. The role of intermediaries is as boundary spanners and

brokers that mitigate such issues constrained by cultural barriers, administrative bottlenecks, and absence of consistent and relevant policy provisions and support. For instance, network development through intermediating is still determined as government-driven and a top-down initiative, rather than a bottom-up and grassroots initiative. Intermediaries would be effective when they are positioned/placed in the bottom-up, rather than the top-down, culture of decision-making (Nakwa and Zawdie, 2015, 2016).

### 2.5 UKC and Networking mechanism

The university-industry links manifest themselves as network relationships. Some scholars (e.g. Perkmann and Walsh, 2007, Lee, 2011**,** Powell and Grodal, 2005**)** argue that these relationships are initiated and maintained as either formal networks (i.e. formally established inter-organisational arrangements spanning different organisations) or informal networks (i.e. interpersonal networks between individuals). The importance of formal and informal networks as mechanisms for knowledge commercialisation processes is inherent in the nature of knowledge creation as socially embedded processes. Knowledge creation hinges on the capacity to manage and coordinate the exchange of complementary pieces of knowledge possessed by a diversity of actors between organisations. Networks are not only considered as mechanisms that coordinate transactions (i.e. relations and negotiations), but also as vehicles that facilitate the commercialisation of knowledge (Korotka, 2015). Thus, this section focuses on discussing the importance and benefits of networks (formal and informal) to university knowledge commercialisation.

Many studies (e.g. Okhuysen and Eisenhardt, 2002, Perkmann and Walsh, 2007, Hermans and Castiaux, 2007, Vlaar et al., 2007, Lee, 2011) give evidence on the importance of formally established networks in university-industry R&D projects. Hermans and Castiaux (2007) found that the formal networks (i.e. collaborative research projects) established between firms and academic researchers enable further knowledge commercialisation. They allow the industry to decrease information asymmetries, counting on tacit, new

knowledge, thus knowledge becomes usable and useful. In addition, Perkmann and Walsh (2007) found that knowledge commercialisation results, primarily, from formalised arrangements, even when informal interpersonal networks act as precursors and continue to strengthen organisational-level relationships. This is particularly important at a time when universities and industry grow to be aware of the value of knowledge commercialisation. For instance, Feller (2005) determined that universities become aware of the importance of their IP and are eager to guarantee the development of protective formal mechanisms when academics collaborate with industry. Hence, the formalisation of network governance is crucial. In support, Vlaar et al. (2007) found one of the most important effects of formal inter-organisational partnerships to be intensified governance over university knowledge commercialisation. They argued that partners' activities become disorganized, random, and infrequent without a formal structure, resulting in unsuccessful organized activities. Formal inter-organisational partnerships contractually function through careful matching to instigate research projects, define the IP rights and the responsibilities and roles of partners, and stimulate stronger commitment to the projects by all partners, all of which have contributed to the success of R&D projects. In a similar vein, (Lee, 2011) investigated the way in which inter-organisational relationships, particularly university-industry alliances, are managed and examined for their impact on joint R&D projects. He found that as inter-organisational relationships are being equipped with formal contractual agreements, specialised/professional coordination, university and industry commitments, and formal evaluations systems, they enable partnered parties to initiate more explorative research and establish larger scale R&D projects. In more detail, different from informal and interpersonal networks, they assist firms in enhancing their ability to explore knowledge that generates future good returns. They also enable firms to overcome local searches through intensive search-and-match activities by specialised coordinators and technology exchange mediums. The coordination activities result in identifying novel search areas as well as establishing new informal, interpersonal networks. This assists firms in

facing the shortcoming of interpersonal networks and offers access to wider knowledge sources within universities. In addition, the problems faced by industry are multifaceted and cannot be addressed through a single discipline. Inter-organisational alliances resolve such issues by giving high priority to firms' strategic interests over relationships. Their specialised coordination assists academics from different disciplines in joining a project team to reach common research goals that match with industrial partners' interests. Moreover, as the team grows in size, the formalisation of governance provides industry with strong protection against possible opportunism.

However, some scholars highlight the negative effect of formalised arrangements in university knowledge commercialisation. Boschma (2005**),** for instance, argued that the implementation of successful university knowledge commercialisation requires flexibility and formally, hierarchically organized networks are unlikely to provide such flexibility. Too much hierarchy results in a lack of interactive learning, as such, networks locked-in specific exchange relations, in which asymmetric relations, arising from the power of partners in the network, may lead to hold-problems, or commitment problems, creating a high reliance on relationship-specific investments in both communication and understanding. For example, a specific form of transaction, such as the type of research outcomes and time-scale of research projects, cannot be determined with certainty beforehand. Furthermore, although he highlighted the benefits of formal inter-organisational alliances over informal networks, Lee (2011) found that inter-organisational alliances create strong isomorphic pressure between universities and industry due to fierce competition for research funds. This makes partners rush into alliances without creating mutually clear and defined goals. As financial commitment is not preconditioned for both, the alliances are much less rewarding. Also, as successful positive loops fail to become established in the early stages, alliance activities rapidly wane due to conflicts of interest. For instance, the scholar found that, although the generated knowledge is jointly owned by the firms and the university, firms still claim exclusive IP rights to gain a more competitive advantage.

Therefore, many scholars emphasize the importance of informal networks as a significant form of governance within university knowledge commercialisation. Cohen et al (2002) and Bekkers and Freitas (2008) found that informal contacts, as a common form of interaction between universities and industries, play an important role in commercialising knowledge to industry. The technology was developed faster as interdependent knowledge was adopted through a bidirectional exchange of information. In this respect, some empirical studies (e.g. Zucker et al., 2002, Agrawal, 2006, Lee et al., 2010) found that informal, interpersonal networks persist to work as a significant form of governance within university knowledge commercialisation, especially when the accumulation of academics' experiences and skills in the research process are difficult to codify. Interpersonal interactions play a vital role in commercialising such tacit knowledge as well as encouraging mutual learning across organisational boundaries. This is evident from Agrawal's (2006) study, in which he examined licensing strategies that directly engage inventors. He found that the likelihood and degree of commercialisation success increase when the firms exploit latent (uncodified but codifiable) knowledge through interpersonal networks by engaging inventors directly during the development phase. Similarly, Zucker et al. (2002) found that the research articles that were jointly written by the universities' scientists and the firms' scientists are considered to be a robust detector of tacit knowledge capture by firms and a strong predictor of firms' success. The development of such articles was initiated informally by the universities' scientists as a way to take charge of their discoveries. This helps firms to communicate new discoveries with less cost through capturing sufficient knowledge, consequently increasing the number of patents. The overall importance of informal interpersonal networks implies that working jointly is a critical commercialisation mechanism when knowledge has large or significant tacit elements/constituents.

Moreover, the significance of informal networks, as a form of governance within university knowledge commercialisation, is emphasized by other scholars (e.g. Slavtchev, 2013, Korotka, 2015) who examined the facilitator for U-I partnership

through measuring different proximity dimensions (i.e. cognitive, organisational, institutional, demographic, and social). For instance, Slavtchev (2013) explored the attitude of academics towards partnership with business. By taking organisational proximity as a measure (i.e. evaluating the extent to which individuals have autonomy and exert control within a network), he found that informal networks are important for academics. It assisted them in controlling innovative projects more effectively as communication was more flexible in comparison to formal networks (i.e. initiated formally by universities through TTOs). Red tape, bureaucracy, and formal obligations were less involved. It also guaranteed access to complementary sources of information and resources for knowledge production. More interactive learning was achieved as partners had the autonomy to shift from one strategy to another.

Given that university knowledge commercialisation can be governed successfully by the establishment of informal networks, more experienced actors are likely to participate in collaborative activities. In this respect, many scholars (e.g. Schartinger et al., 2001, Giuliani et al., 2010, Haeussler and Colyvas, 2011, Landry et al., 2006, Bekkers and Freitas, 2008, D'Este and Patel, 2007, Landry et al., 2006, etc.) found that academics' satisfaction and industry satisfaction from past experiences play a key role in encouraging their interactions. Thus, past personal networking counts. This is supported by Bekkers and Freitas's (2008) observation that previous experience with commercialisation, patenting, or venture creation increases the likelihood of academics' participation in collaborative activities with industry. They found that the more knowledge can be written and published, the more important it is for informal contacts to be considered as a form of knowledge commercialisation between universities and industry. Also, the more knowledge is interdependent and related to systems, the more informal contacts are expected to be important. Other studies (e.g. Landry et al., 2005, and D'Este and Patel, 2007) show that the propensity of researchers to further engage in a variety of interactions with the business sector is explained by their previous, routine involvement in industry interactions. D'Este and Patel (2007) found that in

order to enhance the process of interaction, academics utilised previously established informal networks in opposition to the formal knowledge commercialisation institutions, such as TTOs, which only support academics by concretizing and specifying their interactions with industry through securing their interests in negotiations. The academics' ability to 'network' has a positive effect on their tendency to more willingly cooperate with industry, than the quality of their research.

Furthermore, previous experience plays a major role in university-industry interactions and often constitutes both a precursor and a successor for formal linkages (Faulkner and Senker, 1994). Hermans and Castiaux (2007) found that academics and firms used their already established informal relationships during the formal collaboration, subsequently enabling further knowledge commercialisation outside the project framework. This is in line with Sing's (2005) findings pertaining to interpersonal collaborative networks as a determinant of knowledge flows. He explained the extent to which empirical patterns of knowledge diffusion can be explained by the fact that academics and firms have close interpersonal ties. The influence of organisations' boundaries on knowledge flow decreases once interpersonal networks have been accounted for (as actors already have close networks). This provides evidence that interpersonal networks are an important determinant for knowledge commercialisation between academics and industry.

## 2.6 Chapter Conclusion

This chapter has critically reviewed the literature on important concepts and constructs related to the UKC process. Such review allowed the clarification of important research issues and the identification of critical knowledge gaps in the literature.

The review clarified the notion of SI and its relevance for the study and the understanding of the KC process. The key concern of SI in analysis is how and why institutions matter, which is the main theme of this study, particularly, the analysis of how actions of multiple actors are shaped and influenced by

institutions. One nuanced approach of SI, that explains and defines the content and meaning of institutions, is the ILP, in which institutions (i.e. rules and norms) are perceived as standards of appropriate behaviour for actors within a given identity (university, industry, and government). Hence, this study considers ILP as an analysis tool beneficial for studying multiple logics, both conflict and consensus, through exploring the impact of logics in shaping actors' institutions within the micro-level interaction of KC (i.e. knowledge production and appropriation of contracted R&D projects) - a situation with multiple, co-existing, and potentially conflicting logics. However, some issues were observed. ILP doesn't sufficiently address both the micro and macro levels of context. Most of the earlier studies on institutional logics focused on the macro, rather than the micro-level of interaction. Despite some studies (e.g. Zilber, 2002, Reay and Hinings, 2009, Battilana and Dorado, 2010) attempting to fill the gap, many empirical studies on multiple institutional logics have continued to focus more on the macro-level (Cloutier and Langley, 2013). Moreover, their work of determining institutions at the macro-level has been criticised for its Western focus (Greenwood et al., 2002, Thornton and Casio, 2008). This study rectifies such issues by giving emphasis on micro-level processes, and particularly the way in which multiple actors draw on the institutions associated with interactions involving different institutional worlds within a non-western context, that is, a developing country. More significantly, despite ILP scholars' assumption that the action of an actor within an interaction is guided by institutions (Thornton et al, 2012, Lauren, 2016); they neglect the link between power and institutions. As such, this study is not aware of any other empirical study that has examined such a link, consequently this research follows a novel approach by calling for the need to integrate power with institutions, and viewing their causal sequencing on KC. Arguments were adopted from two general institutional scholars (i.e. Schmidt, 1987 and Samuels, 1971), which will provide a good tool for this study's analysis.

The review of literature also captured theories and research streams relevant to UKC. AC and the THM were reviewed critically through the lens of ILP. The

role of actors and institutions was interpreted where conflicts between logics were identified. Although, there has certainly, been a large volume of published research in this area and research indeed examined the impact of such conflicts, critical gaps were still observed. **First**, although THM scholars emphasize the coexisting of diverse institutional logics in the context of knowledge commercialisation, they do not provide proper justifications for how to, methodologically, explore the implication of conflicting logics (Lu, 2007, Sohn et al., 2009) at the micro-level interaction (Viale and Pozzali, 2010, Fogelberg and Thorpenberg, 2012). More importantly, the empirical studies examined the way in which UKC have focused either primarily on universities (McClure, 2014) or enterprises, infrequently both (Ankrah et al., 2013), and have hardly ever explored the implication of the existence of multiple actors, often possessing different logics. This again obscures the implication of potential for conflict of different logics between diverse actors on the effectiveness of university knowledge commercialisation. These two gaps demonstrate that THM and studies in UKC provide modest practical directions on how to bridge differences and nurture cooperation between actors. They don't pay sufficient attention to the role of different mechanisms that surround and exert direct or indirect effect/influence on knowledge commercialisation. **This may obscure the potential for conflict of different logics between multiple actors and its implications on the effectiveness of UKC. Therefore, this study focuses on exploring the implications of mechanisms as potential solutions for bridging differences in institutional logics within the micro-level interaction of knowledge commercialisation.**

**Second,** THM's naïve and modest view of institutional and normative convergence between academia, industry, and government portrays it as the only institutional order surrounding all three spheres. This is similar to the mimetic isomorphism concept by which the concepts of THM, and its related activities, have come to be the template for action which generated unified or monolithic responses to uncertainty that might lead to isomorphism - a commonality in function and form (DiMaggio and Powell, 1983). This overlooks

the embeddedness of actors within different, conflicting logics (Thornton et al., 2012). Despite, and within the institutionalist literature, there is some research exploring the space between institutional logics (e.g. Furnari, 2014, 2016), very few empirical studies attempted to study the effect of M.I on UKC. **Hence, considering mimetic isomorphism as a potential mechanism in bridging differences in institutional logics promises fresh insights.**

**Third,** the implication of conflicting logics can be explained by the mechanism of power. Power is shaped by opportunities provided for actors to challenge conflicting logics (Thornton et al, 2012). When the institutions (i.e. rules) of a project are established through the processes of structuration appropriating logic over another, actors supporting that logic become more powerful. Actors who are in power often preserve their own logic as they have more control over decision making comparing to those without power. Thus, achieving synergistic cooperation is difficult as it requires the bridging of gaps between different logics. However, THM ignores incentives and power relations among actors (Hira, 2013). More importantly, **there are very limited studies on UKC pertaining to how power bridges differences in institutional logics. This calls for exploring the effect of power as a potential mechanism in bridging differences in logics.**

**Fourth,** undoubtedly, the conflicts associated with logics' differences call for intermediation (Yusuf, 2008, Swan et al, 2010, Lundberg, 2013). However, both perspectives (i.e. THM and ILP) provide modest practical directions on how to bridge differences through intermediation mechanisms (i.e. intermediary and networking). The THM, for instance, doesn't pay sufficient attention to the role of intermediaries (Howells, 2006, Pollard, 2006), though the significance of bridging logics has been recognized (Suvinen et al., 2010). ILP also gives relatively little explanation about the ways in which to manage such conflict at the micro-level (Greenwood et al, 2011). Though the interest of exploring this area is growing (e.g. Reay and Hinings, 2009, Suddaby and Leca, 2009, Lawrence and Suddaby, 2006), no attention is given to bringing about

intermediating within specific situations at the micro-level interactions. This is in part because the ILP has not, to date, provided the conceptul tools to assist the resolution of conflicts logics at this level (Cloutier and Langley, 2013). **Hence, there is a need to explore the effects of intermediation as a potential mechanism in bridging differences in institutional logics.**

**Fifth and finally,** the development of THM is a result of inductive theorizing based on successful knowledge commercialisation stories within a Western context. Although many followers have empirically examined THM in different national contexts (e.g. da Silva et al., 2012, Saad et al., 2008, Saad and Zawdie, 2011a, Zhou and Peng, 2008), these studies have attempted to employ the same model in their studies on developing or emerging economies, despite institutional differences (Pugh, 2014, Cai, 2015). **From this, an investigation into the implication of potential mechanisms (i.e. mimetic isomorphism, power, intermediation) that can be used in bridging differences in institutional logics within UKC and in the emerging economy (i.e. developing country) context gives rise to fresh insights.**

In light of the outcomes of the literature review, this study conceived and formulated research questions, which can potentially lead to filling the critical gaps identified above. The ILP will be the lens through which bridging mechanisms will be examined. As actors from various institutional spheres draw on different logics to direct their actions, the potential mechanisms that bridge differences in institutional logics are at the nucleus of this study and, as a result, they are the unit of analysis. Finally, the research is contextualised in the emerging economy (developing country) setting, that is, Oman. Therefore, the study's research questions are:

**The main research question is:**

What are the implications of power, mimetic isomorphism, and intermediation in bridging the differences in institutional logics involved in University Knowledge Commercialisation?

**The sub-research questions are:**

1. What is the effect of power in bridging differences in institutional logics?
2. What is the effect of mimetic isomorphism (i.e. transferring institutions from the West) in bridging differences in institutional logics?
3. What is the effect of intermediation and networking in bridging differences in institutional logics?

# Chapter 3: Research Methodology

Building on the research questions discussed and formulated previously in chapter two, this chapter provided an explanation of the research methodology adopted in this study, illustrating the research paradigm and study research design. This chapter also includes an explanation of the empirical research context that supports the analysis of this study.

## 3.0 Introduction

This chapter presents the philosophical stance, research design, and the relevant methods to empirically address the main question of this research, which is to investigate the implication of power, mimetic isomorphism, and intermediation (i.e. intermediary and networking) in bridging differences in institutional logics within the micro-level interaction (i.e. contracted research projects) of UKC.

It explains and gives insight to the researcher's philosophical stance. It describes the different research paradigms by examining their advantages and disadvantages as a way of justifying the selection of a specific paradigm as the appropriate approach for addressing this study's research questions. Additionally, this section describes the important elements of the overall picture of the selected research design. More specifically, it explains the ways in which the strategy of qualitative case study was carried out as well as the selected approaches through which the generated data was accordingly analysed. Additionally, this section presents an evaluation of the research process validity and reliability in reference to the limitations and ethical procedures of the case study method.

## 3.1 Research Philosophy and Research Approach

### 3.1.1 Epistemological and Ontological Philosophical Positions

Ontology is the nature of reality (Carson et al., 2001). Epistemology indicates the relationship between the researcher and reality or how reality can be known (ibid). These two concepts relate to philosophical paradigms and, jointly with research methodology and methods, are considered as core notions in social sciences (Eriksson and Kovalainen, 2015). Recently, the two paradigms that have been dominating most of the social science research are labelled as: positivism and interpretivism (Bryman, 2015).

In accordance with '**positivism** ontology', there is a single and objective reality to any research question despite researchers' beliefs (Carson et al., 2001, Bryman, 2015). Therefore, positivists adopt a structural method in performing research through initially finding a research issue, building research hypotheses and questions, and assuming an appropriate research methodology. Also positivists distance themselves from participants as a way to remain emotionally neutral in order to create clear differences between science and personal experience. They usually argue for making clear distinctions between facts and value opinions. They seek objectivity through sticking to particularly structured statistical research techniques in order to discover single and objective realities. Their main objective is to construct a free generalisation of context as they believe that human actions can be explained due to real causes that precede their behaviours (Smith, 2006).

In contrast, **interpretivism** believes that there is more than one reality and more than a single structured way of approaching these realities (Smith, 2006). The knowledge is generated from socially subjective and constructed interpretations (Carson et al., 2001, Bryman, 2015). Researchers' methods are open to meanings in human interactions and able to understand what is apparent as multiple realities. Therefore, interpretativists are more mutually interactive with their participants during data collection to construct a collaborative explanation

of perceived reality. They remain receptive to new ideas during the study and develop it with the help of the participants. This is due to their belief in human capability to adapt and in the difficulty of gaining prior knowledge of context and time bound realities (ibid). Hence, the main objective of interpretativists is to make sense and interpret human behaviour instead of generalising and predicting causes and effects. It is important for them to understand the reasons and motives behind experiences that are context and time bound.

However, the belief of positivism in generalising context by only explaining causes preceding human behaviour was found to be insufficient in justifying the undetermined social phenomena, or inherited explanations, that connect empirical events. Also, the interpretativists' rejection of the independence of reality from the human constructions of it contradicts their reliance on the key set of causal influences that occupy the context of interaction. These points towards the inadequacy of the ontological assumptions of both paradigms.

This inadequacy can be conceptualised clearly by the **'critical realism**' paradigm as it prioritizes ontology over epistemology. It believes that a proper epistemology is determined by the nature of objects such as structure and agency, rather than vice versa. Therefore, critical realists adopt a 'transcendental realism' argument, in which they perceive social activities through producing knowledge about the ways in which the objects' actions exist and act independently (Bhaskar, 2014). Hence, they ask what the social reality must be like in order for the actor's activity to be possible (ibid).

Since, and as will be discussed hereafter, this study has a coherent approach to the problem of agency (i.e. multiple actors) and the ontological status of structures and actions (i.e. their distinctive emergent institutional logics) within which they interact; it adopts critical realism as its philosophical stance. The phenomenon of University Knowledge Commercialisation will be seen through the lens of critical realism's main arguments in relation to the institutional logics perspective.

## 3.2 A Critical Realist Approach to Institutional Logics Analysis

The goal of this section is to understand the impact of actors' actions and the structures which they are embedded in without conflating them. Hence, it outlines a non-conflating model of institutional logics analysis through drawing on critical realism, particularly, Bhaskar's stratified model of reality. As shown in table 3.1 below, the empirical domain reflects actors' actions and their practical experiences. Researchers provide the actors' views of the world through discourse analysis. However, since actors are not always familiar with the existing institutions, researchers cannot get access to all institutions simply through interpreting what actors perceive and analyse. This is because some institutions may be taken for granted when they are well enforced by actors, without the actors actually perceiving them as institutions.

Thus, it is essential to place institutions in the domain of the actual. Institutions are self-producing repeated patterns of behaviour (DiMaggio and Powell, 1991). They ''gradually acquire the ontological status of taken-for-granted facts which in turn shape the future interactions and negotiations'' (Barley and Tolbert, 1997, p. 94). Ultimately, these taken-for-granted scripts can be reproduced by actors without them being totally aware of them and without questioning their legitimacy and efficiency (Scott, 1995). Yet, despite the fact that some institutions might be not perceived by actors, they do still exist in actuality. Hence, researchers can reveal and characterize repeated behaviours and qualify them as institutions (Leca and Naccache, 2006). This is the reason why institutions should be placed in the domain of actual.

In relation to this study's conceptual framework, although institutions shape actions, they are themselves embedded in higher-order institutional logics (Thornton et al., 2002, 2012). The institutional logics perspective explains and defines the content of institutions, in which the rules and norms are perceived as standards of appropriate behaviour for actors within a given identity (university, industry, and government). Thus, institutional logics are linked to structures

located in the domain of the real. As institutions are the rules of the game, institutional logics are the underlying, fundamental principles of the game (Leca and Naccache, 2006). Hence, as structures cannot be reduced to elements from the actual domain (Bahaskar, 2014), institutional logics cannot be reduced to institutions. In this respect, logics and institutions are considered to be interdependent but are empirically examined separately. This separation will bring greater explanatory power to the study. For more clarification, logics are hypothesized as exogenous to actors. Subject to actors' actions, institutional logics are clarified in the domain of the actual as institutions (Lounsbury et al., 2003). Hence, institutions are the consequences of the means by which actors transfer these logics through rules and norms within a specific context.

**Table 3.1: A stratified model of Institutional Logics Analysis**

| | Domain of the Real | Domain of the Actual | Domain of the Empirical |
|---|---|---|---|
| Institutional Logics | V | | |
| Institutions | V | V | |
| Experiences | V | V | V |

Source: Leca and Naccache, 2006, pg. 633

To act, actors have to use institutional logics, more particularly, their causal powers (Bhaskar, 2014) through either reproducing the pre-existent institutions or changing them. In order for actors to develop new models, they use the existing institutional logics which are the essential conditions of any action. Institutional logics do not represent a logical, coherent whole, as they could be either conflicting or complementary. This is explicitly true in university knowledge commercialisation interaction where three inconsistent logics exist (i.e. academia, industry, and government). The diversity of institutional logics describes a different cognitive world where actors can obtain principles to challenge new institutions and justify existing ones. Actors use them to justify the institutions they want to either establish or preserve.

**In conclusion,** ontological realism - what the world must be like for actors to be able to establish or preserve logics that influence knowledge commercialisation - helps in establishing a better understanding as it explains the actual process of KC by considering the perspectives and institutions of the actors who are involved in the same context as well as their decisions or actions, which are determined by different, potentially conflicting, logics.

### 3.3 Research Approaches

Research approaches are classified as quantitative, qualitative, or a combination of both, known as a 'mixed method' approach (Hesse-Biber and Leavy, 2010). A brief examination of these approaches will be given in the following sections.

#### 3.3.1 Quantitative Research Approach

The core of the quantitative approach is the notion that an objective reality exists independently of researchers. In this approach a phenomenon is investigated through the systematic collection of numeric/statistical data (e.g. numbers, percentages, graphs, tables, etc.). Research strategies that are used in this approach involve experiments and surveys along with typical data gathering methods such as questionnaires and structured interviews and observations (Bryman, 2015).

The quantitative researcher believes that reality can be accurately measured. This is in relation to its positivist and objectivist stance. Additionally, they are preoccupied with causality given that, as in natural sciences, causality can provide an explanation of 'why things exist the way they are' (Bryman, 2015). Moreover, they pay more attention to generalising the research findings. Therefore, in order to ensure research validity, the quantitative researcher should be able to generalise outcomes beyond the specific context in which the research was performed.

However, as argued by many scholars, the measurement processes of quantitative research might be either inaccurate or fake. The measure of

validity can be affected by the research instruments used. For instance, the questionnaire instrument, which is one of the powerful tools for collecting quantitative data, is subject to participants' interpretations. Thus, quantitative methods are likely incapable of explaining and justifying the perceptions and perspectives behind the participants' decisions and actions. This study is concerned with understanding the processes of knowledge transfer through the perceptions and perspectives of participants, and thus a quantitative research approach is not appropriate for this study.

### 3.3.2 Mixed Methods Research Approach

In the literature, mixed methods have been acknowledged by using many terms such as integrated, multi-methods, convergence, and combined. Simply stated, the application of mixed methods in a particular study is more specific because it involves the combination of both quantitative and qualitative methods. Researchers believe that mixing both approaches provides a better understanding of the research problems compared to each approach by itself. More specifically, they believe that the inherent biases of one method will cancel out or neutralise the biases of the other method (Creswell, 2013). Hence, the mixed method approach is suitable when a single approach (quantitative or qualitative) is considered insufficient for exploring a research problem. However, and as aforementioned, this study doesn't need to use quantitative methods/instruments to explore and understand how the processes of knowledge transfer are affected by different actors' institutional conditions and frameworks. Thus, the research approach of mixed method is not suitable to this study.

### 3.3.3 Qualitative Research Approach

In contrast to the above two approaches, the qualitative research approach gives emphasis to participants' perspectives and understanding of the subject of study. It relies on the use of texts, image data, and audio-visual materials rather than numbers (Creswell, 2013). It intends to establish a deeper and clearer understanding between researchers and their subjects of study (Hair, 2015).

Therefore, the key strength of a qualitative study is the ability to provide a multifaceted or complicated textual explanation for participants' experiences with regards to a specific research problem. It involves the human side of a research problem, thus, investigating opinions, beliefs, relationships, as well as the behaviours of participating individuals. In carrying out a qualitative study, many strategies can be used including case studies, ethnography, and grounded theory, while methods involve semi-structured and unstructured interviews, observations, and documentary, e.g. diaries, field notes, and journals (Hess-Biber and Leavy, 2010).

These qualitative methods are useful in exploring and justifying intangible factors (e.g. gender role, religion, socio-economic behaviours, etc.) that cannot be analysed by quantitative means. Hence, qualitative studies focus on attaining a complex and deep understanding of a particular social phenomenon more so than obtaining data that can be generalised to other populations and geographical settings. Additionally, the flexibility of the qualitative approach allows more freedom and helps in facilitating a better interaction between the researcher and the participants. Its investigations are mainly inclined towards asking open-ended questions in which it is not necessarily for the researcher to use the same words with every participant. Hence, participants are free to respond by using their own words. Their responses are likely to be extended beyond stating simply yes or no towards more explanation and elaboration. This gives the researcher the opportunity to ask 'probing questions' to reach a better understanding of the essence of the explored problem, which cannot be achieved through quantitative studies. Consequently, the qualitative research approach is most suitable for investigating the knowledge transfer processes through the participants' perspectives and beliefs.

### 3.3.4 Justifications for selecting the qualitative approach

This study aims to investigate the implications of the potential mechanisms that can be used in bridging the differences in institutional logics within University Knowledge Commercialisation. The understanding of this complex

phenomenon requires exploratory research based on a qualitative design. The research is contextualised in an emerging UKC institutional environment, which is Oman. The institutional governance of KC has only emerged recently, and therefore the relationships are impacted by the underdeveloped institutions of the divergent interacting actors. Also, as these actors are embedded within different institutional frameworks, their logics differ as they carry out the interactions. Therefore, as per these two reasons, the qualitative approach helped in obtaining rich and diverse accounts of UKC actions in Oman, which would have otherwise remained obscure.

Additionally, the qualitative approach supports the significance and legitimacy of the main goals of the philosophical perspective of critical realism adopted in this study (Robson, 2011). These goals include the understanding of actors' perspectives as real phenomena which are basic to social science research; using a process-oriented, instead of a variable-oriented, approach to explanation (Maxwell, 2004); emphasizing the significance of context for explanation; and lastly, explaining single situations and events by using an inductive flexible design through applying case study strategies, rather than basing explanations on regularities or universal studies (Savin-Baden and Major, 2013).

Also, despite the fact that a quantitative approach can integrate large samples and provide statistical verifications, it cannot explain a complicated phenomenon like UKC processes. The qualitative methodology, on the other hand, helped the researcher in becoming flexible through asking open-ended questions and probing the response of actors whenever necessary. This resulted in generating unpredictable findings for the researcher as participants' important matters were exposed clearly.

Moreover, the qualitative approach has been explained as being effective for examining institutions and logics. Museus and Harper (2007, for instance, pointed out the inapplicability of exclusive statistical analyses in assessing institutional effectiveness. Hence, they suggested a variety of qualitative

approaches in order to generate intense and instructive data to derive people's decision-making and actions. Finally**,** the selection of a qualitative methodology is justified more by its effective application in this research piloted study.

In summary, section 3.3 discussed the epistemological and ontological philosophical positions of this study. It justified the appropriate research approach. In the next section, a discussion of the study's research design will be given.

### 3.4 Research Design

In this study, the design of the research is represented by the overall framework that directs and guides the data collection and the process of inquiry throughout the analysis (Bryman, 2015). It is considered as the roadmap that describes how the study was conducted as well as the means by which it was conducted. Therefore, with regards to this study, the research design reflects the type of inquiry that dictated the logic of research as well as the research context.

Many scholars (e.g. Creswell, 2006; Yin, 2013) described various approaches of inquiry within qualitative research (some of these approaches are shown in table 3.2 below). This study used the 'case study' strategy. Hence, this section will start by giving a clear justification for selecting the case study strategy instead of other strategies to address the study's research questions.

**Table 3.2: Relevant situations for research strategies**

| **Strategy** | **Form of research questions** | **Required control over behavioural events** | **Focus on contemporary events** |
|---|---|---|---|
| Experiment | how, why | yes | yes |
| Survey | who, what, where, how many, how much | no | yes |
| Archival analysis | who, what, where, how many, how | no | yes/no |

| | | | |
|---|---|---|---|
| | much | | |
| History | how, why | no | no |
| Case study | how, why | no | yes |

Source: Yin (2013)

Though many scholars criticised the case study approach as being deficient with respect to producing generalisable outcomes, it is considered to be the most appropriate strategy for this study. This is due to many reasons:

First, the experiment strategy doesn't match with the study's research questions. The UKC processes emerge within a natural context rather than an experimental one. In fact, experimental methods are incapable of capturing and revealing the complications of actors' behaviour, particularly their decisions and actions. On the other hand, the strategy of case study, as per its ability to investigate a phenomenon as per its natural emergence, can explore complicated behaviours effectively (Yin, 2013). Through this, the researcher will not be under stress to change conditions or force control neither within nor around cases. Also the usage of archival and historical analyses is not suitable for this study, because the issue under study is considered as contemporary (is currently emerging in the context of inquiry). This calls for the need to use systematic interview techniques in order to acquire and capture the underlying casual powers of knowledge commercialisation actions and decisions.

Second, surveys aim at drawing and obtaining generalisations instead of focusing on particular details. They attempt to test hypotheses constructed from general theories regarding variables of economic or social units or relations among phenomena. This necessitates the development of assumptions in relation to how contextual variables function. Hence, by accepting generality and denying complexity, surveys are deemed an unsuitable strategy for exploring the complicated UKC processes. For instance, as shown in the literature review, the UKC processes are iterative rather than linear. Due to their numeric linear nature, surveys cannot capture the decision processes that influence bidirectional actions and activities within interactions. Additionally, the

depth of the contextual factors and issues of UKC processes cannot be explained by surveys. Thus, the usage of surveys in this study will limit the understanding of the dynamic or underlying forces of those processes.

Third, surveys need adequate samples to form a continuous aggregation of events, while case studies draw deep descriptive theories from rich information/data within multiple case designs (Yin, 1994). Hence, as per its ability to explain and justify complex actors' actions and decisions and the 'how' and 'why' research questions, and due to this study's nature of being contemporary, the case study approach is deemed the most appropriate strategy for exploring actors' multiple institutions and logics within UKC.

### 3.4.1 Case study as a research strategy in this study

A case study is a strategy of investigating "*a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomena and context are not clearly evident*" (Yin 1984, p. 23). In other words, and as this study focuses on understanding and examining thoroughly 'the institutions of multiple actors within KC processes of knowledge production and appropriation', such understanding includes important contextual conditions because they are highly pertinent to the processes. These conditions are related to the social and institutional settings of the actors involved.

However, it is worth mentioning that the case study approach is not supposed to be considered as a methodology choice, but rather should be regarded as a choice of what is to be studied (Denzin and Lincoln, 1994). Therefore, in addition to the above justifications, this strategy will be adopted for the following key reasons, which can be justified by the following two points:

### 3.4.2 Case study and critical realism

A qualitative case study is suitable for 'sticky' practice-based problems (Lu, 2007) in which actors' experiences are significant and the context (institutions and logics) of actions is crucial**.** In this study, the context of UKC will be examined while identifying actors' consciousness, intentionality, and

responsibilities (Knowler et al., 2007). More relevantly, UKC will be examined while identifying actors' logics and institutions, as a knowledge producer, user, or manager. Hence, actors' logics and institutions are interdependent but are examined separately, which is the main feature of critical realism**.**

First, and with respect to context, as maintained by critical realism, the elements of reality are considered as given by actors existing within a context located in space and time. This study focuses on analysing the influence of mechanisms on bridging multiple actors' logics on UKC and within an unexplored single developing institutional context that is Oman. A context-rich knowledge (Kim, 2012) will be produced by studying the contextual elements, such as institutions (i.e. rules and norms), within the pre-existing institutional logics of UKC in Oman. Furthermore, a qualitative case study helps in investigating a phenomenon within its real-life context of interaction (Yin, 1984). Thus, the process of UKC is influenced by the internal structure (logics) of the action situation in which interactions (contracted research) are regularized by a set of institutions (rules, norms) and governance forms and modes of organisation to put institutions into action. In this study, these forms are related to the potential types of UKC mechanisms that have the power to facilitate and manage the interaction between actors, more specifically, in bridging differences between logics.

Second, the case study approach is a multi-perspective analysis in which the researcher considers not only the perspective of an actor, but also the perspectives of the relevant groups of actors and the interactions between them. This supports the critical realist argument of considering actors as a mechanism, either for or against UKC, to be actualised or not. Although the above-mentioned structures (logics) and expected mechanisms have power over actors, they are still influenced by actors' logics which shape decisions and behaviour within interactions.

### 3.4.3 The role of the case study approach as a method

Though the two most dominant goals are exploration and theory building (Eisenhardt, 1989), case studies also have several roles in research. These roles can be classified as: explorative, theory building, theory testing, and theory refining or extending (Voss et al., 2002). Likewise, the design of the case study can be used to research questions that are, in nature, either: confirmatory, exploratory, or explanatory (Yin, 1994). In this study, the goal of the case study goes beyond any aforementioned single category. This study aims at accomplishing multiple goals involving informing, exploring, and explaining. Yet the main role of the case study research relates to the exploratory aspect, as this study intends to explore the implications of the potential mechanisms on UKC.

The research of 'exploratory case studies' is likely to be conducted in developing settings, in which the knowledge of the investigated phenomenon is inadequate to build a strong conceptual framework that can guide the investigation into the suggested research problem. The knowledge of KC is very limited within the setting of an emerging institutional environment, such as Oman, especially considering that the phenomenon is still in its infant stage (new and not yet developed). Even the existing literature in this area is not sufficient to establish a framework that helps in guiding the inquiry into how potential mechanisms influence the bridging of differences in logics within an emerging UKC institutional environment. Therefore, there is a need to conduct exploratory research through case studies in order to build a robust conceptual framework relevant to Oman's emerging institutional environment.

## 3.5 Case Study Strategy

There are, as suggested by Yin (2013), four types of case study designs: holistic-single case, embedded-single case, holistic-multiple cases, and embedded-multiple cases.

Generally, it is acknowledged that multiple case studies result in more rich and understandable findings than single cases (Erikson and Kovalainen, 2015). They enable case comparisons, which make them more desirable in exploratory research. A number of comparative cases allow patterns in the UKC processes of contracted research projects to emerge and to segregate significant descriptions of the processes and their underlying features. In other words, they allow in *"mapping common patterns, mechanisms and properties among cases"* (Erikson and Kovalainen, 2015, p. 119). This might include, for instance, the identification of common institutional issues across cases that affect processes.

Since this study is concerned with studying the processes of UKC (i.e. production and appropriation) from the perspective of multiple actors (i.e. university, academics, industry, governmental bodies, and government), the decisions of these actors are determined by their individual and organisational logics. Hence, multiple accounts of contracted research projects, including all actors, would possibly result in more accurate findings. Accordingly, 'embedded-multiple case studies' was selected as being the suitable design to conduct this study. Given that such design is denoted as very time-consuming and expensive (Creswell, 2013), and the study's objective is to achieve an understanding about the concerned investigated phenomenon instead of achieving replication, 4 cases of publically funded, contracted research projects were selected for investigation in this study.

### 3.5.1 The selection of cases

In comparison to quantitative research, random selection of qualitative cases research is not preferable. Since the nature of this research is exploratory, an application of purposive and convenience sampling was required (Yin, 1994, 2013). First, the application of convenience sampling helped in selecting cases as per their accessibility and proximity to this study's researcher. Hence, due to the researcher originating from Oman and having good networks in the area, it was easier for her to engage local actors such as the university, SMEs, and governmental entities. These networks facilitated access and secured the

engagement of the expected participants involved in the projects. Second, instead of following sampling logic and representativeness, case selection is usually carried out based on replication logic (Denzin and Lincoln, 1994). From this perspective, a case is selected if it results in literal replication (expects similar results for expectable reasons); or in theoretical replication (generates conflicting results for expectable reasons). Nevertheless, with respect to this study, the frame of limited sampling made following these two criteria difficult. Hence, purposive sampling was applied. For the successful application of purposive sampling, a clear clarification is necessary to underline why the focal cases (i.e. projects) represent the subject of interest in this study. The four selected projects were found to be interesting for the following three reasons:

**(a)** The selection of these projects was related to the selection of 'embedded-multiple case studies'. In this respect, the researcher had the ability to investigate the logics of UKC from multiple institutional perspectives, including, knowledge producers (academics and university officers), knowledge users (commercial, i.e. SMEs, and non-commercial, i.e. governmental entities), and knowledge managers (government). This resulted in getting rich information on the underlying causal factors of different actors that affected existing structures.

**(b)** All of the selected projects raised interesting issues and, hence, resulted in more understandable findings. They allowed the emergence of common patterns within the investigated processes, which consequently helped in identifying important similarities and differences in the explanations of these processes and their underlying characteristics.

**(c)** The project initiation was synchronized with the commencement of different innovation programs at the university and national levels. Particularly, these projects were conducted after one year of launching the Innovation Affairs Department at the university for the purpose of enhancing innovation within local industry, and, on the national level, after the development and provision of many public funding programs by

the TRC as a way of encouraging R&D and KC between academics and industry.

To ensure that the population of interest is covered, in addition to purposive sampling, a snowball approach was used (Robson, 2011). Three key informants (from the university, TRC, and the governmental entity overseeing SMEs) were contacted first in order to get a relevant list and directory of the contracted research projects between academics and industry. This helped in developing the study frame. The researcher arrived at a sample of twenty public funded projects. The participants within the listed projects were selected as per their direct involvement in those projects. They had been classified as knowledge producers, users, and managers. The producers are the large diverse groups that make the required knowledge available, such as the university and its academics from different disciplines. Users are the ones who appropriate knowledge at any given time, such as SMEs from different industries. Managers are officials from the government (fund operators, agency, and policymakers), who are responsible for supporting the processes by managing and making policies.

Next, efforts were made to reach all the identified participants through phone calls and e-mails. This was done after a formal letter, requesting access, was sent to the participants. However, the final number of projects that were sampled was four out of twenty. This was because the researcher couldn't cover multiple perspectives in most projects. Most of the targeted interviewees, especially SMEs owners and policymakers, were hard to reach due to their busy schedules. However, the selection of these four cases (i.e. projects) was made for several good reasons. In addition to the abovementioned reasons, they were found to fulfil the criterion of 'literal replication', in which similar results were expected for predictable reasons. Additionally, the cases were rich in information, which facilitated a detailed understanding.

Despite the argument about the ideal number of cases for a research being between four and nine cases (Eisenhardt, 1989), the researcher of this study

believes that too many cases would jeopardize losing the focus and detailed view of each case. Hence, the need for getting a more detailed view on each case justifies limiting the number of cases to four. As argued by Yin (1994), the quality of cases is more significant than their number.

Again, with regards to the snowballing process, after interviewing the key informants, the research was snowballed outwards into the university's officers and academics involved in the project. This helped in getting contact with other collaborative stakeholders from enterprises and governmental bodies. In addition, it helped in generating a better picture of the actions and decisions taken by the involved actors, as well as in getting diverse opinions from different institutional contexts.

### 3.5.2 Unit of Analysis

Yin (1994) identified that unit of analysis as a concrete source of information, by which evidence will be created in interaction between the participants and the researcher. It is the 'who or what' of the study, which an analyst may generalise. Therefore, a unit of analysis can be regarded as several things such as a set of policies, a process, communities, social capital, or interest group of individuals and alliances.

In this respect, it is necessary to distinguish between a unit of analysis and a unit of observation. The unit of analysis is at the level where the researcher sets the conclusions, while the unit of observation is at the level where the researcher collects data. In this study, the observation units are the individuals' (within the university, SMEs, and government) who have multiple, different, and potentially conflicting institutional logics. The unit of analysis involves the research project. This matches with the definition of instituional logics adopted in this study, which considers logics as causal powers for influencing and shaping actors' actions in the micro-level interaction, that is, the investigated contracted research projects. Furthermore, it gives the chance to explore the socially constructed rules and norms through which actors produce and

reproduce the meaning to their social reality (Thornton and Ocasio, 1999; Thornton et al., 2012).

### 3.5.3 The logics of inductive and deductive

In research, the investigation is guided by either inductive or deductive logical arguments. In deductive logic, researchers usually start a study with a hypothesis which they presume to be true (Robson, 2011). They, on the basis of this initial hypothesis, try to determine what else would be true. The usage of such logic makes the proof of findings, and the conclusions to be reached, beyond doubt. Nonetheless, the opponents of deduction argue that truth is maintained only when the initial hypothesis on which the study is based turns out to be right and accurate. While in inductive logic, finding out meanings in contrast to causes is essential. It uses theory to develop a clear explanation of data. In this logic, the researchers start with collected data to derive inferences. Though induction's aim is not to prove the correctness of a theory, it can demonstrate how a theory can suggest a logical explanation of data.

Since the goal of this study is both to explore and explain how potential mechanisms influence bridging the differences in logics within an emerging UKC institutional environment, a combination of induction and deduction was used. This is due to the belief that both logics are considered to be involved simultaneously and cannot be separated (Perry and Jensen, 2001). At the beginning, the approach in this study was only induction; however, depending on this logic alone would direct the researcher's attention away from capitalising on theoretical concepts that already exist in UKC literature. Therefore, existing literature was used as an instrument in guiding the preliminary exploration goal of this study. More specifically, the initial protocol of this study was constructed using the framework established from literature and the initial inductive stage of investigation (which involved six interviews).

There was a regular interaction between data and theory. Moreover, many new themes emerged from the multiple institutional perspectives of participants.

Hence this study applied inductive and deductive logics concurrently rather than separately.

In summary, the research design of this study, explained in sections 3.4 and 3.5, provides justifications for using the case study strategy, unit of analysis, and sampling strategy. An exploratory approach was adopted to investigate the research questions by using embedded-multiple case studies, which involved four cases. The researcher's view with regards to deduction and induction logics was also justified.

### 3.6 Methods of data generation

As data is generated rather than collected, this study uses the term of 'data generation'. Data generation within case study research involves the usage of different data sources (Yin, 2013). This is due to the logic of capturing sufficient insight that cannot be accomplished by using one data source. Hence, the usage of more than one source can bridge the gaps. Additionally, multiple links of evidence help in addressing discrepancies and conflicts that might result from various sources as well as allow the emergence of different layers of meaning. Furthermore, it enhances the validity of case study research (Creswell, 2006).

According to Yin (2013), the evidence for case study may come from six different sources, namely: documentation, archival records, interviews, direct observation, participant observation, and physical artefacts. While other scholars have suggested that the methods used in collecting data for qualitative research are to involve either interviews, documents, or observations (Merriam, 1998), this study, in order to attain a rich understanding, adopted two sources of data: semi-structured interviews and documentation.

The usage of two sources instead of one was supported by the recent principle of 'triangulation', which is defined as "a validity procedure where researchers search for convergence among multiple and different sources of information to form themes or categories in a study" (Golafshani 2003, p. 8). The aim of triangulation is to compensate for the weaknesses of one data generation source by balancing that with the strengths of another data source (Jick, 1979).

The weakness of interviewing in this study is the possibility that the perceptions of multiple participants are likely to be indigenous statements of reality. Also there is a possibility that the researcher's interpretations might be influenced by bias and inaccurate understanding. Considering this, there is potentiality that the participants' perceptions and the researcher's opinions alone can overlook significant facts, consequently affecting the depth of understanding. Hence, there was a need for building accounts of the studied phenomenon by using documents (published and unpublished) as supplementary data sources. The following section explains these two data sources.

### 3.6.1 Semi-Structured Interviews

The primary data generation method in this study is the semi-structured, "*structured-open-response-interviews"* (King et al., 1994, p. 15). The study implemented 32 interviews in total. The interview process is explained later in section 3.1.5. The aim of this section is to explain the logic behind using semi-structured interviews.

First, structured interviews restrain the inquiry to particular dimensions, thus constructing specific meanings to interviews (Pawson and Tilley, 1997). The interaction in UKC is complex. Hence, understanding such a process requires that the responses of participants are not dependent on the interviewer's biases, which can result from structured questions. Therefore, the usage of a semi-structured interview guide is significant as it includes a set of comprehensive themes and adaptable suggested questions. Second, semi-structured interviews are highly flexible and allow the gathering of in-depth data (Bryman et al., 2004; Bryman, 2015). The researcher used a set of prepared questions as a guide. While efforts were focused on ensuring that key questions were asked to every participant interviewed, semi-structured interviews allowed the researcher to interpose this with additional questions as the researcher deemed suitable. However, it was important to mention that the flow of the interview was intended to be mainly driven by the interviewees. The interviewees were requested to talk freely and openly about whatever they viewed to be significant. This encouraged further elaboration and took the conversations in an unpredictable

direction. Third, it is important to note that actions and decisions are not documented, which makes it difficult for the researcher to observe them. Therefore, there is a need to obtain the perspectives of actors by asking them context-specific questions. Semi-structured interviews enable interviewees to expand on what they consider to be important and to frame the concerned issues in their terms (Savin-Baden and Major, 2013). Fourth, semi-structured interviews are in line with this study's philosophical stance of critical realism in stressing the demonstration of social reality with actual, empirical, and real causal powers. Hence, in order to obtain reality, the researcher should move from being an external observer towards investigating UKC from the views and perceptions of individuals who effectively engaged in such processes. Only those who are involved in the processes understand them and their mechanisms of work.

### 3.6.2 Documentary data

This study used documents as a secondary source of data. Documents used in performing qualitative research can be either published or unpublished printed materials. Documents can be considered as a source of massive data offering important insight into the subject matter of study.

This study focuses on advancing a new topic (i.e. university knowledge commercialisation) in an emergent institutional environment in Oman – something which has already been performed successfully in developed countries. Hence, in order to attain accurate findings pertaining to the national and organisational strategies, policies, and institutional frameworks in relation to the UKC movement, the documentary analysis approach was selected as a suitable method to strengthen the analysis of the interviews. Different types of official documents were identified after the development of the study's research design.

There are two types of documents, primary and secondary. The primary documents came into existence during the period under which the research took place (Bell, 2014); while secondary documents were written by a non-direct

observer or participants in the specific events (Anderson and Anderson, 1998). In this study 'primary documents' from relevant organisations were used in the analysis. These involve the university's strategies, national research and innovation strategies, industry regulations and frameworks, Oman Vision 202, national fifth year's plans, TRC annual reports, and His Majesty's speeches. National studies about KC and entrepreneurial potentiality in Oman were also used.

### 3.6.3 Pilot study

Before commencing the actual empirical phase of data collection, the study's research design was tested for the purpose of generating initial understanding about the institutions (i.e. rules, norms) and logics of UKC within the Omani setting. Hence, three open-ended interviews were conducted during September 2013. One university officer, one user-funding operator/manager, and one TRC officer were interviewed. The interviews were recorded and transcribed.

The pilot study provided five advantages for the researcher. First, it helped in refining the interview guide and protocol that was used in final case studies work. Second, it provided insight into how participants might perceive the research, consequently uncovering the possible barriers that might be faced by the researcher during the actual process of data collection as well as the way in which to overcome such barriers. Third, a significant understanding was obtained regarding some of the UKC issues, which conformed to the existing literature. Hence, the pilot study resulted in experiential and practical observations that were conformant to the researcher understands of the existing literature. Fourth, it helped in identifying the appropriate empirical context, especially the types of industry and funding, that matches with the inquiry of 'how potential mechanisms enable/constrain bridging the differences in logics within the micro-level interaction (i.e. contracted research projects) of UKC'. These, in addition to the university, form the empirical context of Public Funding Projects and SMEs within the AL Rusayl Industrial Area. Fifth, the successful

carrying out of pilot interviews by the researcher gave additional justification that the qualitative approach was the suitable methodology for this study.

### 3.6.4 Interview process

This section explains the process of semi-structured interview. The explanation covers interview planning, the actual delivery time, and process management. Prior to commencing the scheduled interviews, three documents were sent by the researcher to the participants at least one to two weeks in advance. These documents are:

- Study's agenda involving the main aim of the study and methodology used.
- Interview protocol supporting the study's aim with research questions and defining the intended subject of discussion.
- Letter of intent highlighting the participant's agreement of confidentiality and anonymity. The letter was signed by the researcher and her supervisors.

Equity was used as a guideline to determine the interviews' date, time, and location. The researcher was accommodating and adapted herself to meet participants' preferences. For instance, as difficulty of accessing participants was faced due to their busy schedules, the issue was mitigated by sending the interview guides to the participants well in advance, in addition to allowing them to reschedule times and dates when they found them rather inconvenient. Also travelling within and outside the capital (researcher's hometown) was done in order to meet the participants at their offices. Hence, all interviews were conducted face-to-face.

The interviews were conducted during the period of April 2014 – September 2014. As per the study's aims and as aforementioned in the selection of cases section, the participants were selected using the following categories: (1) knowledge producer, including university's management, KTO officers, and academics from different disciplines; (2) knowledge user, including commercial users, that are, CEO/Owners of local SMEs; (3) knowledge manager, including

governmental officers such as TRC managers and fund operators. In total, and apart from the three key informants, 29 participants were interviewed. This equated to a total sample size of 32 participants in this study. The number and categories of the respondents are show in the table 3.3 below:

**Table 3.3: Interviewees' Overview**

| | **Categories/Interviewees** | | | | | |
|---|---|---|---|---|---|---|
| | **Knowledge Producer** | | **Knowledge User** | **Knowledge Manager** | | |
| **Cases** | Academics | University Officers | SMEs CEOs | Public Fund Operators | Policymaker/ Public Funding | Government Officers, MoCI & HE |
| **A** | Ac1, Ac2 | UO1, UO2, UO3, UO4 | CU1 | PFO1,PFO2, PFO3, PFO4 | PPMF1, PPMF2, PPMF3 | GO1, GO2 |
| **B** | Ac3 | | CU2 | | | |
| **C** | Ac4, Ac5, Ac6, Ac7 | | CU3, CU4, CU5, CU6 | | | |
| **D** | Ac8, Ac9, Ac10 | | CU7 | | | |
| | 10 | 4 | 7 | 4 | 3 | 2 |
| **Total** | **32** | | | | | |

Source: Author's research

Before commencing the actual interview, an introduction about the researcher and her background was given. This was then followed by a summary of the research main questions and sub-questions, in addition to, a restatement of confidentiality. Despite the fact that confidentiality was assured by the interviewee's signed consent form, from the researcher's view it was essential to restate the matter verbally before each interview. The permission was granted from all interviewees to audio-record the interviews. The average duration of the interviews was between one to two hours. Each recorded interview was

saved as an audio file, which was identified by the participant's category, name, position, and organisation.

**In summary,** section- 3.6 gave details about data generation and methods. In this study, data generation involved semi-structured interviews with multiple actors and key informants across the four selected cases. Documentations were used as supplementing materials. The next section presents the analytical phase of this study.

### 3.7 Data Analysis

This section presents the analysis phase of the study's research process. Data analysis includes "organizing and interrogating data in ways that allow researchers to see patterns, identify themes,.., develop explanations, make interpretations" (Hatch 2002, p. 148), and draw and verify conclusions in order to discover and understand the relations between different issues. Therefore, the analysis of data comprised four key techniques and steps.

#### 3.7.1 Interviews' Transcription

As mentioned above, each conducted interview was recorded as an audio file. This study used a digital MP3 Player. Next, in order to facilitate analysis, all 32 oral interviews were converted into written text and saved as a word document file. A solid basis on which the analysis will be built and data interpreted was ensured by reading the transcripts repeatedly.

During the reading of transcripts, the researcher had adopted four different views. The first view focused on reading the experience of participants who had in fact experienced the events. The second view was accepting that the respondents are neutral informants of different events. The third view was considering respondents as subjective individuals who represent their experiences, hence their reasoning is supposed to be taken into account. The fourth view was seeing respondents as pro-active agents in the investigated phenomenon, thus their beliefs were also taken into consideration. After

concluding the deep reading of transcripts, the researcher moved to the second phase of analysis.

### 3.7.2 Data coding and condensing

Qualitative data is mostly bulky and includes much irrelevant material (Robson, 2011). Therefore, to facilitate analysis, the researcher carried on categorizing and organizing the data. Hence, the data condensing approach was adopted. Data were organized and condensed in order to draw clear conclusions and confirmation (Cassell and Gummesson, 2006).

Though the researcher was aware of qualitative analysis software packages (e.g. AQUAD, NVivo, etc.), none of these packages were used in this study. The researcher didn't find them essential due to the interest in the meanings that lie underneath the respondents' subjective reality in relation to their context of interaction. Hence, a manual coding technique was preferred and considered sufficient for this process.

Before starting the coding process, pre-categories were developed from the UKC literature. They were established around institutions and logics of UKC, in addition to the potential mechanisms and their influence on bridging differences in logics. This gave the researcher a starting point for the analysis. Nevertheless, the purpose of establishing these pre-categories was to assist the modification and re-specification of the themes that will emerge rather than to verify or test a particular theory.

In this stage 'thematic coding' was adopted. The main goal of this technique is to set down the content of the transcripts' main ideas, which is known as coding. Coding is how researchers define what the data they are analysing is about (Robson, 2011). According to (Bazeley, 2013), there are two stages for coding qualitative data. The initial stage, called 'open coding', in which interesting codes are identified and labelled, and the second stage, called 'focused coding', in which those codes interpreted and refined to build clear analytical categories. In these two stages, the researcher analysed each interview transcription line by line to find key words, phrases, or sections and then pasted them under particular relevant categories.

A code, or category, is a piece of text of the transcript that captures *"the meaning of that unit text-not just the words"* (Lee and Lings, 2008, p. 244). The main type of code that was used in this study was 'interpretive code' because, first, the responses of actors were treated as *"interpretive, 'storied', social products that they produced in unique contexts, to represent themselves or their worlds rather than facts to be assessed for truthfulness*" (Savin-Baden and Major, 2013, p. 444). This is because actors are embedded within particular institutional and central logic systems. Their actions are restricted by the rules and norms of these systems. Therefore, the researcher needed to analyse the effects of such systems on enabling and constraining actors' collective actions (i.e. logics bridging/spanning) through explaining the relevant institutional factors. Second, was thinking about the nature of the generated data on the basis of the critical realism assumption of actors having the ability to narrate the experiences of knowledge creation and appropriation. Their 'narration', however, was based on the observable institutions (Blundel, 2007), and they only described the rules that they used at the operational level. However, actors' narration was not only considered as evidence of 'what actually had/has happened', but also as a statement of 'what they believe to be true' as knowledge produced and appropriated by actors themselves through regular interactions within projects. The researcher established a meaningful explanation of the unobserved institutions (i.e. norms) by finding out the activities that actors adopted in the process.

Some scholars, however, raised the issue of the probability of coding system rigidity, which might consequently hinder rather than facilitate data analysis (Carson and Coviello, 1996). To mitigate such issue, the researcher, first, was open to new themes that might arise separately from the pre-categories that were identified at the first stage of analysis. Hence, other new analytical variables start to emerge from the identified categories or sub-categories. Data that failed to conform to categories was listed under different analytical categories. Second, the researcher used memo writings while proceeding with

coding. Writing notes supported recording the researcher's first impressions when reading a specific passage of text.

In general, the process of coding established a clear structure of categories, sub-categories, and sub-units. The process finished after ensuring that the list of codes was congregated to show the potential mechanisms of UKC as well as the positive or negative interactions between institutions and the logics within those mechanisms.

### 3.7.3 within-Case Analysis

After developing thorough details of cases and finalised coding for all transcripts in each case, the researcher began the next step, which involved the analysis of the patterns that emerged from the data within individual cases. The focus was to enhance familiarity with individual cases and to make patterns emerge at case level before examining data across all cases. The categories established in the coding phase, with written memos of each case, assisted in determining relations and connections. In this within-case analysis, the researcher applied many strategies for the purpose of generating meaning of data. These strategies included clustering, observing patterns, and observing links between variables (Miles and Huberman, 1994).

When there was an instance of insufficient data in explaining particular relationships, secondary data sources (i.e. documents) and literature revisiting were used as ways to gain a better understanding of such emerged relationships. As this research used an iterative approach, the researcher had the opportunity to rely on deductive thinking while at the same time revisiting data to search for evidence. This process was similar to the pattern matching process (Yin, 1994). Hence, a dialectic relationship was merged amongst data and theory, which represented the adopted inductive-deductive approach within this study.

### 3.7.4 Cross-case Analysis

Attached to within-case analysis is the cross-case search for patterns (Eisenhardt, 1989). Such analysis technique is used due to the fact that people

are extremely poor at processing information as they jump to conclusions that are grounded within limited data. They are influenced by selected respondents and might sometimes unintentionally drop evidence that contradicts their inquiry, which results in reaching false and immature conclusions. Hence, a cross-case comparison was used in this study in order to overcome such '*information-processing biases'* through examining data in different ways (Eisenhardt, 1989, p. 540).

The aim of cross-case analysis is to interpret the inquired research phenomenon by determining similarities and differences across cases (Stretton, 1969). In other words, it enables the comparison of differences and commonalities in the activities and processes that are the units of analysis in case studies. Involving cross-case analysis increases the researcher's know-how beyond a singular case. It enables the researcher to define the "combination of factors that may have contributed to the outcomes of the case, seek or construct an explanation as to why one case is different or the same as others, make sense of puzzling or unique findings, or further articulate the concepts, hypotheses, or theories discovered or constructed from the original case" (Khan and VanWynsberghe, 2008, p. 2)**.**

The logic of pattern matching and explanation building were used for the purpose of making sense of different findings from cases. This was done through rigorous comparison and contrasting of themes driven from individual cases. There were some patterns that were determined in this process across some cases, which necessitated the re-examining of the general pattern. The researcher tried to solve the complexities of the situation by taking into account both the internal and external institutional contexts of the contracted research projects of UKC. Hence, the cross-case considered both the inner -rules and actions of the actors involved in the project, and the outer -institutional contexts and frameworks at the national level (i.e. the study's research context discussed in section 3.2), in which the institutions (particularly rules) of interactions occur.

Cross-case analysis sought to enhance the validity of the findings. For validity checking there was a need to apply multiple data sources. According to

Eisenhardt (1989), the comparison of emerging themes with existing literature is considered one of the significant features of case study research. Therefore, the researcher considered the questions of what is similar, what is different, and why in the literature of UKC.

In summary, section 3.7 presented the analysis stage of this study. Both the within-case and cross-case analyses entailed a continuous iterative approach by examining patterns that emerged from interview transcripts. The following sections will explain the research language, the operational procedures the researcher followed to meet the quality criterion of reliability and validity, the potential limitations of the case study research, and ethical considerations.

### 3.8 Data gathering and analysis language:

As the official language in Oman is Arabic, the researcher expected to encounter some participants (especially from the government) who might not be able to understand or speak English. Therefore, the final copy of the interview questions was written in both English and Arabic to make sure that the participants had no difficulty in understanding the questions. Prior to the actual data collection, the researcher made sure that the key informants could understand English, otherwise they were asked to choose which language they would prefer for communication. In fact, the majority of the interviews were conducted in English (as many Omanis had an English academic background and as some were non Arabic-speakers) and only three respondents (from the government) preferred to conduct the interview in Arabic.

To ensure the accuracy of translations from English to Arabic, the interview guide was doubled-checked by the researcher. To ensure the accuracy of the translation of interview transcripts from Arabic to English, the researcher wrote them first in Arabic and then translated them into English, again the transcripts were doubled-checked by the researcher. In phase two, bilingual transcripts were given to two teachers who were proficient in both languages to check the translation of the transcripts. The two were asked whether the translation of

these transcripts into English was clear and accurate. Few changes were suggested in the wording in both versions. The versions were subsequently modified as per the suggestions given.

### 3.9 Case study validity and reliability:

This section discusses the case study's quality concepts of validity and reliability. Many scholars (e.g. Yin, 1994; Patton, 1990) raised the concern of the difficulty of establishing validity and reliability in qualitative research, due to its reliance on individual perceptions. This study adopted procedural precautions, which aided in obtaining reliable and valid findings.

Qualitative research supporters have questioned the appropriateness of quantitative validity measures and concepts for qualitative research. Some referred to the validity in quantitative research as construct validity (Golafshani, 2003). This includes measurements of accuracy in whether or not they are measuring what they are intended to measure. The notion of validity, however, is acknowledged differently in qualitative research, in that some scholars have gone as far as to reject the term of validity in itself. They used other terms such as trustworthiness, rigor, and quality. However, this study used the same term of validity and reliability, yet, it was used to better reflect the qualitative notion of quality. Hence, in this study, validity and reliability denote redefined criteria which are applied to match with the reality of this study and assess the quality of research away from methodological dimensions (Guba and Lincoln, 1989; Robson, 2011).

There were several measures followed by the researcher that helped in enhancing validity in this study. First, credibility was ensured through the engagement in the country's contextual environment as a researcher and through the interaction with existing actors, which was more during the data generation period. In addition, it was ensured by peer debriefing through sharing the data analysis process with a supervision team who are experts in the field and as part of the process of analysing and writing. Moreover, a member-check was carried out with the selected actors. A discussion about

findings and themes was done with actors in order to validate if the interpreted data reflected their accurate views. Second, reliability was clearly satisfied by defining thoroughly the procedures used in studying the research phenomenon. These procedures were explicitly detailed in this methodology chapter. Third, a constructed interview guide and protocol was established to ensure a high degree of reliability in the interview questions' focus, procedures, content, and ethics. This guide was assessed in the pilot phase to resolve potential issues. The changes in the phrasing of some questions, as well as in the order of the questions, helped in allowing a pattern of responses to develop and emerge relatively. Fourth, the researcher constructed clear conceptual assumptions from the existing literature of institutional logics perspective and UKC. This helped in guiding both the research design and data generation. Fifth, a clear route towards authentic responses was established by including many open-ended questions within the interview guide. This supported the aim of attaining an authentic understanding of actors' or participants' experiences. Sixth, the usage of a triangulation principle was helpful in increasing the quality of the interview data. The usage of documents as a supplementary source helped in validating the findings from the interviews. Lastly, the coding system and related coding tables, which were developed for 32 interviews, supported the systematic analysis of data illustrative instances. They are considered as transparent evidence for data collection, sorting, and organizing.

### 3.10 Potential limitations of case study research:

Despite the fact that the case study approach was considered as the most appropriate method for this study, it has many limitations.

First, the most popular criticism of case study is the difficulty of generalising findings to the whole population from which it was extracted. However, the researcher is aware of the weaknesses and the strengths of what was carried out in this case study research. The second limitation is related to the case studies vastness of information, which created a challenge in ensuring research quality and rigor. A Large volume of collected data could result in more

complicated theories, consequently compromising accuracy (Leitch et al., 2010). The researcher tried to mitigate such issue through validity and reliability procedures, as mentioned above. Third, an issue pertaining to determining the boundaries of the case study's time-scale, events, and processes was faced by the researcher. However, this was solved by assigning the boundaries of each case study from the very beginning of the study.

Moreover, the semi-structured interviews, which were employed as the only instrument for primary data collection, have some weaknesses. This is because of their reliance on verbal behaviour, which might cause the issue of interviewees' bias**.** Participating actors may pay no attention to some information that is very critical for the researcher (Bryman and Bell, 2015). To mitigate such problem, the researcher asked many probing questions during the interview whenever she felt that the interviewee was withholding something important. Additionally, it is argued that a researcher's absolute non-bias cannot be ensured totally in formulating the interview guide or in data analysis; especially if a researcher is seeking for better qualitative data. The researcher's subjectivity may control the way in which the interview questions are formulated and the data is analysed in favour of her own bias to manipulate outcomes. Therefore, the issue of bias should be used consciously in order to find out the embedded views of actors. The researcher mitigated this by enhancing validity and reliability while maintaining a systematic process of data collection.

### 3.8 Ethical issues consideration

It is essential to ensure that the study is carried out in strict adherence to ethical standards and that its procedures are set down in line with the conventional practice of social science research. In this respect, research ethics serve as protection for all participants involved in the study, such as the researcher, actors, organisations, as well as society against any possible harm that the study may cause. Such harm was avoided in this study as follows:

First, before starting field work, an ethical approval was acquired from the Research Ethics Committee of the University of Bradford. This included the full required details and documents demonstrating that all precautions and measures were in place to protect the participating actors and their organisations, the university, as well as the researcher. Second**,** the participating actors were invited to participate in the research through written official letters signed by the university and the researcher. In the letter the research objectives and questions were clearly communicated, in addition to, the way in which the data was planned to be used. Third, a formal consent form was attached with the letter in order to ask for their signature to confirm their agreement in participating in this study. In the letter a clarification was stated pertaining to their rights to confidentiality, anonymity, and the option to withdraw whenever they want. To ensure anonymity, it was agreed that the names of all participants and their organisations were to be anonymized**.** Fourth, all participants were informed that the collected data will be used for research purposes only, and that no one will get access to the collected data unless they requested so in writing. Fifth, as interviews were recorded with a tape recorder in order to gain more accurate information and facilitate analysis, justification was given to the participants and no interviews were recorded without their permission and consent. Sixth, a copy of the transcripts and written interpretations of the interviews were given to participants. They were given the freedom to omit any details they disagreed with.

### 3.9 Chapter conclusion

This chapter has explained the philosophical stance, contextually developed research design, and the relevant methods to address empirically the aims of this research, which is to investigate the implications of power, mimetic isomorphism, and intermediation on bridging the differences in institutional logics within contracting research projects.

A description of different research paradigms was given, in which their advantages and disadvantages were examined. Critical realism was selected

and justified as being the appropriate approach for addressing the aim of this study. The critical realism philosophical perspective was explained to show how the underlying assumptions influence the study's main focus on structure (logics) and agency (actors). Then, a qualitative research approach was adopted as the most suitable for this research design. Consequently, the case study approach was deemed to be the appropriate strategy for studying the processes of KC through the interaction of multiple actors' logics within contracted research projects in Oman's UKC emerging institutional environment. An embedded-multiple case design was justified given its strength in describing complicated inter-relationships. The design incorporated four Omani cases of public funded contracted research projects. The used primary source for data generation was semi-structured interviews, while the secondary source involved published and unpublished documents. A thorough examination of the interview transcripts and emergent themes was planned to be carried out through within-case and cross-case analyses. Careful attention was given safeguarding quality criteria through directing efforts towards confirming constructed validity and reliability. Finally, the practical and ethical limitations were explained with a demonstration of how they had been undertaken by the researcher.

Having elucidated the study's overall research methodology, the next chapter explains the study's research context, cases and emergent themes.

## Chapter 4: The Context, the cases and the emergent themes

Chapter three elucidated the study's overall research methodology. This chapter provided an explanation of the study's research context. This chapter also includes a summary of the cases selected in this study and presentation of the tables of themes explaining how the study's themes were driven and emerged from the data within the individual cases.

### 4.0 Introduction

This chapter is organized into four sections. The first section provides a glimpse of the challenges within the Omani existing and developing UKC institutional settings. It describes the overall contextual conditions of Oman in which a national innovation system functions. Additionally, it explains the institutional contexts of the key actors of KC and innovation in Oman. It gives more clarification on the strengths and weaknesses of the institutional environment within which each categorized actors is embedded. The second section provides a summary of each case (presented in detail in Appendix-1). Four contracted research projects were selected as per the justifications presented in 3.5.1 of Chapter-3. The third section presents tables of themes explaining how the study's themes were driven from individual case. Precisely, the categories from the coding served as building blocks supplemented with comments and notes within each case file. This enabled the researcher to detect relationships and connections. The fourth section entails the themes that emerged from the data within the individual cases. It focuses on allowing the patterns at the case level to emerge before attempts are made to examine the data across the four cases.

## 4.1 The Context of the Research

### 4.1.1 The Omani Overall Context

**Figure 4.1: The Map of the Sultanate of Oman**


Source (Encyclopaedia Britannica, 2012)

The Sultanate of Oman is an Arab country located on the Eastern corner of the Middle East, bordering the United Arab Emirates, the Kingdom of Saudi Arabia, and Yemen. It has a population of approximately 3 million, and occupies a territory of approximately 309,500 square kilometers (STIP, 2014). Before 1970, Oman was characterized by political chaos particularly in the South and interior regions, along with poverty and widespread illiteracy (Al Shanfari, 2012). Henceforth, a regeneration period of infrastructure developments in all sectors derived from 'oil capital' began, which placed Oman as one of the most advanced countries in the Middle East (Al Moharby and Khan, 2007). The discovery of oil was a keystone in the development of the economy and infrastructure in the region. For the past 43 years, oil was the main export of

Oman and is still considered as the backbone of the economy, constituting around 53% of the GDP (Al Shanfari, 2012). Despite the fact that oil has been the main source of most of the social and economic wealth in the past, it has become, to a certain degree, a curse with respect to the development of diversified and innovative economy. Past efforts to diversify the economy have not been successful. However, as it is predicted that Oman will have less than 15 to 20 years of oil reserves left[1], and especially nowadays, there is greater urgency to diversify its economy (STIP, 2014). Furthermore, as the population grew faster than the economy could sustain, the country is failing to create sufficient jobs for national citizens. The unemployment rate is estimated at 15% (ILO, 2010). This is due to the massive import of cheap labour, which constitutes around a third of the whole population (CIA World Fact book, accessed on 14 April, 2017). These challenges called for accelerating the change to a new economic structure, especially with the focus of the creation of new jobs. So far the government instated an Omanisation policy in the public and civil service. Yet, this is not sufficient to solve such challenges. There is a need for initiating new activities offering quality jobs. In 2005, the government reconsidered its strategies, and began to look towards a knowledge-based economy where universities play a vital role in the country's socio-economic development (STIP, 2014, Al Harthy, 2014). This is seen to be of national importance for Oman in its desire to diversify its national economy's resources in order to not depend fully on non-renewable resources such as oil and gas, and to try to improve its knowledge-based economy to provide good potential prospects for Omani future generations to become wealthier in attractive and quality jobs. As stated by HM Sultan Qaboos:

*"One of the priorities of the current stage of development and the next stage which we prepare for is to revise the educational policies, its plans and its*

[1]All national and international indicators predict a continued decline in oil production. There are two scenarios Oman and GCC are facing as being oil-based economies. First, the oil reservoirs will run out, and/or the oil age will disappear and become a 'stone age', when energy becomes based on the increasing renewable energy alternatives.

*programs, which need to be developed to keep pace with the changes that the country is going through. More attention should be accorded to the requirements imposed by scientific and cultural development towards the evolution of a generation armed with awareness, knowledge, and the abilities required for worthwhile work." (His Majesty Speech, 2012, page 6).*

However, fostering an indigenous knowledge-economy through universities is not going to be easy for a country in which KC is considered a new phenomenon. Oman has low efficiency in terms of R&D and innovation. Its scientific and technological research base is still in its infancy, with little or no track records in innovation and commercialisation achievements (GCR, 2009; GII, 2013; STIP, 2014)[2]. Moreover, it is worth mentioning that Omani governance has an unconstructive feature. The processes of decision-making together with joint policy development and inter-institutional consultations are greatly bound by a hierarchical organisation culture as well as rigid interactions and communication flows[3] (STIP, 2014). For more clarification see Appendix 2.

[2]According to the 2009 Global Competitiveness Report, out of 128 countries Oman ranked 66th in innovation**.** More specifically, it was 103rd in quality of scientific research institutions, 86th in private sector R&D spending, 86th in industry research collaboration, and 76th in availability of scientists and engineers. There is no existence of technology transfer offices and extremely few patents registered. Moreover, according to the 2013 Global Innovation Index (GII), out of the 141 surveyed countries Oman ranked 80th in innovation, while ranking a low 134th for efficiency ratio. This is because the country is still lacking the competence of exploiting the existing assets and environment that are beneficial for innovation. When comparing inputs and outputs innovation dimensions, Oman ranked 53rd for innovation inputs, but was lagging behind in the indicator of innovation outputs (ranked 111th). On the output side, Oman performed poorly on knowledge and technology commercialisation (ranked 102nd). There are extremely few innovative products (e.g. high-tech), patents and technological products (STIP, 2014). What's worse is that Oman's overall rank has dropped significantly on the GII. In 2011 Oman was ranked 57th and 67th in 2010, however, this dropped to 80th in 2013. This indicates that Oman has not transformed as much as it needed to in order to maintain its rank and position.

[3]The most serious administrative difficulty Oman has been facing is bureaucracy (Recabi, 2001). HM, the Sultan is the Head of the State, the Prime Minister, the highest and final legislative authority, and the Supreme Commander of the armed forces. The Sultan presides over a Cabinet of Ministers, who are responsible for developing and implementing national policies in all aspects. All Ministries have hierarchical structures, which are determined by the Royal Decrees. Therefore, structures are strictly hierarchical and bureaucratic authority is assigned from the top to the bottom. This bureaucratic procedure of organizing is found in all government organisations (Al Tobi, 2006). In this respect, government employees are expected to act according to the decisions made by their superiors and to firmly adhere to the rules and regulations that manage and organize the work of these organisations (Al Busaidi, 2004, Al

### 4.1.2 The Institutional Contexts

Within a particular interaction (i.e. contracted research project), various institutional actors have roles and responsibilities and relationships with other actors and logics (i.e. defined rules and incentives) that govern these relationships. The mapping of these projects should help to explain the institutional logics through which actors take actions and make decisions that affect knowledge commercialisation. However, the factors that determine the logics of actors may not come from inside the project itself, but be generated by the overall institutional contexts that surround it. Hence, this section unfolds the challenges and weaknesses of institutional contexts within which each categorized actor is embedded.

**The Research Council-TRC (as an organisation that shape the institutional context):**

The establishment of TRC-The Research Council in 2005 arose from the desire to establish a knowledge-based economy[4] (Royal Decrees No. 54/2005 and No. 30/2010). TRC acts as both a policy-making and funding body for science, technology, and innovation. Fundamentally, it plays a key role in carrying the NRS-National Research Strategy and in the interim started funding research in 2009. By the end of 2013 it had funded a total of 114 various research projects at different institutes within Oman (TRC annual Report, 2014). TRC is organized within different funding programs covering both research and innovation. These programs were designed to further develop synergies in university-industry research collaborations. Primarily, these programs were designed through benchmarking, by adopting models drawn from Western contexts, which are required to be customized as per the situation in Oman. They were designed by adopting Canadian and American models as a trial over

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Ghailani, 2005). This supports the natural tendency of all bureaucracies to work in silos (STIP, 2014).

[4]TRC has a different position within the government setting. It doesn't act as ministry rather more as an adjacent body being chaired by a high level adviser to H.M. the Sultan. It is managed and administered by 80 staff led by a Secretary General.

a five-year experiment. Together these programs serve to help achieve Oman's Vision of 2020 and the strategic plans of different economic sectors, reflected in the TRC's vision of making *''Oman a regional hub for innovation and a leader in new ideas, products and services… build the largest research capacity in the region''* (TRC, 2014).

Research programs, such as ORG-Open Research Grants, aim to increase applied research that directly fulfils the social, economic, and environmental needs of Oman. They touch a considerable number of national research projects - hundreds including undergraduates and postgraduates - notably in view of the limited number of researchers who work in the country[5]. Funds allocated to each individual research project are significant, and can reach up to OMR 250,000 per project (TRC-ORG, 2014). However, the design of ORG is not aimed at supporting the business sectors' innovation needs or efforts (STIP, 2014). The program doesn't include mechanisms to involve industry directly in its design or performance to exploit innovation potentials from conducted research. This is an unexpected aspect that may impact negatively on the economic relevance of the programs as well as the application of their results.

Innovation is considered as an integral part of the TRC's mission from its commencement by the Royal Decree. In terms of practical innovation support (where university-industry interaction is policy-driven), the only significant effort was the establishment of the Industrial Innovation Centre (IIC)[6], located in the

[5]The number of existing researchers (in full time equivalent) can possibly be estimated at 2000 persons. Of those researchers, around 25% (one fourth) is associated with Sultan Qaboos University (SQU) and other universities (500 in FTE); 10% (one tenth) with the Agriculture and Fisheries public research system (200 in FTE including service staff); while the rest (65%, 1,300 FTE) are with the PDO and other enterprises.

[6]The IIC is designed to find out and fill the requirements and gaps within both enterprises and academia. It is a government entity set up from the collaboration of TRC and the Public Establishment for Industrial Estates (PEIE). The defined goals of each parent organisation were stipulated in the Industrial Innovation Assistant Program (IIAP), which has been executed successfully since the centre's official inauguration in February 2010. The main aims are, first, to improve industry and academia R&D collaboration, second, to build capacity for sustainable industrial growth and knowledge creation.

Russayl Industrial Estate, Muscat. However, regardless of the strong support at the national level for increasing industry contribution to socio economic development[7], as well as for promoting and fostering its financial capabilities that focus on knowledge and innovation in 2013[8], a low budget was dedicated to the Industrial Innovation Centre (IIAP fund operator) and the project in which it is operating; only OMR 1.5 million in total in comparison to the significantly higher amount for the research program mentioned above (STIP, 2014). This indicates that there are issues and obstacles in setting up the national innovation system. Although the knowledge commercialisation fund is acknowledged as one of the TRC's proposed policies under the knowledge transfer goal (Al Balushi, 2013), there still exists a lack of clarity in policy as pertains to whether or not to directly support innovation efforts of Small Medium Enterprises **(**SMEs).

The priorities and parameters of the abovementioned research and innovation programs are developed and specified by the TRC board of governance. On the board, the TRC attempted to accommodate a fair representative policy of shared governance, where its board consists of academia, government, and private stakeholders. For more details, see Royal Decree 30/2010, Appendix 3**.** The governing board is dominated by high level government officials (represented by 13 members, in whom heads of the programs steering committee are involved). They were appointed to be members by Royal Decree in 'functional terms' and as per their organisations' duty for improving the climate of R&D and innovation. While the private stakeholders (CEOs of two national large companies) are appointed in 'personal form' as per their interest in R&D and experience in the field of managing financial institutions or public shareholding companies operating in Oman. Moreover, the governmental units

[7]''The economy will no longer be an oil-reliant economy in 2020. It is envisaged to be a diversified economy with higher levels of savings and investments. The sources of national income will be diversified with the non-oil sector assuming the primary role'' (MONE, 2008, p. 18)

[8]In 2013, His Majesty called for a national symposium which assessed all aspects related to the weaknesses of local SMEs in which increasing financial support to SMEs through public and private funding programs is given significance.

overseeing local SMEs (i.e. MoCI-Ministry of Commerce and Industry, PEIE-Public Establishment of Industrial Estates) are appointed in order to champion the interests of enterprises. This leads to the conclusion that the domination of governmental officials might have a negative effect on knowledge commercialisation. Officials might put more emphasis on their demands, such as political agenda (e.g. building research capacity), over the SMEs' agendas (e.g. gaining profit through knowledge commercialisation).

**University Institutional Context:**

Sultan Qaboos University (SQU) is the oldest and only public university in Oman. It was established in 1986 as a realisation of the promise announced by HM Sultan Qaboos during the 10$^{th}$ anniversary of the Oman national day in 1980. Construction started in 1982 and students were enrolled in 1986. As per the Royal Decrees of HM, the university started with five colleges: Medicine, Engineering, Agriculture, Education, and Science. Then the College of Arts was established in 1987, followed by the College of Commerce and Economics in 1993. The College of Law joined the University in 2006, and finally the College of Nursing was established in 2008. With over fifteen-thousand students and eight colleges, it is definitely the largest university in Oman. It is also the most distinctive institution in terms of its curriculum variety, established research centres and postgraduate programs.

Here it is worth pointing out that, as per Royal Decree 2006/71, SQU is considered a public academic entity, which is administratively and financially independent within the framework of national higher education policies. Its organisational structure, VC appointment, and salary scales are determined by Royal Decrees. Its employees (academics and admin) are subject to Civil Service Rules and Regulations.

The university operates under restrictive hierarchical administrative structures within a top-down decision-making culture (for clarification Appendix 2). There is a lack of bottom-up forums for campus-wide consultative processes (University Report, 2013). More importantly**,** its governing board 'The University Council' is

chaired by the MoHE- Ministry of Higher Education[9] and dominated by high-profile governmental officials, in addition to university faculty, only 2 of the 12 are private members - a lawyer and the CEO of the Oman Refineries Company (for more details, see figure 4.1). The Council is the supreme governing body. It is empowered by the charter of the university with the formulation of the general policy of the university and following up its implementation, and undertakes particular duties pertaining to the enhancement of the university's standing and enabling it to fulfill its aims and achieve its objectives. Thus, although the university is independent, it is still governed by the governmental regulations developed by the MoHE. The ministry is mandated to propose the general policies for higher education and scientific research (University Council, 2015). They prepare and draft laws for higher education and scientific research and issue the regulations for implementing them. In doing so, the ministry and SQU developed a partnership with the Research Council (TRC) to generate and apply knowledge: *''Our University and the ministry of higher education is cooperating with TRC in bolstering useful and innovative research throughout Oman's system of higher education.''* (UO2, SQU), each actor is involved interchangeably in the boards of each organisation. The Minister of Higher Education is appointed as the Deputy Chair of the TRC. The TRC Secretary General is appointed as an important member of the SQU Council.

The above implies that, similarly to the TRC, the SQU council is dominated by government officials appointed by Royal Decree in functional terms. The Ministry of Higher Education (as per its position) and other governmental officials (as per their number) have ultimate control over the decision-making for any changes in the process, such as incorporating IP into the university's system. This might explain the potential negative effect of government exercised power on UKC. It can be presumed that even the university's

[9]The decisions of the Higher Education Council are governed by the decisions made by the actors involved in the Council's Board. The Council is chaired by the Royal Court, which delegates the establishment of the policy (especially the Research policy) to the Ministry of Higher Education. SQU (represented by the VC) and TRC (Represented by the Secretary General) are important members of the Council.

management may appear to be the salient actors; the government (represented by MoHE and other officials) has more power in influencing and shaping the direction of the university towards knowledge commercialisation.

With regards to Knowledge Commercialisation, the university has a written strategy with visions and goals towards research and innovation (SQU Research Regulations, 2014). It restructured its governance to adapt to entrepreneurial change, and has included innovation through the establishment of the IAD-Innovation Affairs Department in 2010. Since then, the efforts are still ongoing to resource and strategize the department[10] (SQU-AIAP, 2014). Additionally, the university has a strong collaboration and joint projects (at the consultancy level) with local oil, gas, and energy companies (STIP, 2014). The main purpose of collaboration is to solve industry problems in the oil and gas fields as well as knowledge application. These are engineering project-oriented programs with oil and gas companies and mostly with a single partner, which is PDO (SQU annual report, 2009). It has also good collaboration with the TRC (SQU Research Regulations, 2014). The collaboration is for resource funding and knowledge brokering between academics and industry. More clearly, the collaboration is for knowledge generation and accredited publication (ibid).

However, apart from the accredited programs at international standards, SQU is way behind in terms of being identified as an entrepreneurial university. It is still trapped in teaching in order to provide societal demands and produce skilled and educated graduates. Teaching and education is still the core mission of the university (STIP, 2014). It is in a modest position in relation to knowledge commercialisation, and is lagging behind in terms of performance and quality standards. This can be evidenced from its limited number of quality published articles and journals, limited patents, and no licenses (Al Harthy, 2014). Additionally, none of the promotion criteria relate to entrepreneurship and

[10] As there is a lack of KT staff and professionals within the innovation department, the university attempted to fill the gap by making use of its existing staff (particularly assistant dean of research) by establishing an 'Innovation Advisory Committee' in 2012 under the deanship of research (see appendix 2). The committee works collaboratively with the innovation department in developing the rules and objectives of IP. With regards to the IP disclosure process, the committee is responsible for reviewing the IP disclosures and finding new ways in developing them into patents when it is necessary.

innovation activities. The university is still way behind in terms of putting forward the organisational priorities and individual recognition and incentive systems in order to become an entrepreneurial university (ibid). Furthermore, contacts for research projects with the business sector remain few and small, and rather informal in most of the university's departments. Researchers are more interested in publications in international journals and participation in conferences (ibid).

**Industry Institutional Context:**

Recognizing the challenges mentioned in the above section 4.1, the government has stepped up its efforts to develop and set SMEs as a principal component of its strategy to address unemployment challenges and promote economic diversification and growth along with private sector development. Thus, it embarked on major projects in various sectors that aim to create downstream opportunities and activities for SMEs including industrial areas, such as the Al Rusyal industrial area, as well as for the IIC as an instigator for knowledge commercialisation.

However, as per the Global Innovation Index, despite the fact that Oman has a satisfactory business environment (ranked 45$^{th}$), its outlook is less promising when looking at the factors that determine the dynamism of the economy through knowledge commercialisation (GII, 2013). SMEs in Oman are low in development and economic performance. This can be related to the many cultural factors (e.g. merchant traditions and the inclination of citizens to work in the government rather than the private sector), which are influenced by institutional obstacles. While the importance of SME development and entrepreneurship is acknowledged in the country's five-year plan (2011-2015), there is no separate policy framework drawn up for promoting entrepreneurship culture or SMEs in Oman. Moreover, the Omani economy is dominated by large companies (Dhafar, 2010). The bulk of these companies are in the oil and gas industries. Although there are 91,000 active SMEs, which contribute to 13.8 % of the GDP, the majority are operating in the informal sector (STIP, 2014). Only

about 100 SMEs declare taxes, and the middle-intermediary layer of firms is missing.

Most of the enterprises situated in the Al Rusyal industrial estates lack knowledge-based characteristics and capabilities. They are not considered as knowledge-based firms (STIP, 2014). They are classic, traditional, and 'family businesses'. The board of members and some management are family based (Dhafar, 2010). Moreover, they are mostly owned by expatriates practicing 'hidden trade '- cases where Omani nationals are registered as SME owners, while in reality those nationals are agents of expatriate owners (Al Harthy, 2014). This 'rent-seeking' behaviour generated the incentives that assist nationals in their efforts to grow businesses to be directed by expatriates, which might hinder innovation. SMEs are also without 'in-house' R&D (IIC annual report, 2014). They are lacking technological resources such as research facilities and the qualified personal essential in facilitating complex industrial R&D (STIP, 2014). The existing personnel (managers and employees) have low levels of education and knowledge.

**In conclusion**, reviewing Oman's development over the last 43 years, there have been considerable transformations in all sectors and aspects of Omani life. There have been strong attempts to develop this small country from a very embryonic society to a modern nation. Nevertheless, this development path is unlikely to be sustained for long. There are two primary problems: (1) all national and international indicators are predicting a continued decline in oil production; (2) as the population grows faster than the economy can sustain, the country is failing to create sufficient jobs for national citizens. This has led decision-makers in Oman to re-think their strategies and begin to look towards a knowledge-based economy. However, weak areas exist within actors' institutional settings that are hindering knowledge commercialisation. Their institutional environment with regards to UKC is still embryonic and needs to be strengthened to address key issues identified before. TRC funding (western copied) programs (e.g. ORG, CIIAP) are not aimed at including mechanisms to

involve industry directly in their design or performance to exploit innovation potentials from conducted research. Additionally, despite the desire to capture the concept of KC, there is still an unclear policy related to whether or not to directly support the commercialisation efforts of SMEs. In addition, the priorities and parameters of these programs are mainly developed and specified by governmental officials, as the TRC governing board is dominated by them. This implies that there is a high probability that officials might place more emphasis on their political agenda (e.g. building research capacity) over SMEs' agendas (e.g. gaining profit through knowledge commercialisation).

With regards to the university, although it restructured its governance to adapt to entrepreneurial change through the establishment if IAD, the efforts are still on-going to resource and strategize the department. Moreover, despite the fact that universities have strong collaborations with both industry and TRC, such collaborations are only for knowledge generation and accredited publications. Furthermore, universities are lagging behind in terms of performance and quality standards. They are still trapped in teaching and have a modest position in relation to KC (i.e. having limited patents and no licenses). Additionally, and more significantly, the government has exercised power in influencing and shaping the direction of the university toward KC. The MoHE (as per its position) and other governmental officials (as per their number) have ultimate control over the decisions of making any change to the process, such as incorporating IP into the university's system.

With regards to industry, the Omani SMEs are not knowledge-based firms. They are traditional and the board of members and management are family based. They lack knowledge-based characteristics and capabilities as they are lacking in 'in-house' R&D and technological resources such as research facilities and qualified personal essential in facilitating complex industrial R&D. Additionally, they are influenced by national institutional obstacles such as the absence of policy frameworks for promoting entrepreneurship culture or SMEs,

and the middle-intermediary layer of firms is missing as the economy is still dominated by large companies.

## 4.2 Summaries of Case-Studies:

### 4.2.1 Case A

The project was initiated by academics from the Department of Food and Nutrition Science, in CAMS-College of Agriculture and Marine Sciences, at SQU, in 2008. It was funded by the Public Fund of the Industrial Innovation Assistance Program (IIAP). The project is about the commercialisation of a low fat halwa recipe generated by the university to a halwa local manufacturer.

The collaboration with the factory was first initiated by academics after the new recipe was scientifically generated. Such collaboration was necessary in a curiosity driven process of taking the research outcome to application. The factory's decision of participating in producing the new recipe was influenced by: the non-financial production costs due to the IIAP's incentive of giving the factory the chance to cover the expenses of generating the recipe through contributing in-kind instead of in-cash, where they could contribute in the form of providing the required materials and resources for academics; (2) the similarity between the generated recipe and the nature of products that it produces; (3) the short time expected to produce the product tangibly and launch it in the market since the recipe was already generated by academics.

Due to the relaxation of the IIAP rules the academics and factory had the chance to submit an application as if the factory was the one who initiated the project. The academics' decision was influenced by their motive of getting an access to public funds, securing additional income for themselves and their Department/College; while the factory's decision was influenced by the IIAP's in-kind contribution incentive (i.e. the non-financial cost of involvement). Thus, the

factory utilised the opportunity of getting consultancy services with less cost. For more details see section 1.3 of appendix 1

A mutual agreement reached to disclose the expected IP to the factory, which resulted in a conflict between the academics and their university. The PI-Principle Investigator did not report the potential patented outcomes to the Innovation Director before disclosing it to the factory through the IIC. This action was found to be inconsistent with the university's IP disclosure rules, which was stated as one of the PI's main responsibilities. The PI found it more beneficial to disclose the IP to the factory than to his university as he and co-investigators wanted to benefit from the patenting incentive provided by the IIC, i.e. considering them as patent developers, which was found to be consistent with the their motive of individual academic development through getting the credit for IP development, which has more weight than publications. Therefore, the incentive gave the involved academics the motive to become more persistent in developing their generated research outcomes and making them novel in order to patent them. On the other hand, they found it costly to disclose their IP to their university as there was a lack of tangible return, especially a lack of 'patenting incentive'. Section 1.4.1, Appendix-1 provides more details.

The academics and the factory worked collectively to ensure the generated recipe was close to being patentable and commercially exploitable. An IP application was filled by the academics according to their formal agreement in disclosing the IP to the factory. However, the patent application was rejected by the Ministry of Commerce and Industry (MoCI) as the generated recipe was found to be inconsistent with the ministerial decree number 2004/104 which was developed by the ministry for the concern of protecting the local standards/criteria of making Omani halwa. The academics and the factory replaced the defined ingredients into fat-mimicking ones, which altered the defined specifications. Thus, the director asked the factory and the academics to not patent it elsewhere or publish unless they changed the name of the product. This decree was found to be unexposed to the public electronically

and only known by the ministry's officers and Halwa factories, which are entrusted with the original formula in order to obtain an economical advantage. The factory's GM action of not informing the academics about the rule of the original recipe as a trade secret was due to his lacks of knowledge about the complicated process of patenting. This was his first experiment, which yet was initiated by IIC as a way to encourage the factory to become involved in the system as a way of protecting its ownership right. For more details see subsection 1.4.2 of the Appendix-1.

A chance was given by the MoCI to change the name of the generated recipe to a different one to patent it. As the IP was disclosed to the factory, the decision was left to its GM, who was reluctant to change the name. Rather he was concerned about commercialising the new recipe. For him, changing the name will not add any financial value to its business, which is entirely about the production of halwa under the traditional name of the 'Omani Halwa' that is well-known by consumers in the local market. So, there is the risk of the local market's lack of demand for a newly named product. See subsection 1.4.3 in Appendix-1.

This made the academics decide to take another direction for their research, which would enable them to change the name of the generated recipe. Despite of getting support from their university, the academics couldn't go through with the process as the factory (which had the authority as the owner of the generated recipe) was still reluctant to change the name and patent it through the university. The factory's refusal was because that there was a possibility the university, after patenting it, would sell it at a high price. Thus, it prefers to do things at a lower cost rather than bearing the expense of licensing. Additionally, there was a risk as the university will probably sell or license the protected patent to its competitors in the local market. For more details, see subsection 1.4.4 of appendix-1.

### 4.2.2 Case B

The project was linked with research initiated by two academics from the College of Economic and Political Science, Department of Information Systems in 2011. It was funded by a public fund of CIIAP-Community and an Individual Assistant Program under the TRC's Innovation-Hub. The project is about the commercialisation of a new radar device generated by the academics for the purpose of preventing and reducing the rate of road accidents in Oman.

As mentioned in section 2.3 of Appendix-1, the collaboration with the non-commercial and commercial users was initiated by academics after the radar device was generated scientifically by them. The academics, first, wanted to approach the Royal Oman Police (ROP) as it is the only entity that has the authority in deciding whether to implement the proposed device or not. They managed to raise a fund from one of the national popular telecom companies as a donation in order to develop the device into a prototype to test and show its practicality to ROP. However, the ROP refused to adopt the device. This is due to their common practice of getting ready-made solutions, which had already been applied successfully in developed countries (e.g. UK, US, etc.). Thus, they resisted replacing the existing solutions as they had already paid a large amount of money for them. This made the academics to seek a public fund that supports their generated radar device. They got the opportunity to access the CIIAP fund, which assisted them temporarily in convincing ROP to adopt their device in the future. The ROP's felts secured as the device would be funded and operated totally by TRC. Hence, no financial cost was involved apart from the time of integrating the new device into their system. Second, the relaxation of TRC rules (i.e. bending the rule of commercialisation from start-ups) assisted the academics to get a partnership with a commercial user. The academics lacked business experience, thus they preferred to continue as knowledge producer and got a partnership with a local medium enterprise after disclosing their research outcome to the public through the media.

The CEO of the enterprise was an acquaintance of the PI. They had previously worked together on other projects through informal networking. Thus, they were able to negotiate fairly the responsibility of each party. In addition to personal acquaintance, the decision of the CEO was influenced by two other factors: the similarity between the generated device and his business product line and the non-financial production costs due to the CIIAP's pre-commercialisation incentive of covering the expenses of generating the final device for real life testing. For more details see subsection 2.3.1, Appendix-1.

Before signing the contract with the enterprise, TRC gave the academics the chance to disclose their outcomes to their university in order to get the patent for the generated device. The disclosure was reviewed carefully by the US International IP Company. However, the application was rejected as the produced device was inconsistent with the international criterion of 'inventive step'. The device was produced by making a contribution to an existing device in order to reach innovation where novelty was not maintained. Thus, there is an exclusion of innovative research outcomes from the university's IP protection fund. Form academics perspectives, such exclusion was unfair and unreasonable as the university could also benefit from innovations by generating income through licensing them to industry after protection, which would help in building university's industrial reputations and networks. While from the university's perspective, the exclusion was reasonable as this was in compliance with the aim of improving its image and global ranking by building its own patenting profile. For more details, see section 2.4, Appendix-1.

The failure to patent the generated device was also due to the university's underdeveloped IP disclosure guidelines. Rather than exposing the international patenting invention criterion to academics, it was stated verbally by the university's Innovation Director. The criterion was not stated explicitly in the research regulations or in the process of IP disclosure in the university website. Additionally, there was a lack of communication as there is an absence of KT professionals who are competent to inform academics about the

criteria and advise them on the possibility of taking their generated device further by developing it into a patent. Since the academics couldn't meet the inventive step requirement, they filed another application through the CIIAP. This is due to the CIIAP's flexibility of allowing academics in deciding the type of protection as per their outcome's nature (i.e. innovative outcome). Yet, the academics' previous action of 'public disclosure' in searching for an enterprise confronted them with the issue of fulfilling the requirement of prior art search. Some of the aspects of their generated device were copied by the public which destroyed the possibility of its protection. This was influenced by the lack of recruited experts within the CIIAP who can point the academics' attention towards the negative consequences of public disclosure. IP awareness is ensured by the temporarily engagement of international IP experts. Due to this and to the TRC rules of commencing pre-commercialisation action in parallel to the IP registration process, the academics and enterprise shifted their attention to commercialising the unprotected device. . For more details for the above account, see both sections 2.2 and 2.4, Appendix-1.

### 4.2.3 Case C

The project was about an energy saving research initiated by a local electrical enterprise with assistance from one of the IIC consultants. Smart boards were generated in order to be commercialised by the enterprise as cutting edge technology in managing power consumption within premises by means of prioritizing power demand. The practical production of the generated boards was funded by the enterprise through in-kind contribution and financially by the IIAP- Industrial Innovation Assistance Program operated by IIC. While the decision of commercialisation of these boards was left to the enterprise in a way that they find yields commercial returns.

As revealed in subsection 3.3.1 of Appendix-1, the collaboration between the enterprise and academics was established through the mediation of the IIC. After approaching many local universities, SQU academics in electrical engineering' was selected by the consultant due to their positive response and

strong initial research proposal. In accessing IIAP fund the enterprise gained many opportunities: securing consultancy service money for solving their clients' problem without affording any financial costs (i.e. the fund incentive of in-kind contribution); engaging directly with academia to establish networks and to deliver accurate information necessary to generate the required boards to achieve commercial viability. While the academics' decision to participate with the IIC and enterprise is influenced by: their motive of getting an access to public fund to secure additional income for themselves and their College; and the opportunity provided by the IIC in increasing their industrial research capabilities through smoothing the process of engagement with local SMEs.

However, a conflict emerged regarding the project's short time-frame suggested by the enterprise. The academics' logic is that the development of scientific outcomes into industrial products requires time. They found the completion of project within one year to be insufficient for instilling and translating their scientific knowledge into a language that is understandable to the enterprise. They need to assess the reactions of basic concepts in producing such boards. Contrary, the enterprise's main concern was just to get a final commercial product in a short-period of time to gain a quick commercial advantage. Its logic is that basic research is time consuming as it requires more time for the solution to come. The enterprise's logic was supported by the IIC's rule of considering projects as 'development projects', mainly oriented towards conducting applied research for the purpose of answering enterprise's specific questions through coming up with solutions that have direct applications. This made the academics had no choice but to agree to develop the required boards within the agreed time-frame of one year**.** For more details see sections 3.2 and 3.3, Appendix-1.

A mutual agreement reached to disclose the expected IP to the enterprise. This is as per the action enforced by the IIC consultant in safeguarding the ownership for the enterprise. The academics understood, as they agreed from the beginning that they would collaborate through receiving a consultancy fee,

the IP would be disclosed to the enterprise. After generating the boards, a patent application was filled by the academics and submitted by the enterprise's GM to the MoCI's IP Office as he found it costly to protect the generated boards internationally. However, the MoCI was slow in processing the patent application. An official recognition of the patent is still pending for more than two years. This is due to the absence of the patenting process and professionals within the MoCI IP Office. For more details see sections 3.2 and 3.4, Appendix-1.

The academics found this as an opportunity to have more time to develop the design of boards further to make it patentable. They decided to get support from their university. To avoid conflict, the university asked them to get the agreement first from the enterprise as it has ownership of the generated boards. However, the enterprise's GM was reluctant as he didn't want to bear the expense of licensing. There is a possibility that the university, after patenting it, would sell it at a high price, which hinders his enterprise from having the authority to market the boards to its clients. Thus, he preferred to keep it unprotected. For more details see subsection 3.4.2, Appendix-1.

As mentioned in subsection 3.4.3 of Appendix-1, this resulted in the university losing the opportunity to patent the outcome generated by its academics. Hence, it approached the IIC to negotiate the possibility of convincing the enterprise. However, the IIC found such negotiation with the university to be unreasonable since it would be non-compliant with the IIAP rule of safeguarding the IP for enterprises. Since the participating enterprises contributed to the cost of the design generation and the centre paid the consultancy fees for the academics, the university doesn't have the right to claim IP.

The slow process of patent application created a threat for the enterprise in terms of quick exploitation of the generated boards. Thus, the GM decided to start commercialising the unprotected boards. His decision was also influenced by other factors which emerged from the IIC's underdeveloped commercialisation guidelines: leaving the decision of commercialisation to the

enterprise and considering filing a patent application sufficient for protecting the generated boards. To commercialise, the GM along with the academics demonstrated the generated boards to the concerned local electrical SMEs through a workshop. Yet, the SMEs refused to invest. They found it risky and too costly to buy the generated boards as it: incurred high capital cost (i.e. it required a great deal of investment for buying electrical fittings to tailor it according to their system requirements). For more details see subsection 3.4.4, Appendix-1.

### 4.2.4 Case D

The project was initiated by two academics from CAMS-College of Agriculture and Marine Sciences, in addition to two post-doctoral fellows from the same college and one academic from the College of Engineering. The project was about commercialisation of quality assessment software generated by academics to a local dates' factory under the supervision of the Ministry of Agriculture and Fisheries. The production of the software was on the subject of using an existing computer vision technique in assessing date quality in Oman. The project was funded by TRC's ORG-Open Research Grants, while the commercialisation is considered as the responsibility of the ministry.

The collaboration with the factory was initiated informally by academics during the production of the software to run pilot testing. This was due to the PI's curiosity of practical applicability of the research outcome in solving the problem of dates' surface cracks. This was also due to the GM's factory support as their participation will help them enhance the quality of date processing without encountering any financial cost.

The academics found an opportunity to get an access to public fund as there was consistency between their research and the issues within the 'Environmental and Biological Resources' sector, within ORG. Before granting the funding, TRC requested the academics to reach an agreement with the factory's GM about the nature of his involvement. After negotiation, the

academics decided to recruit the GM as an industrial research expert. The academics' decision was influenced by the freedom given by ORG to academics in generating knowledge according to their interests, where the nature of user involvement is left to them. Hence, the academics had the opportunity to avoid partnering with the factory where secrecy and withholding data was included, which would consequently hinder them from imminent appropriation of generated outcomes through publications. Additionally, in accessing the fund, the academics could: secure additional income for their college, which assisted in establishing a lab for computer vision technology for their students; attract and recruit postgraduates to assist them in the research and to gain personal financial awards as pocket money, for every postgraduate they recruited in their research. For more details see section 4.3, Appendix-1

As ownership conferred to university, the academics had the right to disseminate the scientific aspects of the research findings. To ensure dissemination doesn't preclude the ability to file for a patent, the university asked the PI to submit a patent application before disclosing any scientific description of their research outcomes through publication. The patentability of the generated software was assessed by the US IP Company.

However, the application was rejected. The software was found to be inconsistent with the criterion of 'inventive step'. It was an obvious development of what had come before (i.e. usage of technology that implemented previously in other countries). This was because the academics found it costly to go through the long process of patenting as it delayed publications. Their academic promotion is based only on publications and specifically on the number of published papers rather than on patent development. This can be evidenced more by incentives provided by the university (e.g. publication awards such as outstanding researcher and distinction in research). Thus, patenting doesn't add any value to their professional profile. Moreover, the academics found it beneficial to use their time and effort in utilising the publication incentives provided by the ORG (i.e. granting academics personal

financial incentives as rewards whenever they took initiatives to publish). These incentives were consistent with the academics' motive of achieving research productivity by gaining credit for publishing their outcomes and increasing the number of publication in their profile. For more details, see subsection 4.4.1, Appendix-1.

After publishing, the generated software was demonstrated through a workshop funded by TRC. They educated the concerned ministry by showing them the practicability of their proposed software in order to adopt and implement it in the existing local factories. However, and as it lacks R&D policy as one of its mandates, the ministry was hesitant to adopt and asked TRC to cover the cost of implementation, as the software was generated through a research funded by their ORGs. TRC found this unacceptable as they are not responsible for implementing the generated software as this is not considered to be one of ORG's objectives. Thus, TRC didn't intend to impose implementation and left it to the ministry to decide whether to apply the generated software or not. For more information see sections 4.2 and 4.4.2, Appendix-1.

### 4.3The Process of Data Analysis:

In this process, the data condensing approach was adopted in order to categorize and organize data as well as to draw clear conclusions and confirmation.

First the researcher developed pre- categories, mainly from the UKC literature, before embarking on the coding process. The pre-categories were formed around the institutions as either enablers that facilitate or as inhibitor that imped UKC process. The intention at this stage was not for these themes to serve the function of testing or verifying the theory. Rather they were applied to facilitate the contextual refinement and specification of the themes that will emerge from the data. Hence, in the course of the research, pre- categories may not manifest into substantive themes.

Second the researcher adopted the principles of coding. The process involved breaking down data into different units of meaning. The process began with a complete reading of text of all interview transcripts, documentary evidence, as well as the field notes and then examined line-by-line, seeking to identify words or phrases that suggest/imply specific meanings. This was the first step of coding, and was done manually through a line-by-line analysis and identification of phrases, sentences, or sections, and then pasting them under particular relevant categories.

As shown in Table 4.1 below, the process of coding culminated with the emergence of sub- categories (i.e. Open Coding) and categories (i.e. Focused Coding). In Open Coding, interesting codes were identified and labelled within each individual case. While in Focused Coding, these codes were interpreted and refined to build clear analytical thematic areas. For example, the funding provided incentives and assistance during the collaboration establishment (Cases A & C Open Coding) were interpreted as an intermediation activity (Cases A & C Focused Coding), which consequently explained the positive influence of funding rules (Thematic Area 1).

The process of coding was stopped after the researcher felt satisfied that the list of codes had converged to depict the process of UKC the institutions that shape the actions and decisions of participants towards bridging differences in logics. The coding process is detailed more in Table 4.1, which shows how codes converged to illustrate the actions/decisions involved in facilitating the development of UKC under major themes, which include: The Influence of: funding rules; government's board of governance; networking; fragmented policies; funding operational rules and actors' different logics.

**Table 4.1**: List of Study's Codes and Themes

| **Open Coding (as per individual case initial coding)** | **Focused Coding (Categories)** | **The Emergent Thematic Areas** |
|---|---|---|
| Academics:<br>**A**-Generating revenue for themselves and their organisation by securing additional income through consultancy;<br>**B**-Engaging with non-commercial users (end-user), which increases the potentiality of the application and purchase of their research outcomes;<br>**C**-Generating revenue; securing additional income through consultancy services;<br>**D**-Generating revenue; securing funds for laboratory establishment (e.g. equipment, research assistants) which can be used for further research income (e.g. pocket money reward fund for every student they involved in the project) and for themselves through securing personal income; | Benefits (from fund incentives) | Theme-1: The influence of funding rules: |
| Commercial User:<br>**A**-Possibility of financial revenue (with less production cost) through the commercialisation of the product developed by the academics<br>**B**-The CIIAP's production incentive ; Non-financial liability:<br>**C**-coverage of consultancy service expenses (in-kind contribution incentive); accessing the university's resources (e.g. labs and scientists);<br>**D**-Securing additional income through industrial consultancy; Enhancing the existing system without encountering financial cost; | | |

| | | |
|---|---|---|
| **A**-ability of IIC to bend the rules of the research initiative direction to assist academics in getting the fund for their research and to take advantage of research outcomes for the benefit of the factory<br>**B-**ability of the CIIAP manager to bend the commercialisation rule of 'transferring outcome through start-up' to help academics in covering their weakness of business incapability | IIAP & CIIAP Relaxed Rules | |
| **A**-reaching a mutual agreement due to IIAP provided incentives:<br>**-**IIAP's financial assistance of 'in-kind contribution' and ownership rules<br>**-**IIAP's incentive for academics to become patent developers | IIAP/IIC Role of Intermediary | |
| **C**-IIC' increased the chances of enterprise of getting local services with less consultancy fees<br>**C**-IIC assisted the academics in engaging SMEs in their research, | | |
| **A & B-**nature of the IIAP & CIIAP as an experimental trial with a five-year experiment,<br>**C & D**-incongruence policies:<br>**C** -IIAP fulfills users' requirement of short-term research of achieving quicker returns and directs academics' actions away from achieving the long-term benefit of fundamental understanding of scientific inquiry;<br>**D**-ORG gives academic the freedom to assign the user as an industrial consultant, rather than a research partner; to keep the control of ownership with the academics | Copying funding programs from the Western context | |
| **A & B**-Absence of financial incentive of patenting; the absence of patenting in promotion; | The absence of written guidelines | Theme-2: The influence of |

| | | |
|---|---|---|
| **A & C-**the absence of 'IP prior contract negotiation' with the industry<br>**C**-university's difficulty of safeguarding the ownership of the knowledge generated by its academics<br>**B**-lack of awareness about the criteria of patenting; giving verbal directions rather than written<br>**B & D-**inability of directing the creation of knowledge toward invention while conducting research; | within university (such as the patent criteria) that guide the academics in the process of IP disclosure | government's governing board |
| **A**-Academics communicated with the factory they networked with in the early engagement of their research; no financial liability; sharing of resources;<br>**A**-congruity between the generated recipe and factory's business production line;<br>**B**-They had previously worked together on different projects through informal networking; ability to negotiate fairly the responsibility of each party.<br>**B**-The congruence of the generated device with enterprise's business production line: | The positive influence of informal networking | Theme-3: The influence of networking in producing research outcomes that have potential for commercialisatio n; |
| **A, B & D** -the assessment of patent protection is done through a US international IP company;<br>**B** & **D** -Lack of experts in numbers and competency; university's inability to support the systematic development of inventions;<br>**B**-the absence of permanent local experts within CIIAP who can guide academics throughout the process; international experts are present temporarily; lack of regular communication<br>**B**-projects are assessed and coached by American and Malaysian IP companies<br>**C**-patent assessment & protection for IIAP's projects is done through a contracted Egyptian IP firm; the absence | -signing separate contracts with IP companies from different countries;<br>-the absence of the physical presence of the required experts in Oman; | Theme-4: The influence of fragmented policies in processing invention prototyping and patenting; |

| | | |
|---|---|---|
| of a patenting process and recruited patent experts within MoCI; | | |
| **A-**a collision of two IP elements (Omani Halwa Trade-Secret and Patenting); Halwa is considered as an Omani traditional local product that was stipulated to Oman;<br>**A-**halwa production should comply with the defined criteria to bear the name of 'Omani halwa'; otherwise it is subject to legal liability;<br>**A-**Rejection of patent application due to changing the original traditional recipe; | Misalignment between IIC actions and MoCI IP rules | Theme-5: The influence of funding operational rules |
| **B**-inherent misalignment between the ROP rules of getting ready made solutions and the CIIAP bent rule of commercial exploitation of knowledge:<br>**D**-The fund and the ministry misalignment strategies: the practical application involves the cost of financial liability since it is not assigned as one of its mandates (e.g. lack of R&D strategy); generating knowledge according to the academics' interests only; exclusion of ministry | Misalignment among TRC's rules of exploitation and the non-commercial users' actions/rules; | |
| **A-**Academics disclosed IP to factory; personal remunerations from the IIAP incentive of becoming patent developers vs. their professional obligation of disclosure to the university;<br>**D-**The academics disclosure through publication before assessing the option of seeking IP protection through their university; against secrecy through patenting, violates their classical ethos and moral duty open-science;<br>**D**-Academics' motive of publication in opposition to the users' requirement of secrecy or data-withholding. | Academics' logics | Theme-6: The influence of actors' different logics |
| **A**-Cost of local demand risk: no financial value to its business, which is entirely the 'Omani Halwa' | Commercial Users' Logics | |

| | | |
|---|---|---|
| **A**-factory's resistance to change; resisted changing something that has consistently yielded profit:<br>**A-**the factory violation of national trade-secret; factory's prospect of making profit with less production cost:<br>**B**-Academics' public disclosure: their interest in involving enterprise for accelerating the possibility of bringing the generated device into application;<br>**C**:IIAP: dissimilarity between academics need of fundamental understanding of scientific inquiry and users' requirement of short-term industrial benefit to maximize profit. | | |
| **D-**Ministry's perception of R&D as a cost; not assigned as a mandate or a routine practice within its institutional prerogatives;<br>**B**-ROP preference to the practice of buying ready-made solutions; their perception of considering technology as imported, seen as cheaper and more trustworthy in terms of its existing successful application in developed countries. | Non-commercial Users' Logic of maintain their logic of public fund protection | |
| **A & C**-the rigorous enforcement of patenting/licensing arrangement:<br>**A&C**-Costs for factory and enterprise: The 'non-exclusive license', and the risk of licensing the outcome to existing local competitors, the high royalty payment and inability to bear the cost due to financial incapability; | University's KTOs logics | |

### 4.4 The Emergent Themes for Cross-case Comparison:

Six themes derived from the within-case analysis (presented in detail in Appendix-1) and shown briefly in above section 4.2, table 4.1). These themes were selected as per the pattern shaped by the confluence of meanings within individual accounts (Ayres et al., 2003). They explain the influence of the participants' institutions in shaping power, mimetic isomorphism and intermediation within the UKC process.

The **first theme** explains the influence of the funding rules. Despite the actors' different motives, the financial incentives meant that the academics and users stood to benefit. Also, the IIC's and CIIAP's relaxed management process supported actors' interactions in developing a collaboration arrangement characterized by greater flexibility. This also facilitated the emergence of the IIC as an intermediary as it permitted its officers to make changes in research direction, which consequently reduced the costs of searching for a partner and bargaining. However, the role of intermediary was found to conform only to the IIC rather than across all funding schemes. Moreover, the transformation of funding programs from the west created incongruity among policies, which overlooked the conflict between academics' and users' logics.

The **second theme** discusses the influence of the rules that shaped the activities of the government's governing board. The missing operationalisation of IP guidelines within the university constrained its KT officers from creating awareness about the criteria of patenting and safeguarding ownership of the knowledge generated by the academics. Moreover, the missing operationalisation of commercialisation procedures within the IIAP constrained the fund-operator (i.e. IIC) and the commercial users from commercialising the knowledge generated. The funding parameters were established to control the scope of research projects towards only achieving the goal of knowledge generation. Commercialisation was deemed as the users' responsibility, who found it costly to do so due to their financial limitations. The university and the IIC's inability to operationalise guidelines and rules and the users' inability to

commercialise has raised a question regarding whether or not the voices of those actors are considered within the TRC governing boards. Such issues need to be explored further.

The **third theme** explains the influence of informal networking in facilitating the negotiation of the responsibility of each party. Mainly, it contributed to the decision of commercial users to engage in collaborative activities with academics during the conduction of the research. This was viewed as being considerably beneficial because of the attributes of the knowledge to be produced: The congruence of the generated outcome with the users' business production line, and the parallelism between the short time expected for knowledge production and the users' goal of quick financial return.

The **fourth theme** discusses the influence of fragmented policies in processing actions of invention prototyping and patenting**.** The fragmented action of signing separate contracts with IP companies from different countries impacted negatively on UKC as each country follows different IP rules. Fragmentation was demonstrated also by the absence of the physical presence of the required experts in Oman, which resulted in the lack of face-to-face and regular communication and guidance for academics and users.

The **fifth theme** discusses the influence of funding rules in causing misalignment between actions and rules. The relaxation of funding rules gave the managers and operator the chance to misalign their actions with existing rules. They were able to reformulate rules in response to the requirements of the assigned goals, which impacted positively on the academics' and commercial users' collaboration. On the other hand, the misalignment between TRC's actions and MoCI's rules caused a collision of two IP elements, which subsequently resulted in the academics' and the commercial user's inability to appropriate the knowledge generated. Such inability was also caused by the misalignment among the fund and the non-commercial users (i.e. the Ministry and ROP). For the users, the practical application of the outcomes appeared to involve the cost of financial liability since it is not assigned as one of its

mandates (e.g. lack of R&D strategy). Such misalignment can be explored through the lens of institutional fragmentation.

Finally, the **sixth theme** explains the influence of actors' different logics. Many scenarios across the cases demonstrated that actors acted in accordance with their pre-existing logics, which resulted in conflict. One of these scenarios showed that the user's resistance to change inhibited academics from enhancing their academic prestige through patent development. For the user, changing the knowledge name involved the potential cost of local demand risk, consequently impeding him from achieving his logic of profit maximization. Another scenario was that as the non-commercial users (i.e. ROP, the Ministry) have the ultimate authority on the knowledge adoption and application decisions, they preferred to maintain their logic of public fund protection. Consequently, this inhibited commercial users from reaching their logic of profit maximization and the academics from achieving their logic of curiosity of knowledge application. These and other scenarios are discussed in detail in the cross-case analysis.

### 4.5 Chapter Conclusion:

A description of the Omani overall context was given, in which a justification for why Oman is beginning to re-think its strategies and look towards a knowledge-based economy. The institutional context of the key actors of UKC was explained to provide a glimpse of the weaknesses of their developing institutional settings. Additionally, a summary of each individual case was provided to indicate the main issues/facts effecting UKC. Moreover, a table was drawn to explain how themes were driven. Finally, a brief description of the emerged themes was given to detect connections across cases.

These emerged themes are important as they made sense of the diversity across cases in a way that integrates differences and similarities between them. They are noting the relationships between actors' institutions (i.e. rules and norms) and their embeddeness within particular institutional and central logic

systems. They are also showing the positive and negative interactions between institutions and logics that might influence shaping power, mimetic isomorphism and intermediation in bridging differences in logics within the UKC process.

Having elucidated the study's research context, and giving the summaries of cases and themes, the next chapter explains the analysis in details. Given the size of the thesis, and as aforementioned, it was decided to include the findings of the within-case analysis in Appendix 1 of the thesis. The next chapter is the cross-case analysis where the findings and emergent themes of individual cases were compared and contrasted to generate patterns of outcomes which then led to arriving at higher summative results.

# Chapter 5: Cross-case Analysis

## 5.0 Introduction

The purpose of this chapter, as aforementioned in section 4 of the methodology chapter, is to (1) compare and contrast the four case studies with the goal of generating themes and patterns pertaining to the issues that resonated across individual cases, (summarized in Chapter-4 and presented in detail in Appendix 1), and (2) utilise the themes generated within the study's research context and institutional frameworks (presented in details in section 4.1 of Chapter-4) to facilitate higher analysis in order to arrive at the main findings of the thesis. The perceptions that come out of this analytical process will then be linked with theories and concepts from the literature in chapter six. For the purpose of clarifying the links between the analysis and the research questions, the chapter's headings represent the themes generated from the resonating issues as per the study's research questions. Consequently, the chapter is designed in the form of questions focusing on the implications of the potential mechanisms that can be used in bridging differences in logics within UKC. For each question, a critical discussion of the major implications of the emergent themes was made during the comparison of commonalities and differences in the actors' logics on the events and activities within the processes. This helped in facilitating and reporting a higher summative analysis.

## 5.1 How funding rules influenced the establishment of collaboration

The findings across cases revealed the expansion of government role from the traditional practice of planning and regulating towards supporting and operating the processes of knowledge commercialisation cooperatively with academics and commercial users (Lu, 2007, Leydesdorff, 2009). This can be justified by the following three findings:

First, the analysis highlights the role of the fund-operator (IIC) as an intermediary in supporting the collaboration between commercial users and

academics. Such a role was found to clearly conform to cases ***A*** and ***C***. This is because the design of the Industrial Innovation Assistant Program (IIAP) program is aimed at supporting practical innovation through intermediating/facilitating participation and linkages between industry and universities. The role and responsibilities of the program's Consultants to work in multi-organisational settings and to serve as a connection between different constituencies played an integral part in facilitating the establishment of direct interaction and communication. Such intermediary responsibilities include: (1) visiting and assisting SMEs in coming up with a research idea; (2) communicating with academic institutions to find the right knowledge producers;(3) inviting/bringing together both parties (academics and users) to jointly brainstorm the research proposals, responsibilities, and the ways in which to develop the required product into stages (TRC, 2014).

More specifically, the role of the IIC as an intermediary is highlighted by its advantage of reducing search costs. The search costs in this study referred to time and other resources essential to the search for potential partners (Kodama, 2008). In Case-***C***, for instance, a lack of information on which academics undertake relevant research and a lack of opportunities to meet potential collaboration partners were identified as serious obstacle for both (academics and commercial users) in entering into a university–industry collaboration. The IIC increased the chances of commercial users finding knowledge producers. It reduced the search costs for its member SMEs (clients), which are looking for researchers to support the firm's R&D activities (i.e. obtaining local services with less consultancy fees) by providing information, meeting opportunities, and, mainly, directly coordinating R&D consortia to bring together university researchers and firms that have the necessary knowledge, technologies, and other important resources for the targeted research themes. This helped commercial users in identifying applicable knowledge locally and with less cost as well as in delivering the accurate information necessary for generating knowledge. It also assisted the academics in engaging users in their research

and building good relationships. The following statements by the University' co-investigator and commercial user give evidence:

**"***IIC encouraged us to engage directly with academics which helped in delivering our requirements accurately which was helpful in creating our design to be tailored afterward to be suitable for our clients. By this also we could build good relation with academics that we can use in the near future when we have another problem to be solved with less cost." (CU3, SMEs)*

*"They (enterprises) are not willing to spend time to listen about ideas and knowledge. That is a big challenge for us … The IIC made it easy for us in getting enterprises involve in our researches. Now they are keen to listen to us." (Ac7, SQU)*

Furthermore, and as demonstrated in Case-***A*** of IIAP, the role of the IIC as an intermediary had an advantage in reducing the bargaining costs. Bargaining costs refer to the costs necessary to reach satisfactory agreements with the other party (Kodama, 2008). They are associated with the negotiation and coordination activities with potential partners, particularly those involving asymmetric information[11] and other transaction costs related to motivation and incentive problems with regards to each of the parties joining the collaboration. The financial assistance and incentive of 'in-kind contribution' as well as ownership rules mitigated the commercial uncertainty arising from the involvement in new business activities (i.e. R&D activities) of commercial users. Additionally, the incentive for academics to become patent developers shunned the potential conflict of IP disclosure as they had a greater understanding of the knowledge and its production than the commercial users. As argued by commercial user and university's principle investigator:

[11]Asymmetric information in this study refers to information failure and is present whenever one party in a transaction possesses greater material knowledge than the other party.

*"We are getting service and the IIC gave money to the university not us. For us it was in-kind investment by time and providing the materials, tools, space and so on." (CU1, SMEs)*

*"IIC consider us as patent developers…Patenting is important for us to get the credit that they have innovative ideas…Patent is different way of innovation than publication. It gives more weight for us within not only our career but also within the industry." (Ac1, SQU)*

**In summary,** the above confirms that the government policy within IIAP, aimed at enhancing the role of the intermediary, can more effectively facilitate knowledge commercialisation interactions. Its bridging role improved the connectedness between academics and commercial users and facilitated the diagnosis of needs and the stimulation of the search for solutions. It helped in bridging the information gaps between academics (knowledge producer) and commercial users (knowledge user). More specifically, it reduced search costs and bargaining costs for commercial users and academics seeking collaboration partners.

However, the findings revealed that the role of the intermediary is not consistent across funding schemes. This is due to their different rules and objectives. The design of programs in cases ***B*** the Community and an Individual Innovation Assistant Program (CIIAP) and ***D*** the Open Research Grants (ORG) is not aimed at supporting the business sectors' innovation needs or efforts. None of these programs include mechanisms to involve commercial users (i.e. existing SMEs) directly in their design or performance to exploit innovation potentials from conducted research. Instead, the involvement of users, as evidenced from the cases, was driven and controlled by academics as per their research agenda and interests.

Second, the findings revealed that the flexibility of the funding programs assisted the IIAP operator (IIC) and the CIIAP manager in attaining the scope to relax rules. This, as shown in Case-***A***, can be evidenced by the client

manager's ability to bend the rules of the 'research initiative direction' in order to support the development of collaboration arrangements that have greater flexibility. The operator could integrate new policy towards assisting academics in their applied research by taking advantage of their outcomes for the benefit of local enterprise. Similarly, and as shown in Case-***B***, this can be demonstrated by the ability of the program manager within CIIAP to bend the commercialisation rule of 'transferring outcome through start-up' by assisting academics in covering their weakness of business incapability (lack of business experience and knowledge) through establishing partnerships with local medium enterprises.

**In short,** the flexibility of the IIAP and CIIAP funding rules assisted the operator and the managers to relax the rules. It gave them the power to make changes and integrate new formal rules, which ultimately had a positive impact on establishing successful collaborations between academics and commercial users.

Third, the analysis shows that the financial incentives provided by all funding programs (i.e. IIAP, CIIAP, ORG) played a big role in facilitating the establishment of collaborations between academics and commercial users. Although the analysis shows that collaborations were assisted by the different motives of academics and users, both parties were ultimately positioned to benefit (See table 5.1 below). However, this benefit was found to be different for each party because of funding, particularly institutional financial incentives. Such incentives had contributed effectively to academics' and users' decisions to engage in collaborative activities. When examining cases with regards to the benefits gained from funding, the findings indicated that the majority of the involved academics placed a very high level of importance on additional income as a goal in collaborative practices. They were incentivized more by the opportunity of securing a substantial amount of funds for themselves and their universities. In Case-***D*** of ORG for instance, revenues were generated for research assistants and lab equipment in their field of research, and personal

income was secured as a pocket money reward for every student they involved in the project. While for users, the findings showed that all of them were incentivized by the opportunity to generate new knowledge (i.e. new product or system development) without incurring any financial liability. As in IIAP cases-***A*** and ***C*** for instance, the funding rule of in-kind contribution (i.e. usage of current materials and HR) assisted users in getting free consultancy services that resulted in developing new products similar to their production line through direct engagement with knowledgeable local consultants.

**Table 5.1: Motivation for and benefits of university-industry collaboration**

| Actor | Case | Motivations | Benefits from funding |
|---|---|---|---|
| | | | |
| **Academics** | **A IIAP** | Curiosity driven - taking research scientific outcome into application; | Generating revenue for themselves and their organisation by securing additional income through consultancy; |
| | **B CIIAP** | Commercialising the final product, possibility of financial revenue for academics through licensing; | Engaging with non-commercial users (end-user), which increases the potentiality of the application and purchase of their research outcomes |
| | **C IIAP** | Insight into practical trends in industry; increasing their industrial research capabilities; yielding a positive effect on their student education. | Generating revenue for themselves and their organisation by securing additional income through consultancy services; |
| | **D ORG** | Curiosity relating to practical applicability of the research outcomes in solving the problem of | Generating revenue: for their organisation through securing funds for laboratory establishment (e.g. equipment, research assistants) |

| | | | |
|---|---|---|---|
| | | concern; Testing of existing theory in practice; | which can be used for further research income (e.g. pocket money reward fund for every student they involved in the project) and for themselves through securing personal income |
| **Users** | **A IIAP** | Possibility of financial revenue (with less production cost) through the commercialisation of the product developed by the academics | Getting consultancy services without incurring/experiencing any financial cost (e.g. IIC in-kind contribution incentive). |
| | **B CIIAP** | Possibility of financial revenue (with no production cost) through the commercialisation of the product developed by the academics | Avoiding the huge cost of outcome production and guaranteeing the potential future local market demand due to the involvement of the main buyer; |
| | **C IIAP** | -New product development;<br>-Access to university labs and scientists | -coverage of the consultancy service financial expenses (in-kind contribution incentive);<br>-opportunity of accessing the university's resources (e.g. labs and scientists); |
| | **D ORG** | new development of technology; | -Securing additional income through industrial consultancy;<br><br>-Enhancing the existing system without encountering financial cost; |

Source: Author's research

On the other hand, the analysis shows that the transferred funding programs hindered the production of research outcomes that had potential for commercialisation. The programs, as aforementioned in this study's research

context (see section 4.2 of chapter 4), were designed through benchmarking, by adopting models drawn from Western contexts, which are required to be customized as per the situation in Oman. As stated by one of the TRC's Officers:

*''Benchmarking! All the used rules are from benchmarking, but eventually the rules were twinkled and customized according to the culture around. So they are implemented by us, the original work done in fact by two experts from developed countries such as Canada and others. It is a way to learn how they did it. So we make them viable and run them as an experimental;'' (PPMF1, TRC)*

The IIAP and CIIAP programs, for instance, were designed by adopting Canadian models as a trial in a five-year experiment. However, this resulted in unbalance between academics' and industrial logics. This is shown through the emergence of incongruence between funding policies. In this respect, and as conformed in Case-***C***, although the IIAP funding program (represented by IIC) was established to facilitate collaboration through filling the gaps between SMEs and academia, its research-orientation policy was found to be aiming at encouraging applied, rather than basic, research. More specifically, the IIAP promoted interactions by directing academics' actions away from achieving the academic value of 'research quality' (i.e. long-term benefit of fundamental understanding of scientific inquiry) by reason of fulfilling the users' requirement of 'time' (i.e. short-term industrial benefit of achieving quicker returns to maximize profit). In other words, it promoted interactions by shifting the academics' mentality of reward system from basic to applied research, specifically, from focusing on discovery and quality to focusing on satisfying the needs of the users. Moreover, full ownership was given to the users to prevent academics from publishing through fulfilling their requirement of secrecy and data withholding. This is evidenced by the fund's action of maintaining user control while neglecting the academics' need for publishing. From the fund's perspective, with regards to solving their issues, users usually look for a

practical solution rather than theories. For the users, the science is not quite as valuable as the commercial application, because they are into making small incremental improvements and getting ideas to the market fast. Therefore, giving sufficient control for academics and prioritizing the long-term prospects is not seen as being as profitable for users. Evidence to support this argument is seen in statements made by the IIC's CEO and one of the commercial users.

*''They (SMEs) used to look for a temporarily solution that makes them live for a while. So they don't wait for theories to come and solve their issues… I don't think doing long-term research is significant now, encouraging enterprises to start any R&D is more important." (PFO1, IIC)*

*''It (basic research) is timewasting because you are trying to say I am doing research now and I am expecting to get the return maybe after two years' time or more to start coming and we are not sure if it comes. And when the time the technology comes to us to commercialise it becomes obsolete because someone else came with the same or something better. So, there is a risk of taking long time to do it because we cannot guarantee success." (CU3, SMEs)*

Conversely, and as evidenced from Case-***D***, the ORG research-orientation policy is seen to be targeting the other side, which encourages basic, rather than applied, research. It encouraged the interactions by directing academics' actions towards accomplishing their value of research quality without emphasizing the importance of accommodating the users' time constraints. The interactions were promoted by supporting the academics' logic of 'open science' as opposed to the users' requirement of 'secrecy or data-withholding'. This is evidenced by the control given to academics in assigning the user as an industrial consultant, rather than a research partner, in order to keep the control with the academics and restrain the users' control over ownership and the type of research outcomes. For the fund, giving such control to academics is essential as they are into targeting research that is based upon their interests. Therefore, restricting them to the users' logic of secrecy or data-withholding

hinders the fostering of high-quality research and developing the research capacity within the country. As argued by one of the TRC's Officers:

*''I believe to ask me what the biggest challenge for Oman when it comes to research; I would say it is the lack of researchers. We don't have enough researchers to do research and the number of high-quality publication is low… so this program was designed to fill this gap. We need to encourage existing academics and generate new one. That's why we don't impose academics to involve companies as research partners it is up to them.'' (PPMF2, TRC)*

**In summary,** the fact that funding programs (i.e. IIAP and ORG) were copied from the Western context hindered the production of outcomes with potential for commercialisation. The incongruence of funding research orientation policies caused a lack of incentive for exchange due to the logics divide. An unbalance between academics' logics and industrial logic emerged as neither funding policies holds itself responsible for bridging the differences in logics. They are focusing more on achieving their own agenda while neglecting the opportunity of producing successful commercialised research outcomes.

### 5.2 How governing boards influenced knowledge appropriation

The findings revealed that the actors (university, fund-operator-IIC, and commercial users) are operating under opaque bureaucracy and government control in terms of knowledge appropriation activities. This is highlighted by the opacity of decision-making, which was demonstrated by the absence of symmetric power within the governing boards of both the university and TRC. As aforementioned in this study's research context (see section 4.1 of chapter 4), there is considerable interaction and involvement of high-level governmental officials on the boards, who are appointed by Royal Decree and Ministerial Cabinet (for more details see Appendix 2). This resulted in an unbalance of power between actors in the decision-making process. In this respect, although the KTOs voice is welcomed by the University Council (The academic council, in which the officers take part) and has the power to contribute to the development

of policies with top management, and despite the fact that the voice of the IIC-board members is acknowledged and they contribute to the development of the IIAP policies, both are still not satisfied with this power since they have failed to achieve full autonomy in designing and restructuring the operational guidelines of their programs. The governing boards consult with them and take their feedback/suggestions, but do not share power with them or transfer power to them in making decisions and developing policy.

Additionally, and with regards to commercial users, despite the fact that the TRC tried to accommodate a fair representative policy of shared governance, the decisions are still mostly made by the governmental officials, and the private sector members simply have to approve it as they have a fewer number of votes (for more details see this study's research context section 4.2 of chapter 4). More significantly, the members involved are individuals who work only in large companies and were appointed by the heads of the governing board on a 'personal basis' as per their interest in R&D and experience in the field of managing financial institutions or public shareholding companies operating in Oman**.** SMEs owner/managers who would champion the interests and needs of commercial users in knowledge commercialisation were excluded from the board.

The high-level governmental officials (as per their positions and representation on the boards) are considered to be the main drivers and producers of policy agendas. They retain more control over the development of policy priorities and parameters. This, as will be discussed hereafter, had a negative impact on knowledge appropriation.

First, the officials' greater power compared to that of the university KTOs and the funding-operator', led to a lack of accessibility to the information necessary for designing the required policies (operational guidelines). The voices and participation of the university's KTOs and the fund-operating officers were reduced and limited, which consequently resulted in secrecy and a lack of transparency, as the officials are the ones who hold such crucial information.

This left scope for ambiguity as actors do not share the entire process of policy development and implementation.

With respect to the university, the University's Council practice of limiting the participation of KTOs (i.e. IAC[12]) in decision-making had caused a lack of transparency. This can be evidenced by the unclear vision and understanding of the direction of the university' council as pertains to injecting the national IP rules into the university's existing IP regulations (i.e. publications, copyrights, etc.). A proposal was drafted by the officers two years back, but has not yet been approved by the University Council. Their suggestions were not applied, and they related this to the Council's unclear direction. As stated by one of the KTOs:

*''See our suggestions are welcomed by the top management here, but we are not sure to what extent our suggestions are and will be applied; because we cannot see this in reality. And the direction of university council is not clear to us with regards to this. So we have to wait for their decision.'' (UO3, SQU)*

This constrained the operationalisation and dissemination of IP guidelines required for governing actions. Instead of having written guidelines for IP (i.e. patenting), verbal directions are given by the department's staff as a way to coordinate IP matters whenever the academics disclosed their expected inventions. This consequently caused: (1) the university's inability to create awareness about the criteria of patenting (which are enforced within the university's protection fund), as demonstrated by cases ***B*** and ***D***, because the criteria were not exposed and disseminated among faculties; (2) the university's difficulty of safeguarding the ownership of the knowledge generated by its

[12]As the innovation department lacking experts, the university made an effort by getting use of its existing staff. An IAC-'Innovation Advisory Committee' was established in 2012 for the purpose of ''*Developing, implementing and evaluating policies, procedures and practices of SQU IP and innovation policies (e.g. ownership of IP rights, royalty sharing, confidentiality clauses, material transfer agreements, etc.)'' (UO2, SQU)*. The committee consists of assistant deans in research of three colleges of (Engineering, Science, Agriculture and Marine Science). They were selected as per their positions and colleges' high research performance.

academics due to the absence of 'IP prior contract negotiation', which resulted in the failure of directing the action of concerned officers towards negotiating the possibility of safeguarding ownership to the university before signing the contract with industry. As per the university's procedures, the research contracts were signed under the supervision of the consultancy and contracted research section within the university's research department, in which IP negotiation was not assigned as one of its mandates. The absence of such guidelines, as confirmed in cases ***A*** and ***C***, meant that the specifics of IP were not negotiated, in the signed contract between the parties (academics and user), neither by the section nor the innovation department officers. This gave the university no right to claim ownership, consequently hindering it from safeguarding the ownership of the knowledge generated by its academics. As stated by two of the university's KT officers:

*''we are developing the IP and that we are missing in our university… Now what we do is that we are giving verbal directions in how to process their application… So if they want patenting then we will support them with the initial system screen and sign an agreement with the US firm. We are planning to place these guidelines in the website or in written in the future.'' (UO4, SQU)*

*''No, we cannot claim for it. It is already disclosed to industry. You know what is actually happening they are developing in the university the innovation department but there is a unit of research department in handling new system. It should be our department. We should be in the picture in negotiating IP with industry… Recently, we don't have any involvement and when we get the information from the research department, I saw they are having very minimal contracts and these contracts should come actually to us. They don't negotiate IP because it is not their responsibility.'' (UO2, SQU)*

Similarly, and with regards to the fund-operator, the limitation of IIC participation in the TRC board's decision-making process resulted in a lack of transparency about the probability of operationalising the knowledge commercialisation stage

as one of the IIAP fund's responsibilities. A proposal[13] for further investment was drafted in 2012 by the fund-operator (IIC) to the TRC, but it has not yet been approved. Their suggestions were not applied, but rather parameters were established to control the scope of the activities followed by the IIC. The activities are influenced mainly by the goal of achieving knowledge generation, first, as a way to encourage commercial users to adopt outcomes generated by academics to be used for their own benefits; and secondly, as a way to encourage academics to participate in research to find solutions for national issues. Therefore, commercialisation is not operationalised in the interaction as one of the IIAP's activities, but is rather deemed as the commercial users' responsibility, who (as will be discussed hereafter) found it costly due to their financial limitations.

*''until now we cannot commercialise, because TRC 5 years ago we gave a proposal and they said will do it. We told them what about this, why don't you allow us to do commercialisation until you open your commercialisation office, and we will shift our experience. But for 5 years we are doing the same things. We do research then when we finish we look what to do next, because we are waiting for TRC to approve our proposal.'' (PFO1, IIC)*

Second, the greater power of high-level governmental officials (mainly as per their representation in the TRC board) against commercial users (as per their exclusion) led to the emphasis of their demands, such as political and national agendas (i.e. research capacity building) against SMEs' agendas (i.e. knowledge commercialisation requirements). In this case, the voice of the users was absent, which restricted the users' control over the achievement of their need for KC.

[13]The fund operator with TRC was planning to design a comprehensive database of services provided by existing public and private funding agencies. This was in order to create a single point of reference for domestic innovators and SMEs. Moreover, a partnership with large private companies was planned in order to offer expertise to SMEs to help them to innovate and commercialise new products and services.

This is evidenced by the unclear standards of fund allocation, which can be shown by the incongruity between different funding policies regulating knowledge commercialisation. Regardless of the strong support at the national level for increasing industry contribution to socio economic development[14], as well as for promoting and fostering its financial capabilities that focus on knowledge and innovation in 2013[15], and although the 'commercialisation fund'[16] is acknowledged as one of the TRC's proposed policies under the knowledge transfer goal, such policy was not implemented in the IIAP program by any means. Rather, further investment was allocated for other funding programs. This, as shown in table 4.2 below, can be evidenced from cases ***A*** and ***C*** by the low budget devoted to the IIAP (which is considered the only funding program overseeing SMEs' R&D and commercialisation) in comparison to other programs, in Case-***B*** (CIIAP-Community and Individual Innovation Assistance Program, and Case-***D*** (ORG-Open Research Grants Program). Also, it is worth mentioning that there was no oversubscription within the IIAP. The fund's overall expenditures for the projects (total = 30) conducted during the 5 years was 570.296 (equating to 39% of the total budget OMR 1.5 million), and the remaining 61% was not exploited for supporting knowledge commercialisation.

**Table 5.2: Comparison between funding programs**

| | **IIAP (Cases *A* & *C*)** | **CIIAP (Case-*B*)** | **ORG (Case-*C*)** |
|---|---|---|---|
| **Overall Budget for 5 years (2009-2013)** | OMR 1.5 million | OMR 11.5 million | OMR 15 million |

[14] *''The economy will no longer be an oil-reliant economy in 2020. It is envisaged to be a diversified economy with higher levels of savings and investments. The sources of national income will be diversified with the non-oil sector assuming the primary role''* (MONE, 2008, p. 18)

[15] In 2013, His Majesty called for a national symposium which assessed all aspects related to the weaknesses of local SMEs in which increasing financial support to SMEs through public and private funding programs are given significance.

[16] *''funding innovative ideas with commercial potential in the private sector'' (PPF1, TRC)*

| | | | |
|---|---|---|---|
| **Budget per project** | OMR 50,000 | OMR 100,000 | OMR 250, 000 (differ as per type of project) |
| **Number of projects in 5 years (2009-2013)** | 30 projects | 23 projects | 102 projects |

Source: Author's research

From the above, the availability of Public/governmental funding is not to be seen as a major concern, but the allocation of the funds is problematic. The modesty of the budget engaged within the IIAP is incomprehensible at a stage where innovation is more expected, in view of the country's diversification goal. This is particularly clear when compared to what is spent on other funding programs (i.e. ORG), as well as from the provision of the commercialisation fund for programs (i.e. CIIAP) which, by and large, are not found to be aimed at supporting existing users' commercialisation efforts and needs. This is also clear from the lack of exploiting the outstanding percentage of the fund for achieving the goal of commercialisation.

Hence, it is not surprising to find that policies within funding programs are not aimed at supporting users' commercialisation activities. Certainly, the majority of actors (governmental officials and academia) involved in the funding governance board will take the opportunity and become more driven towards targeting their own agendas (such as building research capacity in preference to commercialisation) while neglecting the needs of absent actors (i.e. SMEs). This has consequently distracted users' commercial potentials and activities and has translated into marketing weaknesses and inefficiency. In IIAP, particularly Case-***C*** for instance, commercial users, as small enterprises, were unable to afford the high capital cost of final product production. For them, the cost of implication of commercialisation was considered disadvantageous to such an extent that additional funding or fiscal support may be required, which again was not provided by any means.

*‘‘Production cost is an issue for us. See we are always struggling here to source finance support and partners in the commercialisation and marketing processes…They (government) consider it as a cost not as an investment… So it is hard to get support from them. Now we are looking for a help from IIC but things are not clear yet.’’ (CU4, SMEs)*

*‘’SMEs are willing to do research but providing them that they can see the outcome of their products! They don’t want the produced product to become obsolete. They want to market it and I think there is adequate money for commercialisation, at lease seed-money because we are not using all budget. But the allocation system is not clearly standardized.’’ (PFO1, IIC)*

**In summary,** the opacity of decision-making of governing boards hindered knowledge appropriation. This was demonstrated by the boards’ bureaucratic and regular practice of limiting and reducing the voices and participation of other actors. Hence, shared governance was missing and an unbalance of power occurred. The power of decision-making was not transferred or shared with the other actors. This resulted in unbalanced decision-making between actors, which consequently had a negative impact on knowledge appropriation. The unbalanced decision-making between high-level governmental officials and the officers of both universities and the IIC caused a lack of transparency with regards to the information required for injecting operational guidelines, while the unbalanced decision-making between high-level governmental officials and commercial users resulted in restraining the users’ control over achieving their goal of knowledge commercialisation.

### 5.3 How networks influenced the production of research outcomes

The findings revealed the effect of the type of networks towards producing research outcomes that have potential for commercialisation. The analysis in cases ***A*** and ***B*** indicates that the informal networks that emerged through early engagements between academics and commercial users (in the first and second stages of scientific knowledge production), and prior to forming a formal

collaborative R&D project, assisted in producing outcomes that have potential for commercialisation.

The formation of such informal networks was interest-driven. The process followed an emergent pattern as environmental interdependence[17] and similar interests motivated actors to cooperate. Here, and as demonstrated in both cases, the actors experienced and faced a common need for resources, which led them to form an informal tie. For instance, as evidenced in Case-***A***, structural resources (i.e. personnel, tools, machinery, materials, equipment, research labs, etc.) as well as cognitive resources (i.e. professional experiences, research experiences) were needed and shared for ensuring knowledge proximity, particularly, similarities in what they produced and how they produced it (i.e. guaranteeing the congruence of the expected generated knowledge with the commercial users' production line).

*"They provided us with resources. So he liked the idea. The natural fat-mimic ingredients are expected to provide similar mouth feel as high fat halwa. He allowed us to use all his piloted plans and facilities and we are taking all the ingredients and other things." (Ac1, SQU)*

"*We are producing similar product. So there was no loss as I said we gave the required resources which we are already using and available, in addition of using low fat materials which were less in cost." (CU1, SMEs)*

Their common interests generated the preconditions for developing formal structures for their relationship, in which research outcomes were transformed into commercial tangible products. Central here were the prior personal relationships, which became a source of mutual trust on which the formal collaboration was based. In the trial phases, the development process through which the actors get to know each other and learn how to work together led to the development of clear expectations, which together form the initial structure

[17]"Interdependence exists whenever one actor does not entirely control all of the conditions necessary for the achievement of an action or for obtaining the outcome desired from the action" (Pfeffer & Salancik 1978, p. 40).

for knowledge exchange. Consensus was generated on the domain of their cooperation, which established a strong expectation of continuity of interaction. These factors reduced uncertainty and resulted in no cultural conflicts during the stage of practical knowledge production. Hence, the emergence of informal networks assisted in merging/converging logics, in particular, the academics' logics of 'discovery-driven research' (in Case-***A***) and curiosity of knowledge application (in Case-***B***) with the commercial users' logic of 'profit maximization'. Additionally, users' logic of profit maximization (i.e. gaining exclusive license) also converged with the academics' logic of individual career progression (i.e. patent developer). In this respect, the commercial user, as per its strong relation with academics, utilised the collaboration to develop skills to interact with academics, in addition to the legitimacy generated from the project. This ultimately reduced the tensions arising from logics:

*'Giving the ownership to academics helps in their career advancement. See as they gave us license we don't have any issue. We are still gaining profit…The outcome is innovative and similar to our production lines and this is our first project with academics here. We want to build our skills in how to collaborate with academics and by this we establish stronger relation with them.'' (CU2, SMEs)*

On the other hand, the analysis in cases ***C*** and ***D*** indicates that the networks which emerged through formal linkages (i.e. through IIAP and ORG) hindered the production of research outcomes that have potential for commercialisation. The formation process followed an engineered pattern as the government was considered as the triggering entity initiating the cooperation. Here, an intervention of government was a necessary condition for collaboration establishment. The actors didn't experience strong external stimuli to cooperate, such as a common need for resources, and didn't have an apparent/explicit common motivation. Rather, the government created a 'perception of the need for the collaboration'. With this as a starting point, the collaboration establishment process followed a hub approach where the actors in the network cooperated with the government agent, but only indirectly with

each other. As the actors at the start didn't recognize similar interests, their expectations of the relationship as well as the embeddedness within the networks were likely less.

This, as seen in cases ***C*** and ***D***, can be shown by the emergence of logic conflict between academics and commercial users. Actors' conflicting logics had constrained the incentive for exchange across the divide. In this respect, the analysis shows that academics and commercial users complacently accept the divide between them as inevitable. Neither side holds itself responsible for breaking down the logic divide.

In Case-***C*** of IIAP for instance, a conflict arose with regards to the type of research outcome. While the user sought a profitable product in a short time, the academics prized excellent scientific research outcomes which only accrue in the medium to long run. For academics, there was a need to revisit and understand the basics in order to know the reaction of basic concepts in producing knowledge. Therefore, the development of basic outcomes into industrial products requires a long time. While basic research for the user was seen as time consuming as it requires a longer time for the solution to come (or to be obtained). Therefore, he was afraid to take the risk of getting involved in long-term research where success and immediate profit are not guaranteed. Hence, time was a key element for the user whereas quality was vital for the academics.

*''the research for us is mainly basic research and for industry means a product; See the product has to be created but not at the cost of basic sciences. We need to revisit the basics first to get the knowledge from gross root to implement it. But they want to get a final product quickly to get profit." (Ac4, SQU)*

*''It (basic research) is t**imewasting** because you are trying to say I am doing research now and I am expecting to get the return maybe after two years' time or more to start coming. So, there is a risk of taking because we cannot guarantee success.'' (CU3, SMEs)*

Similarly, in Case-***D*** of ORG, a conflict had emerged between the academics' logic of 'open-science' and the commercial user's logic of 'data-withholding'.

While the intrinsic aspect of the academics' reward system was based on establishing IP priority through publications, the user sought a competitive advantage by safeguarding IP through data-withholding or outcome non-disclosure. The academics view data-withholding as distracting the academic scientific community from generating publicly available research. It violates their moral duty in academic science of emphasizing the importance of "giving back" to society and making research outcomes available to the public. It also results in infringement on their rights to publish. While commercial users view data-withholding as significant for safeguarding their data from being leaked to competitors as academics had more intimate access to company information. Sometimes academics learn information that is outside the scope of the research project and therefore outside the scope of intellectual property-sharing agreements. Hence, for them it was crucial to withhold data through signing a non-disclosure agreement in order to protect the information that the academics picked up during the course of the research.

*''You know if we have an industry as a partner in the project there is a possibility that they won't allow us to get use of our outcomes properly. They will have right to withhold publications and information dissemination because they are afraid that we will include confidential information." (Ac10, SQU)*

**In summary,** the emergence of informal networks assisted in merging both cultures-the academics' 'curiosity or discovery-driven research culture' with the commercial users' 'innovation-driven environment'- such networks emerged as environmental interdependence and similar interests motivated actors to cooperate. The resources (structural and cognitive) that became available through the structure of informal networks gave the actors the opportunities to cooperate, but also led to recognition of common interests and explicated motivations for further cooperation. Such resources were needed and shared for the common purpose/motive of ensuring knowledge proximity. Hence, mutual trust was generated during trial phases. Agreement was generated on the domain of their cooperation, which established a strong expectation of

continuity of interaction. A formal collaboration was formed, in which research outcomes were transformed into commercial tangible products.

In contrast, formal networks had hindered the merging of both cultures. Such networks emerged through the intervention of government (in which the government created a 'perception of the need for collaboration' within, e.g. IIAP and ORG). Preconditions and motivations were not integrated. The parties didn't experience common interests and motivations as stimulators for cooperation, as early engagements were missing. Hence, they had a lesser degree of embeddedness within the network as mutual trust was not reached. A logic divide which resulted from conflicting logics, had emerged as both academics and users were inherently incentivised toward different motives. The academics relied on producing high quality research through achieving scientific standards, whether it is product-based or service-based, while users depended on projects that maximize profit and survive in the market. Therefore, users were rewarded for bringing commercial success, while academics were promoted based on publishing clout. This consequently constrained the production of outcomes that have potential for commercialisation.

### 5.4 How fragmented policies influenced invention prototyping

According to the interviewees, and in addition to the official documents, the university[18] and government (represented by TRC as a policy-making and funding body) seem to have well-written rules with clear visions and goals towards knowledge research and innovation transformation. However, and regardless of considering such rules as triggers for KC activities, the university and government are still in a poor position in relation to knowledge appropriation (particularly in invention generations and patenting). Efforts are still on-going to resource and strategize the concerned bodies. There is a lack of expertise, both in terms of numbers and competency, with regards to allowing and facilitating the assessment of invention prototyping and patenting. The

[18]The university restructured its governance to adapt research and innovation changes through introducing the 'Innovation Affairs Department' as part of its formal administrative structure in 2010.

university lacks in numbers as the IAD-Innovation Affairs Department has only four employees and lacks in capability as those employees are not qualified and don't have knowledge/experience in IP patenting law and process. Similarly, at the national level, despite the fact that the MoIC-Ministry of Commerce and Industry is considered the institution that is the main IP authority in Oman, its IP office lacks in numbers as it only has three administrators who lack expertise in how to search and assess patents.

*''yes the strategy is there, but we lack expertise. At the moment in the innovation department we have only four staff but we are planning to get more specialised staff form chemical engineering, science, business and political science, so in this office we want people from different backgrounds.'' (UO1, SQU)*

*''We don't have patent examiners. There are only three admins in patenting and they only specialised in receiving applications for patent disclosures. And the number of applications increasing and nothing is new. No guidance is there yet to help them and they don't have the experience and the abilities to handle those applications and we shouldn't blame them… We need actually more than 40 experts in different specialised areas to judge on the novelty of the patent and we cannot actually hire those'' (GO1, MoCI).*

As the lack of experts can be, as stated by many interviewees, related to the policy priority of building research capacity at both the university level and the national level[19], another more important factor emerged, which goes with the issue of fragmentation across university and government systems.

[19]The focus on research capacity policy was due to the shortage of research competence (i.e. qualified researchers, assistant researchers, technicians, etc.). In this regard, the university has considerable competence gaps within its different academic faculties due to the turnover of more than 25% professors and staff in 2014. Significant part of faculty who are coming from foreign countries including developed industrial economies resigned and moved to another university. One of the main reasons behind this turnover is university's low salaries as compared to those offered by other universities in the neighbouring region (GCC countries such as Qatar, UAE and Saudi Arabia) (USP, 2009-2013). Moreover, and at the national level, the limited number of Omani researchers caused mismatch between country's priority sectors (i.e.

The findings across the cases revealed the emergence of fragmentation in processing actions of invention prototyping and patenting. Instead of recruiting experts, the university and government initiated policies for using foreign experts as a channel for filling the gap of expertise. However, such policies were initiated separately. There was an absence of joint policy, and the policies were scattered and disjointed between both parties. From what is apparent, the initiated policies appeared to be rather uncoordinated. Rather than having a single contract, they signed separate contracts with IP companies from different countries. At the university level, a contract with a US IP company was signed for assessing and registering IP disclosure; while at the national level, contracts were signed with IP companies from different countries (i.e. Egypt, Malaysia, Canada, etc.). In Ministry of Commerce and Industry (MoCI) for instance, a contract was signed with an Egyptian IP company to assess the received patent applications from IIC (operator of IIAP). Additionally, a contract was signed by the TRC under certain funding programs (i.e. CIIAP) with another US IP company to guide individuals in the process of protection in addition to examining and studying the strengths and weaknesses of disclosed IPs. This had a negative consequence, as each country follows different rules and regulations.

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Oil and gas, biological resources and industry as per their GDP contribution) and current research efforts by academia. The number of research scientific publications in such top sectors is small, which made TRC to allocate high research expenditures in building required competences within the country's different HEIs (TRC, 2014): *''the fund is coming from the government and the government is into the area of building capacity in research. They focus on research aspects and awareness, trying to encourage research to build infrastructures of each institution. So they are not concerning about building capacity in IP, may be in the future, but not now.'' (UO3, SQU)*; *''The capacity building is very important. But we cannot say it is important and we are not developing the skills in the area of innovation and KC. We have to have staffs that are actually capable and have experience. But they are building the capacity in faculties and forgetting us! We lack expertise. And at the moment we have only four staff who are also under expertise.'' (UO2, SQU)*

More significantly, fragmentation across boundaries has emerged. This can be explained by the absence of the physical presence of the contracted companies (required experts) in Oman, a situation akin to that of the lack of face-to-face communication which appeared to result. Actions and decisions across systems and agencies were taken independently, which consequently limited to a great extent what the university and government can do as well as restraining experts' understanding about what is applicable consideration.

The fragmentation across funding and university, as well as across boundaries, had adversely impacted the university's ability to support the systematic development of inventions. This can be justified, as confirmed in cases ***B*** and ***D***, by the IAD's inability to assess and guide academics in the potentiality of developing their research outcomes further to make them novel. Lack of communication between department and academics resulted due to the absence of professionals who have the competencies to advise academics on the possibility of developing their outcomes into new ways of doing things that can be patentable and reach the international criteria required by the US IP Company.

*"There is a lack of qualified staff (experts) who can advise in patenting and IPs … who can go and communicate with academics, particularly the PI about the outcome of their research and give advice in how to develop it to a patent and as per the followed criteria." (UO2, SQU)*

Moreover, the absence of the physical presence of experts resulted in the funding's inability to support patenting activities, consequently hindering academics and users from securing protection for the generated knowledge. This can be justified by the engagement of those experts after the outcomes were generated. The absence of continuous guidance subsequently caused failure in governing the actions of academics within the process of patenting. For instance, as shown in Case-***B*****,** it resulted in the inability to govern the academics' action of public disclosure, which deprived them from the validity of

granting IP (i.e. failure of achieving the patenting criterion of 'prior art'). Furthermore, the absence of an operational patenting process within MoCI created slowness in processing patent applications. This is found to be relevant to Case-***C*** of IIAP, where an official recognition of patent was pending for more than two years, which subsequently hindered commercial users from securing IP ownership. For them, the implications of such deficiency confronted them with the costs of knowledge commercialisation obsoleteness.

*''The process is taken very long. We are afraid that we will lose the idea … when the time the protection come to us to commercialise the design it become out-dated because technology doesn't wait and maybe others from the market will come with better design. So there is a risk involved and we will not be able to commercialise it successfully.'' (CU4, SMEs)*

**In summary,** a core institutional challenge in actors' relations is a growing degree of fragmentation. The natural tendency of actors is to develop their own agendas and policies that largely ignore issues of coordination and interaction with each other. On-going regulation and legalisation processes have led to functional overlaps between parties. As a consequence, a problem of fragmentation occurring from the segmentation of governance systems along spheres has become unavoidable.

Hence, the fragmentation across the university and funding (i.e. CIIAP and IIAP) systems, associated with the absence of coordination and joint policy (action of signing separate contracts with IP companies with different countries), and the fragmentation across boundaries, associated with the absence of the physical presence of the required experts in Oman, adversely impacted what happened on the ground. A lack of direct and regular communication and guidance occurred, which consequently impacted negatively on processes/actions of inventions prototyping and patenting.

This caused a lack of communication between the university's department and its academics, which subsequently hindered supporting the systematic

development of its academics' inventions, specifically limiting the potentiality of developing academics' research outcomes further to reach patentability. Also the absence of continuous guidance subsequently resulted in an incapability in governing the academics' action of public disclosure. Additionally, the absence of an operational patenting process (within MoCI & IIAP) constrained accelerating the assessment process of users' patent applications, subsequently resulting in knowledge commercialisation obsoleteness.

### 5.5 How the funding operational rules influenced KC

The findings revealed misalignment between the actions of funding operator and managers and the rules of programs. Misalignment was found to have both positive and negative effects on the process of KC. In this study, the comparison between two effects is significant in order to generate more understanding about the situation.

As mentioned in section 4.1, the analysis shows, at earlier stages of interaction within cases ***A*** and ***B***, the possibility that some degree of flexibility in funding at the organisational level (between the funding, i.e. IIAP and CIIAP, management's actions and rules) had resulted in benefits. This is with reference to the positive effect of relaxing funding rules on facilitating collaboration establishment between academics and users. In this respect, despite the although the actions of program managers and operators were found to be misaligned with the funding rules and procedures, the relaxation of the rules had a positive effect on the academics' and users' decisions to collaborate. The fund managers and operators had the ability to reformulate rules in response to the funding objectives and internal requirements in relation to the assigned goals. Hence, misalignment appeared to offer the benefit of the ability to bend the rules, while at the same time remaining relevant to the operational needs of the organisation, which is the necessity of collaboration establishment.

On the other hand, the analysis shows that misalignment between actors at the national level resulted in detriments/losses. The successful commercial exploitation of the generated knowledge was found to be a hindrance for commercial users. This issue was confirmed in all cases within this study.

The findings in Case-***A*** (of IIAP) for instance, demonstrated an emergence of misalignment between the actions of the fund-operator and the IP rules of the Ministry of Commerce and Industry (which is considered the main IP authority in Oman) with regards to patenting. This can be evidenced by the action of the fund consultant in giving the user the chance to change the national trade secret recipe without prior coordination with the MoCI IP office (i.e. alteration of the defined specifications stated within the ministerial decree). Hence**,** a collision of two IP elements (Omani Halwa Trade-Secret and Patenting) emerged due to the absence of legal written guidelines for the entire process (from knowledge production until appropriation).

Moreover, there is misalignment between the actions of non-commercial users and the TRC's rule of knowledge exploitation. Such misalignment can be linked to the lack of assigning R&D and innovation as a mandate within users' formal institutional prerogatives. This, as shown in Case-***D*** (of ORG), can be demonstrated by the ministry's refusal to implement the generated technology within the system of local factories under its supervision. Similarly, it can be evidenced by Case-***B*** (of CIIAP), where, although the non-commercial user was involved in the process of knowledge generation, there was the possibility of misalignment between the non-commercial users and funding rules with regards to commercial exploitation of knowledge. Consequently, a potentiality of uncertainty of knowledge utilisation by the commercial user might emerge.

Additionally, as evidenced by Case-***D***, the negative effect of misalignment can be explained by the exclusion of the concerned non-commercial user from the process of knowledge generation. This exclusion was combined with the fact that the process was influenced mainly by generating knowledge according to the academics' interests, where it was not necessary for other entities to be

involved. This consequently hindered the ministry from implementing the generated outcomes in small local factories that come under its supervision.

While in Case-***B***, although the concerned non-commercial user was involved in the process of knowledge generation, there existed the possibility of inherent misalignment between the non-commercial user and the funding rules with regards to the commercial exploitation of knowledge. This can be caused by the absence of a formal contractual agreement (as an obligation) for governing commercialisation action. Consequently, a potential uncertainty of knowledge utilisation by the commercial user might emerge.

**In summary,** misalignment appeared to offer the benefit of the ability to bend rules, while at the same time remaining relevant to the operational needs of the organisation. Due to the flexibility of the funding programs (i.e. CIIAP & IIAP), the fund managers and operators had the ability to reformulate rules in response to the funding objectives and internal requirements in relation to TRC national strategy. Yet they focused such abilities and flexibility on achieving the goals relevant to the processes of collaboration establishment rather than knowledge commercialisation. This is due to the absence of written operational guidelines (i.e. IP national regulations, contracts) that direct the actions of fund managers/operators and concerned governmental entities towards knowledge commercialisation. This is due to fragmented governance between the TRC and other governmental units (MoCI) as well as non-commercial users (ministry and ROP).

### 5.6 How actors' logics influenced knowledge appropriation

The analysis across cases shows that actors' (academics, university's KTOs, and users- both commercial and non-commercial) logics had a negative impact on knowledge appropriation.

The findings revealed that academics and commercial users tried to achieve benefits by subverting rules in order to pursue their own goals. Their behaviour

was influenced by the calculation of the material consequences of deviating from the preferred course of action.

As demonstrated by cases ***A*** and ***D***, the academics' violation of university rules was affected by the perceived personal remunerations (i.e. building self-esteem through career progression) from the complementary benefits embedded within IIAP and ORG funding. The academics' decisions of retaining the value had resulted in violating their university's disclosure rule (i.e. the academics professional obligation of IP disclosure to the university). Despite their familiarity with the rules and despite their usage of the university's resources (i.e. labs, technicians, etc.), academics, in Case-***A***, disclosed the IP to the commercial user (the client of IIC-the IIAP operator) without informing their university's innovation department. For the academics, disclosing their IP to the university involved the potential of losing the opportunity of gaining the perceived benefit of having the credit of becoming patent developers. Hence, the provision of such incentive made the IP disclosure to the commercial user a better idea from the academics' perspective. Similarly, in Case-***D*** the academics preferred to disclose their outcomes through publication before assessing the option of seeking IP protection through their university. For them, secrecy, which was promoted through patenting, appeared to violate their classical ethos and moral duty of academic science (logic of open-science) in emphasizing the importance of giving back to society and making research outcomes available to the public. It conflicted, as aforementioned in section 4.3, with their intrinsic aspect of the reward system within ORG, which is based on the establishment of intellectual property through publications. Novelty was not maintained as the generated knowledge was an obvious development of what had come before (i.e. usage of past experience of applying the same technology implemented successfully in other countries.).

The academics' preference of preserving the benefits for the purpose of achieving their own goals (i.e. personal remunerations), had constrained the university's control over knowledge appropriation. It hindered the IAD from

safeguarding the IP as well as from directing the academics' attention towards producing patentable outcomes. This can be demonstrated by the difficulty faced by the university in changing the academics' mind-set towards patenting:

'*'researchers don't want to engage in knowledge patenting. They prefer to go for publishing in high ranked journals, that's why they are targeting that (publication incentives within funding).'' (UO4, SQU)*

*"It is important to not disclose the invention to a third party in order to protect it. What is happening is that they are not negotiating and contacting directly with us…They would say why I bother myself to go through IP process, so what the benefit of patenting to academics, nothing! Also they get money from industry or public fund, so they will definitely target that. It is more profitable!'"" (UO2, SQU)*

Additionally, although the academics in Case-***B*** were aware of the international patenting rules followed by the CIIAP fund, they deliberately subverted the 'prior art search' rule through disclosing their research outcomes publically and before assessing the option of seeking IP protection from the International office. They were driven by their interest in involving the commercial user for the purpose of accelerating the possibility of bringing the generated knowledge into application. This consequently hindered knowledge appropriation as it made the academics neglect the opportunity of safeguarding their research outcomes.

*''my concern was to get solution whether by me or by another person. So I was not really concerned about or afraid if someone copy me; but my concern was the solution must be applied as soon as possible." (Ac3, SQU)*

Furthermore, the commercial user's violation of national IP rules (i.e. trade-secret) in Case-***A*** was affected by his prospect of making profit with less production cost (i.e. usage of low fat-mimic ingredients) compared to the original recipe. Although he was entrusted with the original formula of the recipe, he made changes for the purpose of achieving his interest of controlling the continuity of his family business.

As family enterprises, commercial users are generally considered to be risk averse. Risk aversion is influenced by the psychological factors, such as goals and behaviours of family members, which stem from the close relationship between ownership and control (in the form of family managers) within these enterprises. Such relationship has likely created a strong emotional tie between the family and the enterprise. Therefore, it is normal that one of the typical goals of the controlling families is to keep the family enterprises alive and in the hands of the family through the employment of family members, maintaining the harmony between family and workplace, and sustaining the association of family status with business ownership and management. All these goals would be endangered if the family failed to control, or lost control of, the business. To avoid business failure or losing control, avoiding risks is often regarded as the proper approach. Consequently, family enterprises have a higher degree of risk aversion, as higher risk might endanger the goal of business succession and the family enterprise's long-term survivability.

However, the analysis across cases ***A*** and ***C*** shows that risk aversion in family enterprises, which is traditionally considered to be a positive attribute (RW Hiebl, 2014), have resulted in emerging behaviours that endanger family enterprises' long-term existence. The negative consequence of risk aversion can be evidenced by the enterprises' unwillingness to invest in R&D and pursue growth strategies. The findings revealed the absence of long-term spending in R&D projects because of their uncertain outcomes. They are perilous (risky) and profit might not be granted. Therefore, the non-investment in R&D is frequently perceived by family enterprises' owners and/or GMs as securing the survivability of the enterprise.

*''Most of these enterprises are family based and this is why they don't want to involve in high risk like spending in innovation and research projects. When they spend in research they are not sure of the outcome.'' (PFO1, IIC)*

When the controlling family fears losing control of the firm, the owners/GMs try all means possible to save the socio-emotional wealth associated with controlling the firm, by maintaining the family firm's survival (RW Hiebl, 2014).

As such, risk aversion was subservient to the continuous loyalty to family members. Nevertheless, the exaggerated risk aversion caused resistance to change. The owners'/GMs' perception of maintaining the 'status quo' has been aggravated by a climate of caution with regards to business failure or losing. They were found to be very sceptical and quite traditional in terms of openness to change. There was a lesser degree of propensity to adopt new ways of thinking and doing business, particularly in dynamic markets where enterprises need to manage internal and external resources to become innovative and stay competitive. This consequently resulted in missing growth opportunities. This can be evidenced and demonstrated in Case-***A***, through the GM's negligence of the opportunity of commercialisation assessment of what is a very different commercial opportunity (i.e. new product) which may possibly result in a better economic outcome in the long-run. Despite the inability to use the same name and despite the opportunity given by the MoCI, the manager resisted changing the name of the generated knowledge in order to commercialise. For him, changing the name involved the commercial cost of local demand risk, which would have consequently impeded him from getting his family members' satisfaction in securing quick financial gain. He didn't want to be seen as cutting profit and spending money towards commercialising an outcome that resulted from research collaboration.

***''****Industry board is quite sceptical. They are happy with their status-quo as far as they are making profit. Particularly that have board of family members and they want to satisfy them. So logically the managers will target that in order to satisfy them. You know the industry is nervous of doing research and being involved and this makes GMs ignoring the chances of innovation from those projects." (PFO2, IIC)*

Additionally, the exaggerated risk aversion had, in the long run, impacted negatively on building the enterprises' knowledge-based capabilities, which constrained the businesses' ability to innovate and grow. As evidenced in Case-***C***, for instance, the enterprise became deficient in in-house R&D

capabilities. There is an absence of technology resources, such as research facilities and qualified personnel, essential in facilitating complex industrial R&D (TRC, 2014). The existing personnel (managers and employees) have low levels of education and knowledge experience, as the research ideas' 'think-tanks' are brainstormed by the IIC consultant.

*''They don't get the problem and discuss with us because most of them having low education and without knowledge experience. We do the big think-tank. We do the thinking for them. They are not technical and not knowledge-based. They are based on certain technology rather than indigenous because they lack the skills and capabilities." (PFO2, IIC)*

**In short,** the academics and commercial users acted in accordance with their perceived remunerative incentives solely due to their belief that doing otherwise would result in a loss. Their orientation towards rules was such that they are to be broken in accordance with a calculation of material consequences. Therefore, rules were violated or subverted to maximize their own benefits.

For academics, the violation of university rules was for the goal of avoiding the loss of retaining the benefits perceived from IIAP fund. However, their preference of remunerative incentives prevailed over their professional obligations, which explains that the academics' engagement with industry and public funds are based on importance of securing personal benefits rather than maximizing the number of university patents. This has restrained the university's control over knowledge appropriation.

While for the commercial users, the violation of national IP rules was due to their family's long-term orientation and desire to enable business succession within the ranks of the family, which strengthened/reinforced the family enterprise's risk aversion, as more risk could endanger the enterprise's long-term survival. However, although family business owners and GMS may think of risk aversion as prolonging their enterprises, the exaggerated risk aversion caused the contrary: The probability of the family business' failure in the long-term. Waiving growth opportunities due to unwillingness to take risks hindered innovation,

consequently compromising the long-term survivability of the family business. They tended to commit no investment to R&D projects and no resources for building knowledge-based capabilities, which led to nonexistence of innovative products or services, and hence to limited sales growth.

***The influence of non-commercial users' logics:***

The analysis shows the lack of readiness and willingness of non-commercial users to procure or adopt the knowledge generated.

Civil servants in public organisations systematically stick to their job descriptions and avoid initiatives and changes that may be seen as challenging established practices. The established routine practices are institutionalised and seem to have predominated and reproduced throughout the administration for the sake of controlling a good accomplishment of assigned responsibilities. Concomitantly, financial auditing practices seem to have proliferated throughout the administration in terms of controlling good use of public money or protecting public funds. The non-commercial users' overbearing preference of maintaining the accomplishment of the financial auditing practice, and as per this study, is linked to the fact that the production of new knowledge in Oman is still considered a new phenomenon[20]. Therefore, the level of uncertainty of the outcomes generated through R&D was difficult to establish and any likelihood of

[20]In this respect, and according to 2013 Global Innovation Index (GII), out of 141 surveyed countries Oman ranked 80th in innovation, while being placed at a low 134th for the efficiency ratio. When comparing inputs and outputs innovation dimensions, Oman ranked 53rd for innovation inputs, but was lagging behind in the indicator for innovation outputs (ranked 111th). On the input side, Oman's weakness appears to be on the indexes of: market sophistication (ranked 44th) and business sophistication (ranked 31st). This denotes that its economy is neither adequately mature nor sufficiently complex. While on the output side, Oman performed poorly on knowledge and technology (ranked 102nd), with very few innovative products such as high-tech, patents, and technological products. Also it performed poorly on creative outputs (ranked 119th). These include trademarks, new business models, online creativity (e.g. websites), and audio-visual creations. Although these are easily produced and require less financing to gear up production, Oman still has few creative outputs.

bringing the new technology to market was required to be financed internally by commercial users.

Hence, there is a degree of risk aversion as there was, as shown in cases ***B*** and ***D***, a prohibitive incentive-structure for being open to new ideas and practices such as involvement in R&D collaboration. This is evidenced by the lack of interaction of non-commercial users with other actors. The most straightforward signal is demonstrated by the academics' and funding programs' (i.e. CIIAP, ORG) difficulty in establishing early engagements with the involved non-commercial users. The networks, in comparison to commercial users - as mentioned previously in section 4.3, were established formally through funding and after the knowledge were generated and became ready for commercialisation or application.

The difference between commercial and non-commercial users can be explained by the recognition of the value and benefits of R&D interactions to their organisations. For commercial users, the interaction was perceived as integral to their businesses. They were more flexible and open to innovations as they are profit driven. While for non-commercial users, the interaction was perceived as challenging since it risks their established practices. They were inflexible and risk averse as they wanted to control maintaining the accomplishment of their routine practices. Hence, they perceived interaction as a cost and resisted challenging the 'status quo'.

This impacted negatively on KC and application. In Case-***D*** for instance, the non-commercial user's perception of R&D as a cost (since it was not assigned as a mandate or a routine practice within its institutional prerogatives), hindered the application of the generated technology within the system of local factories under its supervision.

*''In ministries research is not on their table!! This is not something that they are interested to do. And if they are not interested they will not. So we cannot*

*impose implementation of outcomes formally on them since they don't have it as a strategy or policy.'' (PPMF2, TRC)*

More significantly, in Case-***B***, the non-commercial users' overwhelming preference to the practice of buying ready-made solutions from abroad or conducting any technology transfer through international trade is influenced by their perception of considering technology transfer as trade-based. It is imported and it is always seen as cheaper and more trustworthy in terms of its existing successful application in developed countries. This resulted in a lack of procuring local solutions. A strong indication is their attitude of perceiving the generated knowledge as a cost since it was not applied successfully in developed countries.

*''They say we want you to go to UK and other European countries and apply it for 4-5 years then come to us with the results to make our final decision… because it is gona to replace the other solutions that they have and paid money for, and for them it is still new! And the main concern was that there is no country in the world that has this device, so we are the first." (Ac3, SQU)*

**In summary,** the non-commercial users' behaviour of avoiding the interaction with other actors within ORG and CIIAP was influenced by their risk aversion, which prevailed within their organisations, for the purpose of maintaining control over the accomplishment of the established/routine financial auditing practices. The proliferation of the same practices was seen/perceived as the best behaviour for the sake of controlling good use of public money (public fund protection). Thus, there was a lesser degree of incentive-structure for being open to adopt new practices. Rather than making changes, the non-commercial users: (1) rejected the introduction of R&D as a new practice within their institutional prerogatives; (2) circumvented the deviation from their routine practice of procuring ready-made solutions from developed countries.

***The influence of KTOs' logics:***

An important issue has resonated, which is inked to the university's policy of 'building patent profile'. The main reason for adopting such policy is related to the university's 'low global rank'. In this regard, in addition to the international standards of accreditation programs, the university is still lagging behind in terms of performance and quality standards, and there is low performance in research and innovation. This can be evidenced by the low number of patents.

*''with the GCCs yes we are one of the top universities but our rank among Arab universities is thirteen and our reputation internationally is very low. This is clearly due to its (university) performance, particularly in research and innovation. We have only two to three patents! We are still way behind. But we are working on this now.'' (UO2, SQU)*

However, the findings revealed that the adoption of the 'building patent profile' policy constrained knowledge appropriation. The current emphasis and the centralisation associated with the policy have encouraged the IAD to become gatekeepers rather than facilitators of KC. The department is charged with concentrating heavily on maximizing the number of patents and revenues from licensing rather than maximizing the volume of innovations brought to the marketplace. This is evidenced by the mission statement, which showed greater focus on licensing and protection of the university's intellectual property through patenting (SQU Research Regulations, 2014). It is also evidenced in the processes followed by the department. In this respect, and with patent profile building as a central goal, the depiction of KC activities is portrayed as linear processes in which research is performed, inventions are disclosed, licenses are executed, income received and wealth is generated. Hence, patenting and licensing of research are depicted as the only means for commercialising new knowledge from university to industry, whereas non-patented innovations are ignored.

*''We are actually looking for putting the university in high rank. So the recent concern is to focus on patented outcomes. This will help in building our patent*

*profile which is important for getting good ranking. It also will generate revenues by licensing them to industry." (UO1, SQU)*

This is less the fault of the department's admin and more as a consequence of the way in which their department is structured with the existing financing and HR dedicated to patent-licensing and no resources dedicated to non-patented research outcomes - outcomes that don't fulfil the international patent criteria (enforced within the limited allocated fund). The net effect is that the department doesn't have an incentive to maximize outputs or the actual numbers of commercialised knowledge, as opposed to maximizing the number of patents and revenues earned by university.

This consequently resulted in the emergence of a 'home run' mentality, whereby the department becomes rigorous in enforcing patent-licensing rules. It focused its limited resources (financial and HR) on knowledge and technologies that appear to yield the biggest payback/return. While the outcomes that require more investment for development, and which have long-term potential or that might be useful for industry even if the return is little or nothing in the way of licensing fees, were overlooked entirely:

*''The university is actually looking for putting the university in high rank. Good ranking and to compete for it. So patents are very important. So we need to build our profile in patenting…So giving us an opinion from a US patent lawyer and what is recommended to know if it is there or not, if not why we waste our money to patent it, so we are trying to avoid rejection by doing this. The budget is limited so we have to be selective." (UO2, Ln, SQU)*

This, as evidenced in Case-***B*** for instance, frustrated academics as it constrained the consideration of other types of knowledge (i.e. non-patented outcomes such as research prototypes). The exclusion of non-inventive outcomes from the university fund protection, and as a goal, had irritated academics as the productivity and usefulness of their research outcomes was not reaffirmed, consequently undermining their research capabilities. This, in

the long run, will have negative consequences on knowledge commercialisation. It will demotivate academics as not all of them have the capability to invent.

*'This is funny! They rejected our application for no clear reason. I don't how these people are thinking!! Why only inventions. What about other outcomes? They are also good outcomes for universities. They can protect and then license and sell them to the industry. By this they can build good networks and image with industry. But they are not doing it and this is really frustrated!" (Ac3, SQU)*

Moreover, this made the department neglect the opportunity of patenting the expected inventions disclosed to commercial users through IIAP funding. This, as shown in cases ***A*** and ***C***, can be justified by the department's solid enforcement of licensing rules (e.g. non-exclusive license and high royalty payment) on users in return for IP disclosure to the university, thus losing the chance of safeguarding the users' agreement. For users, such arrangements appear to involve the considerable costs of (1) inability to cover the high price of licensing due to their financial incapability; (2) risk of licensing the patent by the university to local competitors.

*''No, it will not be free. Definitely they will charge us if we patent it through university. These are their rules. And as I said we cannot afford the high price of licensing. Why we should do that? They may will sell it to our competitors if we didn't buy it, so there is a risk." (CU4, SMEs)*

**In short,** despite envisioning the innovation department as a gateway to facilitate the flow of knowledge, the university's policy (of building patent profile) resulted in it becoming a gatekeeper with a **'**home run' mentality, whereby the department became rigorous in enforcing patent and licensing rules. It focused its limited resources (financial and HR) on knowledge and technologies that appear to yield the biggest returns. This frustrated academics as it constrained the consideration of non-inventive generated knowledge. It also resulted in the department neglecting the opportunity of getting users' agreement to disclose

the IP to the university as the enforcement of licensing rules yields high costs for users.

### 5.7 Chapter conclusion

This chapter has compared and contrasted the four case studies with the objective of generating themes and patterns in the issues that resonated across individual cases. Consequently, a number of key themes as relates to the research questions have been identified. In relation to research question one; the analysis showed that the power exercised by actors (associated with establishing project rules around appropriating one logic over another) generated conflicts between different logics. With regards to research question two; the analysis demonstrated that the action of transferring western programs into the Omani developing context disregarded the existence of both differences in logics and institutional fragmentation. With respect to research question three; the analysis highlighted that the role of government as an intermediary assisted in some way in bridging differences. Yet such a role was focused only at the beginning or the early part of the research process (collaboration and knowledge generation). When knowledge commercialisation came about, intermediation was absent, which resulted in conflicting logics regarding knowledge appropriation. Moreover, the analysis showed that the emergence of informal networks assisted in intermediation (logics bridging/spanning). Yet again, this occurred at the beginning of the research process. This is due to the inability of formal networks to bridge differences in logics during knowledge commercialisation, because power is granted to a single actor, who might lean towards upholding the pre-existent logics in opposition to other logics.

In order to address the research questions more and arrive at higher summative findings, the following chapter provides a further discussion through interpreting and linking cross-case findings to theories from the literature review (chapter two).

# Chapter 6: Discussion

## 6.0 Introduction

This chapter presents an analysis of the cross-case findings in the context of the existing research related to University knowledge commercialisation in emerging institutional environments of knowledge production and appropriation. The chapter presents the major themes that emerged from the cross-case analysis and utilises theories and constructs from the literature review in chapter two, to arrive at higher summative findings. The chapter is structured into three sections, with each section covering one of the three research questions in this study. Thus, the first addresses the effect of power, the second section captures the effect of mimetic isomorphism, and the third one tackles the effect of intermediating on bridging differences in logics.

## 6.1 Conflicting logics between U-I-G and Power Asymmetry

As shown in table 6.1 below, the discussion of this section is focused on the dominant logics as per the rules and norms represented by institutional actors that interact and compete with each other. The following subsections give details.

**Table 6.1: The dominant logics**

| Winner (Dominant) | Loser (Non-dominant) | Theme | Conflicting Institutional Logics | Dominant Logic |
|---|---|---|---|---|
| **Academics** | Commercial Users | Theme 5.3 Case-***D*** | Academics' logic of open science conflicting with the commercial users' logic of secrecy | Academic logic of open science |
| | KTO | Theme 5.6: Cases ***A***, ***D*** | D-open science conflicting with KTO's goal of building patent profile; | Academic logic of open science |

| | | | | |
|---|---|---|---|---|
| | | | A-Career progression conflicting with KTO's goal of building patent profile; (subverting the rules of the university) | Academics' logic of career progression; Individual academic development |
| **KTO** | Academics | Theme 5.6: Case-***B*** | Building the university's patent profile conflicting with academics' interest of producing innovative outcomes, conflicting with commercial users' profit maximization | KTO goal of building the university's patent profile |
| | Commercial Users | Theme 5.6: Cases ***A***, ***C*** | | |
| **Commercial Users** | Academics | Theme 5.3: Case-***C*** | Users' financial returns or profit maximization conflicting with academics' open science; | Users' profit maximization |
| | | | Users' applied research and technological development projects conflicting with academics' long-term basic research | Users' applied research and technological development projects |
| | Government (IIAP) | Theme 5.6: Cases ***A***, ***C*** | Commercial users' interest/goal of family business continuation; risk aversion (subverting rules) conflicting with the government's goal of knowledge exploitation; | Commercial users' interest/goal of family business continuation |
| **Non-Commercial** | Government (ORG, CIIAP) | Theme 5.6: Cases | Non-for-Profit: budget management for the | budget management |

| | | | | |
|---|---|---|---|---|
| **Users** | and commercial users | ***B***, ***D*** | purpose of public fund protection conflicting with government goal of knowledge exploitation/appropriation and commercial user's logic of profit maximization | for the purpose of public fund protection |
| **Government** | University, represented by IAC | Theme 5.2: Cases ***A, B, D*** | Government logic of bureaucracy conflicting with university logic of developing patent profile | Government bureaucratic logics |
| | Commercial Users and IIC-representative of commercial users | Theme 5.2: Case-***C*** | Government logic of bureaucracy conflicting with commercial user's logic of profit maximization | |

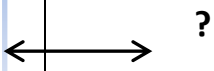
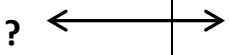
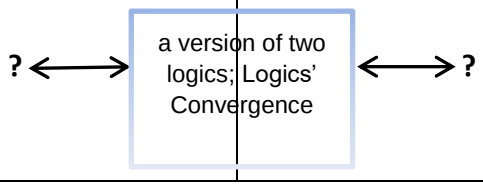
Source: Author's research

### 6.1.1 Conflicting logics between the university and users

In order to conduct contract R&D projects, a continued interaction process is required between the university and the users. However, such interaction process could be impeded by conflicting institutional logics (Thornton, 2012). As shown in the cross-case analysis, actors brought distinct institutional logics to bear in their interactions, which led to differences in actions in response (Lind et al, 2013). The differences in logics that faced partners during the actual process of conducting projects led to conflicting goals and interests (Bjerregaard, 2010). For example, Case-***C*** shows how commercial users (SMEs) acted according to their norms, towards profit making/maximization, in comparison to academics who acted in accordance with their academic norms towards dissemination of knowledge through publication. Hence, the actors differed in their values and expectations regarding the appropriate actions for operating the projects. Conflicting institutional logics that manifested in the R&D

projects shifted the attention of partners away from the scientific and technological contents and towards institutional aspects, which in turn affected the commercial applicability of the generated knowledge.

Although logics differences enhance the need for negotiation and development of a common interpretation of the research aims and outcomes (Bjerregaard, 2010), the pre-existing conflicting logics associated with academics' and users' norms were perpetuated because of power asymmetry. It is argued that the rules governing the interaction within contracted R&D projects are considered as being forms of power (Samules, 1971), since they are socially granted (Schmidt, 1987). As evidenced from the cross-case analysis, power asymmetry occurred as per the funding (i.e. IIAP and ORG) rules of ownership, in the view of the fact that the arena of interaction was structured around 'one' appropriating logic over another. Consequently, an actor occupied a more powerful decision-making position than the others. Hence, rather than forming/structuring the interaction within projects around shared or complementary logics, pre-existing competing logics led to one side winning over the other. Since actors had more power in (or control over) decision-making, the logics of these actors came to be reflected as dominant. As shown in table 6.1.1 below, and as will be detailed hereafter, the appropriation of knowledge was controlled by only one of the parties. There was no power balance between the university's and the user's logics. In the research spectrum, the logics of the university seemed to be dominant. The logics of academics and KTO had more control over the decisions of how to appropriate the generated knowledge. Hence, knowledge appropriation was restrained by the university from the point of view of commercial users. On the other side of the spectrum, commercialisation was based on the dominant logics of users (commercial and non-commercial). For instance, the commercial users in cases ***A*** and ***C*** used IIC rules as a way to develop new products in order to maximize profit. The logics of academics (i.e. open science, career progression through being the patent developer) were completely set aside. Therefore, knowledge appropriation was restrained from the point of view of the academics.

| Table 6.1.1: Actors' logics, research, and commercialisation spectrums | | | |
|---|---|---|---|
| **Actors** | **Actors' institutional logics (How their belief systems shaped their behaviour?)** | **Research spectrum controlled by only one of the parties** | **Commercialisation spectrum controlled by only one of the parties** |
| **Academics** | 1-Status in the scientific community (theme 5.6):<br>-Career progression: open science: publication; patent developer<br>-Industrial knowledge application<br>2-Research and work practices (theme 5.3): Primary basic research; Long-term curiosity-driven research |  |  |
| **KTO** | Building the university's patent profile (theme 5.6) | | |
| **Commercial Users** | 1-Profit maximization for the purpose of family business continuity (theme 5.6)<br>2-Research and work practices (theme 5.3): Primary applied research; short-term research outcomes |  |  |
| **Non-Commercial Users** | -budget management for the purpose of public fund protection (theme 5.6); non-profit | | |
| ???? | ???? |  | |

Source: Author's research

Thus, conflicting logics was inevitable as actors had the ability to implement their own logics when they conflicted with those of others (Schmidt, 1987). There was no chance of logics' convergence because actors were induced to work at maintaining the status quo (Thornton and Ocasio, 1999) through preserving their pre-existing logics (Lunberg, 2013) in order to maintain their power. Neither the university nor the users felt responsible for breaking down the logics divide. They were complacently accepting the logic differences between them as inevitable. As shown in sections 5.3 and 5.6 in the cross-case analysis, when logics conflicted, competition among the university (academics and KTO) and the users (commercial and non-commercial) was likely because each actor supported their pre-existing logic. This had affected how actors communicated their own interests through activities that yield more benefits for them and their organisations. The following provides more detail:

First, the logic of academic professionalism conflicted with the market-like and market behaviour logic (Bullard, 2007, Bok, 2009). According to the funding and university ownership rules of waiving the decision to academics, academics, as powerful actors, were found likely to maintain their pre-existing logics (i.e. open science, career progression, and academic curiosity of knowledge application) to preserve their favourable exchange conditions (i.e. publication, patent developer, knowledge dissemination). Academics were engaged in accordance with their perceived remunerative incentives solely due to their belief that doing otherwise would result in a loss. Hence, their orientation towards rules was such that they were to be broken in accordance with maintaining their pre-existing logics, which ultimately resulted in conflicting logics. In Case-***D***, for instance, rather than moving away from 'open science' logic to a model of identification, protection, and exploitation of intellectual property (Murray and Stern, 2007), the academics preferred preserving their pre-existent logic of open science (Polanyi, 1962, Fini and Toschi, 2016). Hence, the logic of open science became dominant, which subsequently conflicted with their university's logic of 'building patent profile', which consequently restrained their university's control over knowledge appropriation. It also conflicted with the commercial users' logic

of profit maximization. The strong open-science logic underpinning research practices in academic research fields was expressed in the publishing norm supported by peer review and resource allocation systems which are dependent on publication and citation (Goldfarb and Henrekson, 2003, Siegel et al, 2007, Murray, 2010, Calcagini et al, 2016). However, the research in SMEs was close to the market and was guided by the commercial profit making logic (Aghion et al. 2008, Lacetera 2009, Calcagini et al. 2016). Such institutional norms are likely referred to as sources of incentive misalignment between reputation-based reward systems of open science and commercial requirements (Perkmann and Walsh, 2007).

Second, the logic of KTO's patent profile development was dominant in cases ***A*** and ***C***. Since knowledge commercialisation highlights networking as being crucial, Knowledge Transfer Officers (KTOs) are responsible for the central importance of interaction by mediating the gap between the academics and users (Villani et al., 2017, Yusuf et al., 2008). Therefore, and as per the nuanced view of the role played by KTOs, more 'people centred' or relational linkages would be better supported by more decentralised arrangements (Gill et al., 2007). However, as shown in subsection 5.6 of the cross-case analysis, despite envisioning KTO (represented by the Innovation Affairs Department) as a gateway to facilitate the flow of knowledge to industry, its goal of building a patent profile (which manifested as a rule) made it a gatekeeper rather than a gateway, whereby the department became rigorous in enforcing patent and licensing rules. Rather than having an interactive model, the depiction of KC within KTO's activities was portrayed as linear processes in which research is performed, inventions are disclosed, licenses are executed, income is received, and wealth is generated (i.e. maximizing the number of patents and revenues earned by the university). More importantly, this process is an internal practice concerned only with the university's interest of 'knowledge protection' and doesn't involve potential users (either commercial or non-commercial) who can validate the commercial applicability of such inventions. This came into conflict with the logic of intermediation. As a boundary spanner, KTO is characterized

as a mechanism directed towards continuing to seek alignment of interests between its university and other actors, either internal or external. Nevertheless, instead of reducing distance between commercial exploitation and the generated knowledge, KTO focused its limited resources (financial and HR) on knowledge and technologies that appeared to yield the biggest returns, while neglecting the consideration of the non-inventive generated knowledge. There was distance between the research outcomes generated by academics and the exploitation mechanism used by KTO. This was required to be mediated by commercialisation, which necessitates the development of new processes for exploiting non-inventive outcomes. Furthermore, although the defining element of university-industry collaborations is identified as the two-way, reciprocal dimension of engagement (Sandmann, 2007), this was not achieved as KTO didn't attempt to seek and maintain mutually beneficial arrangement with the commercial user. Rather, they neglected the opportunity of getting the users' agreement in IP disclosure as the enforcement of licensing rules yields high costs for the users. This came into conflict with the commercial users' logic of profit maximization.

Third, as per the IIAP ownership rules of waiving decisions to commercial users, as powerful actors, users were found likely to maintain their pre-existing logics (i.e. profit maximization for the interest/goal of family business continuation). This came into conflict with the logics of research and knowledge commercialisation. The users' orientation towards these logics was such that rules were to be violated or subverted to maximize profit and avoid risk, as more risk could endanger their family business' long-term survival (RW Hiebl, 2014). This came into conflict with the knowledge exploitation logic. Risk aversion caused the contrary. Instead of making changes, users waived growth opportunities (i.e. knowledge commercialisation) due to their unwillingness to take risks, thus compromising the long-term survivability of family business. They tended to commit no investment to R&D projects and no resources for building knowledge-based capabilities, which led to nonexistence of innovative products or services, and hence to limited sales growth. The commercial users'

logic of profit maximization also came into conflict with the academics' logic of research quality (Lacetera 2009, da Silva Campose, 2015). While commercial users sought profitable products in the short-term, academics prized excellent scientific research outcomes, which only accrue in the medium to long run (Bentley et al., 2015). This gave rise to competing conceptions of time horizons (long-term versus short-term outcomes) and research types (basic versus applied). The logics of powerful actors shaped how the knowledge could be appropriated and exploited mutually by the involved actors. By preserving his logic of profit maximization, the user in case-***C***, for instance, attempted to maintain his advantageous conditions of secrecy or data-withholding, which are the conditions under which academics can appropriate generated knowledge, thereby reaffirming his power over the academics (Thursby and Thursby, 2007, Gerbin and Drnovsek, 2016). Similarly, and as per the CIIAP and ORG's ownership rule of waiving decisions to users, the logics of research and knowledge commercialisation were challenged by the non-commercial users' budget management for the interest/goal of public fund protection. As aforementioned in subsection 2.3.2.3 of the literature review chapter, a growing body of empirical studies provides evidence for conflicting logics between commercial users and universities without referencing non-commercial users. This study filled this gap and gave evidence pertaining to the logics of non-commercial users which came into conflict with other actors' logics. As shown in section 5.6 of the cross-case analysis, the proliferation of the same practices was perceived as best behaviour for the sake of controlling the good use of public funds. They were risk-averse as there was a lesser degree of incentive-structure for being open to adopting practices within new logics. Rather than making changes, the non-commercial users rejected the introduction of R&D as a new practice within their institutional prerogatives, and circumvented the deviation from their routine practice of procuring ready-made solutions from developed countries. Similarly, this conflicted with the knowledge exploitation logic as well as with the commercial users' logic of profit maximization. As shown in Case-***B*** for instance, rather than becoming interdependent, the ROP

was less dependent on other actors, as he perceived that there were better alternatives (i.e. importing from developed countries) for obtaining the same technology (i.e. radar device) provided by the academics and the commercial user. This explains the inequality in the relative distribution of power between actors. The non-commercial user had more power than the other actors, to constrain the goal achievement (i.e. procurement of the generated technology) of the dependent academics and commercial user. Hence, the high degree of power asymmetry between actors captured the extent to which they differ in their power to constrain each other. Under this scenario, the dominant actor (i.e. non-commercial user) was motivated to preserve their pre-existing logic (i.e. budget management) in order to maintain the protection of public resources (i.e. public funds).

**By providing the above findings**, the interplay in asymmetric power relationships, in which the generated knowledge was expected to be transferred (Lundberg, 2013), hampered bridging the differences in logics and the creation of mutually beneficial organizing structures, such as logics convergence (Bjerregaard, 2010). The power asymmetry (or inequality of power distribution) associated with structuring interaction (i.e. established ownership rules) around appropriating one logic over another led to one actor winning over the other. This created a hindrance in knowledge commercialisation as balance between logics was absent. As per the conflicting logics, the actors will not believe that the practices of other actors are useful and right unless they bring them benefits. Therefore, for the logics of other actors to be appreciated by the participants, an intermediating network must be shrewdly designed in order to bridge the perceived gaps between institutional spheres of the university's research and the users' commercialisation (Håkanson et al., 2011, Villani et al., 2017) . For instance, an intermediating mechanism can be established whereby all parties relatively easily identified a shared and motivating research issue which could establish the foundation for stimulating the development of commercialised products following market-applicability logic as well as fulfilling the academics' norms of producing publishable research outcomes (Lind et al,

2013). Accordingly, the involved parties might in some cases locate a shared research problem within 'Pasteur's quadrant' whereby knowledge production can be developed within a dynamic interplay with technological innovation (Stoke, 1997). Logics governing the collaboration practices of the university and the users will intersect giving rise to a shared and tacit understanding about the project. This can be reflected, for example, by establishing flexibility and a low degree of formalisation within the KTO's contractual arrangements. In order for KTOs to mediate the distance in commercial exploitation of knowledge, it needs to govern commercialisation by arranging with users a collective institutional arrangement - a cross-fertilisation format mixing their two different goals to achieve fairness and better results (i.e. exclusive royalty-free commercial license). Hence, the actors' behaviour could be based upon cultural convergence of institutional logics rather than a hindrance of knowledge commercialisation (Bejerregaard, 2010).

### 6.1.2 Government's bureaucratic logic against University and Industry logics of KC

It is argued that the government plays a big role in promoting universities and industry engagements within local governance (Lawton, 2007). Such a role is institutionalised through allowing universities and industry representation in local economic partnerships, on the boards of science and innovation councils that were established in order to protect the country's interests by strengthening scientific and technological research (Charles, 2003, Lawton, 2007). In this context, the mechanism for participation is used to describe any activity associated with actors interacting with the government, where actors are presumed to have an equal opportunity to participate in decision-making. However, as shown in section 5.2 of the cross-case analysis, the concept of actors' participation and the manner in which participatory mechanisms have been implemented is different. There is a domination of the bureaucratic logic of policymaking within the governing boards of universities and the government (i.e. TRC). The counterparts of the bureaucratic logic in Oman are deeply rooted in the Omani tradition and political system (STIP, 2014). All actors do

not participate equally, and are not given equal opportunity to be involved in the decision-making processes of government. There was, at first, an exclusion of commercial users (SMEs owner/managers) from the TRC governing board (see this study's research context, section 4.1 of chapter 4). The impact on decision-making appears to occur only when the board members represent the right groups involved in the interaction. However, the industry representation on the board involved individuals working only in large national companies who were appointed by the heads of the board on a 'personal basis' and as per the companies' interests in R&D as well as experience in the field of managing financial institutions or public shareholding companies operating in Oman. The involved large companies were not representative spokespersons for the needs and desires of those SMEs for whom the policies were being designed within the programs. The SMEs often had little impact on what was decided. This resulted in the commercial users' inability to champion their logic of profit maximization through knowledge commercialisation. Second, although the IIC's (as per the representation of its parent organisation and head-committee in the TRC governing board) and the IAC's (as per the representation of its members in the University Council and the university in the TRC governing board) voices were welcomed by the boards, they were excluded from participating in making final decisions. In other words, they were not the actual decision makers in the policy process. The IIC and IAC were allowed to exercise only reactive, suggestive, or advisory roles, not actual decision-making. They plan for, rather than included, in the planning and decision-making process. The real decisions - those that ultimately become policies and programs - are made by government actors. In other words, the IIC's and the IAC's efforts are considered more symbolic than substantive. They merely rubber stamp the decisions made by government actors. The governing boards consult with them and take their feedback/suggestions, but do not share power with them or transfer/delegate power to them, to make decisions and develop policy (Abro and Benneworth, 2007, McAdam et al, 2012, Miller et al, 2014). For evidence see section 5.2 in the cross-case analysis chapter.

The exclusion and limited participation of actors in the governing boards is a result of requirements and attitudes generated by a bureaucratic structure, and characterizations of groups held by the main decision makers. The governmental officials believe that it is their responsibility to make decisions and design policies for their constituents based on their designated position, their expertise, and their roles (Weber, 2009). Such attitudes hinder participation because of the over representation of officials on governing boards. This is in line with Samuels' (1971) second dimension of policymaking or creation of rules through the exercise of power. The rules within interactions were established by appropriating the government's logic over the university's and the commercial users' logics. The essential assignment of decision-making rights to high level governmental officials gave them the chance to become more powerful. They had more control over decision-making and their logics came to be reflected as dominant (DiMaggio and Powell, 1983). The bureaucratic logics supported by powerful officials contributed to preserving the 'status quo' as they provided the bureaucratic rules of action and interaction that guided them in decision-making (Thornton and Ocasio, 1999). The dominating logics of the IAC, IIC and commercial users aimed to push back bureaucracy exposing its negative effects on achieving their interests of knowledge commercialisation; while governmental officials (as per their over representation and position) had an interest in resisting the IAC's, IIC's and commercial users' interests and allowed bureaucracy to be seen as convention or the prevailing attitude.

The exclusion of other actors, for instance, and as mentioned above, gives insights into how these officials viewed their bureaucratic role and where they limited/restrained power sharing. More specifically, it gave the officials more chance to exercise purposeful power over the development of policy agendas and the involvement of other actors as the power was centralised with the governmental elite (Saad and Zawdie, 2005, Chaykina, 2012). This was manifested into action in view of the fact that, as per the Royal Decree, the high-level officials (i.e. heads of the board) had the authority to appoint actors from industry. Rather than appointing SME owners/GMs, they appointed CEOs from

large national companies who, as aforementioned, were not representative spokespersons for the needs and desires of the SMEs. Hence, it was not surprising to find that policies within funding programs were not aimed at supporting commercial users' commercialisation activities. Certainly, large companies took the opportunity and became more driven towards their own agendas, while neglecting the needs of the excluded commercial users. In this respect, power asymmetry had emerged due to unbalanced decision-making (i.e. exclusion and reduction of voices and participation of other actors). In other words, there was a lack of power. The representatives from the IIC and IAC tended to feel weak due to the uneven balance of information distribution. The lack of transparency associated with opaque bureaucracy limited the IIC's and IAC's participation in the process of decision-making, consequently constraining their ability to operationalise the required IP according to the suggested commercialisation guidelines. The exclusion of SME representatives (i.e. owners, GMS) made commercial users feel vulnerable due to the uneven balance of financial resources. This is mainly shown by the unclear standards of fund allocation, which are justified by the incongruity between the different funding policies regulating knowledge commercialisation. This resulted in restraining commercial users' control over achieving their goal of knowledge commercialisation. For more details, see section 5.2 of the cross-case analysis.

**From the above**, power, in the context of knowledge commercialisation, is not always thought about in terms of its use by one party over another. Thus, supporting the inclusion of diverse actors and the substantive participation within governing boards are connected. However, the rules of appropriating the government's bureaucratic logic over the university's and the commercial users' logics of KC resulted in power asymmetry. This consequently allowed officials to exercise their power to keep their logic of bureaucracy. The taken-for-granted bureaucratic actions of the exclusion and limited participation of actors from policy-making had negative effects on knowledge commercialisation.

If the input of involved actors (i.e. IIC, IAC) does not make a difference or an impact on policies, then it makes no difference who participates as this is controlled by those who have more power (i.e. officials). On the other hand, if the actors' voice is significant in determining the distribution of benefits and burdens through policies, then all actors, especially those directly affected (i.e. commercial users), should have equal access to participation. Therefore, sharing power does not mean that the officials (as per their position and representation) give up their roles and power but rather allow others to influence their decision-making. In practical terms, it means that there is an interaction in which some decisions are made jointly and in a way that includes all actors' initiatives. All actors commit to sharing information, giving their opinions on goals and developing an agreed set of actions. This raises a question about the use of power in such collaborative settings, which is: "How can power be shared between parties?" There is a need for a supportive context - a setting that allows room for collaboration to emerge and develop solutions as there is a relative power asymmetry among actors. This requires a deliberate effort on the part of a powerful government. Officials may need to give up some of their autonomy in exchange for increased consensus. Thus, a 'delegation of power' is required. In this case, the role of government could be triggered to assist institutionalisation and the representation of all actors.

### 6.2 The transferability of western models to the Omani context: Conflicting Logics and Institutional Fragmentation

As knowledge commercialisation is a new phenomenon in Oman, the country is still seeking the best innovation and operational models to streamline the relation between university, industry, and government. One common approach of the Omani government is learning and transferring models from the West, as these have proven to be most successful in promoting innovation and economic growth. This can be linked to the concept of 'mimetic isomorphism', suggested by DiMaggio and Powell's (1983), which is based on the conscious copying (mimesis) of structural elements of organisational arrangements that are

believed to achieve success and legitimacy. As organisations encounter uncertainty, it becomes normal to imitate successful organisations to avoid loss. This is the case when the government (i.e.TRC) transferred cutting-edge innovation programs from the US and Canada to its local context as a way to foster the country's national innovation system.

However, the TRC should be aware that it is not a matter of learning western practical and technical mechanisms, but rather the extent to which the institutions of these mechanisms can be transferred locally. When the American and Canadian programs of funding were introduced into the Omani context, contextual factors inherent in the local context caused barriers for implementing such models. The successful operationalisation and transfer process of these programs to the Omani context proved difficult due to the (1) overlooked, anticipated conflicting logics (Thornton et. al, 2012); (2) deep rooted fragmentation of the existing innovation systems (Saad and Zawdie, 2005, Inatrakumerd and Cristina, 2007).

First, mimetic isomorphism, more relatedly the action of transferring cutting-edge innovation programs from the West, made the TRC place more attention on homogeneity across institutional spheres and deliberate legitimization activities and practices (Meyer et al., 1997, DiMaggio besides and Powell, 1983). This is in contrast to the institutional-logics perspective, in which organisations are embedded in different, often conflicting, institutional logics (Thornton et al., 2012). This can be evidenced in section 6.1 from the unbalance between academics' and industrial logics. Each funding program presumed a logics convergence between academia and commercial users. The institutionalisation of these western programs meant that academics and commercial users had to share certain concepts regarding knowledge commercialisation. Yet, such perception gave a simplistic view of the institutional environment, as if these western programs became the only institutional order surrounding all three groups. The rules and procedures of the transferred programs were considered the templates for action, which were to

generate unified responses that lead to isomorphism and commonality functions among spheres (Meyer et al., 1997, Benner and Sandstrom, 2000). Hence, the implications of conflict between institutional logics (Thornton et al, 2008) were overlooked. This is shown by the incongruence of funding research orientation policies in cases ***C*** and ***D***. Rather than incentivising knowledge exchange across the logics divide, the programs' rules focused on supporting one logic over another. In Case-***C*** for instance, the IIAP funding program's research-orientation policy was found to be aiming at encouraging applied, rather than basic, research. It promoted interaction by directing academics' actions away from achieving the academic norm of 'research quality', i.e. long-term benefit of fundamental understanding of scientific inquiry, by reason of fulfilling users' norms of short-term industrial benefit to maximize profit. This is demonstrated by giving full ownership to commercial users to prevent academics from publishing through fulfilling their logics of secrecy and data withholding. While in Case-***D***, the ORG funding program was applied the other way around, encouraging basic rather than applied research. It encouraged the interaction by supporting academics' norms of 'open science' in opposition to the users' norm of 'secrecy or data-withholding'. This is evidenced from the control given to the academics in assigning the user as an industrial consultant rather than a research partner in order to keep control with the academics and restrain the user's control over ownership and the type of research outcome. In short, rather than becoming a source of dynamics for change towards innovation, the differences between institutional logics became a hindrance to knowledge commercialisation. The implications of conflicts of different logics between multiple actors on the effectiveness of knowledge commercialisation were discussed more explicitly in section 6.1 previously.

Second, there is a prevalence of institutional fragmentation[21] governing the actions within the processes of knowledge commercialisation. The cross-case

[21]Institutional fragmentation refers to the growing challenges to coordination among different institutional organisations. It is driven by the fact that decisions are made in different places, and in different policy arenas in which actors from various

analysis demonstrated that institutional fragmentation had been a problem militating against the process of transferring those Western innovation programs (Saad and Zawdie, 2005) to Oman. Fragmentation roots in the internal characteristics of bureaucracy (Saad et al, 2008, Intarakumnerd and Cristina, 2007).

**Table 6.2: Actors' Institutional Fragmentation**

| Actors | Fragmented responsibilities | Consequence of fragmentation | Implication on KC |
|---|---|---|---|
| Between government and university: | The responsibility of filling the gap of expertise is fragmented between different governmental agencies: TRC, MoCI, and the university (as a public one); explained by the separated contracted policies with different international IP countries, | Organisations became self-contained when acting in response to needs**;** | Created material and functional overlaps between government and university; consequently, lack of experts; Incompletion of provision of resources and guidelines necessary for academics and users to take action. |
| Government/University and international companies | The responsibilities of invention prototyping and patenting and assessment is fragmented, which can be explained by the absence of the physical presence of experts in the country; | Adverse impact on university's ability to support the systematic development of inventions and the fund's incapability of supporting the systematic assessment of | |

organisations participate (decisions might have been made in arenas ranging from the international to the regional or local level). Hence, the institutional setting in which problems are resolved and managed is highly fragmented.

| | | | |
|---|---|---|---|
| | | patents. | |
| Government and non-commercial users | The responsibility of knowledge application/procurement is fragmented between TRC and non-commercial users; | Misalignment between rules and actions had emerged as the visions and goals of the involved governmental organisations were not aligned with TRC policy; | Hindrance to the successful commercial exploitation of the generated knowledge. |
| Government and other governmental units: | The responsibility of IP/patenting assessment is fragmented between TRC and MoCI, | | |
| Between funding programs within government: | The responsibility of incentivising the exchange between academics and the commercial user is fragmented | Theme 5.1: Incongruence policies: -Incongruent policies of knowledge users' involvement in the process; absence of role of intermediary -Incongruent policies of research orientation and fund-allocation; hindered the balancing of academics' values and commercial users' needs. | hindered the production of research outcomes that has potential for commercialisation |

Source: Author's research

As shown in table 6.2 and sections 5.1 and 5.4 in the cross-case analysis, the responsibility of addressing problems was fragmented among different governmental bodies, such as the university, TRC, MoCI, and non-commercial users (Saad et al., 2008, Chaykina, 2012). Each organisation has an independent policy space and functional areas. They each make their own policy agendas within their field and attempt to enhance the utilisation of resources (HR and financial) to accomplish their policy objectives. With regards to the matter of lack of collective action and coordination, organisations preserve their strength through utilising the available resources to achieve their own objectives. As the governmental organisations in this study (i.e. university, TRC, MoCI, and non-commercial users) were involved in such scenarios, various problems, relevant to fragmented government, emerged and drawbacks in knowledge commercialisation resulted as well. These are now discussed:

Despite their involvement in the governing boards and attempts to address problems jointly, the TRC, MoCI and university were found to remain locked in old logics of bureaucracy (Chaminade and Vang, 2006). Their mind-sets were much preoccupied by the deep rooted concepts of rigid models of interaction (Inatrakumerd and Cristina, 2007). The findings in section 5.4 for instance show how the TRC, MoCI and university became self-contained when acting in response to needs. They believe that they can solve the issue of lack of expertise on their own without coordinating and interacting with each other, but they ultimately failed to fulfil these needs. In this respect, the responsibility of filling the gap of expertise was fragmented between these organisations due to bureaucracy, which, by drawing rigid boundaries between them, accounted for operating in isolation (Saad and Zawdie (2005). Rather than recruiting experts, the organisations signed separate contracts with different IP companies from different countries. This created material and functional overlaps. Repetition wastes resources (such as public funds). Additionally, it might generate confusion and conflict as different rules inherent in those contracts are copied and applied. Hence, instead of having different contracts, they could sign a single contract to tackle the issues of repetition/redundancy and incoherency of

policies. Even if organisations did have joint contracts, another element of fragmentation emerged as the overemphasis on professional interference is still a common practice by all. When these organisations borrow or rent experts from developed countries, they should be aware that it is not the attainment of guidelines, but rather the physical presence of those experts within Oman that is most significant. However, this was neglected, which had an adverse impact on what happened on the ground. The lack of direct and regular communication and guidance negatively affected the processes of inventions prototyping and patenting, which constrained the provision of resources (experts) and the guidelines necessary for academics and users to take action.

Secondly, the findings in section 5.5 show how fragmentation associated with bureaucracy caused misalignment between rules and actions. The visions and goals of the involved governmental organisations were not aligned with the national policy designed either by the central government or TRC. The responsibility of patent assessment was fragmented between the TRC and MoCI, which caused misalignment between the actions of the fund-operator and the IP rules of the MoCI with regards to patenting. A collision of two IP elements (Omani Halwa Trade-Secret and Patenting) emerged. Additionally, not specifically referring to governing boards, the responsibility of knowledge commercial exploitation (application and procurement) was fragmented between the TRC and non-commercial users (ministry and ROP), which caused a misalignment between the actions of the non-commercial users and the TRC's policy of knowledge exploitation. Such misalignments were linked to the lack of assigning R&D and innovation as a mandate within those organisations' formal institutional prerogatives. These findings explain that bureaucracy logic has been aggravated by a climate of caution, which has prevailed in the public organisations as civil servants systematically stick to their job descriptions and avoid initiatives and changes that may be seen as challenging established practices. The established routine practices are institutionalised and seem to have predominated and reproduced throughout the administration. Concomitantly, the overbearing preference of maintaining the accomplishment

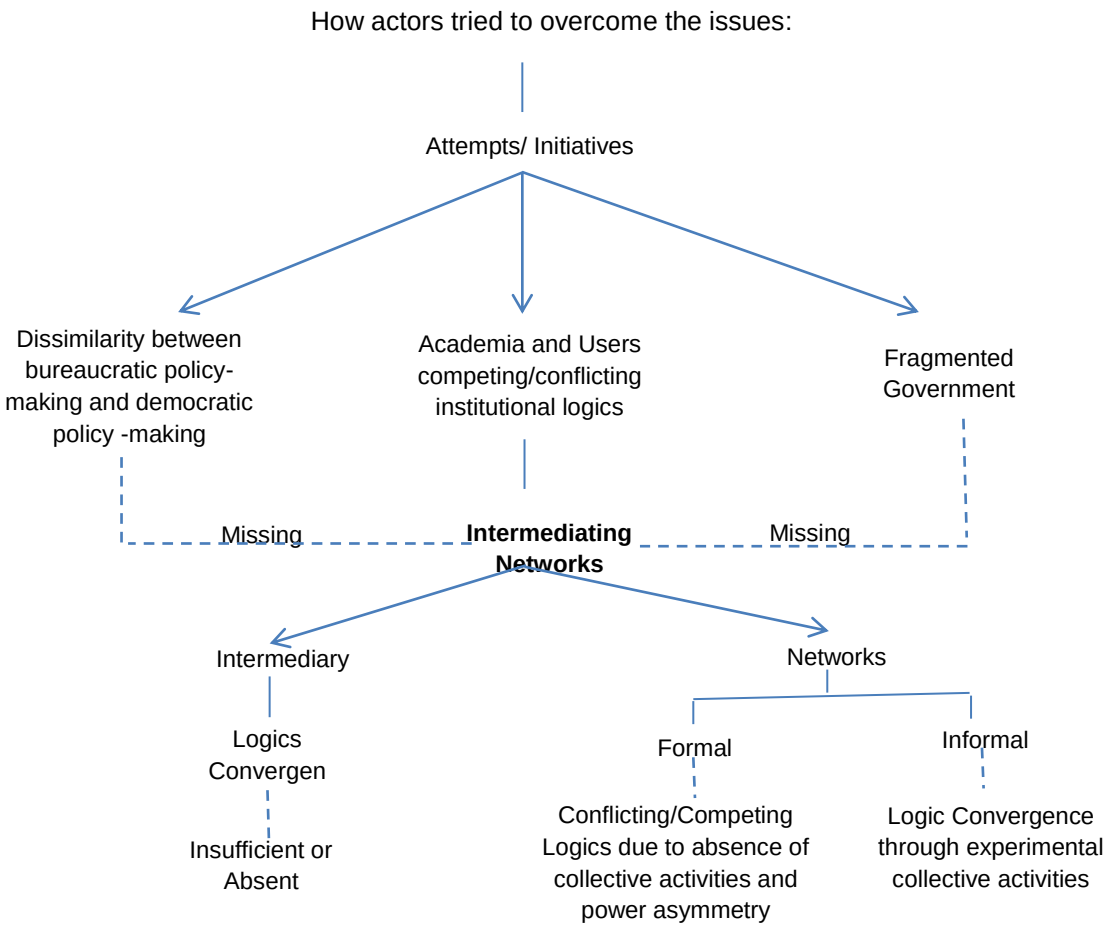
of bureaucratic practices seems to have proliferated throughout the administration's work for the sake of controlling and accomplishing assigned responsibilities (STIP, 2014). However, such culturally embedded bureaucratic rigidity generated fragmented governance, which hindered the commercialisation of generated knowledge.

**From the above**, the overlooked conflicting logics and the prevalence of institutional fragmentation have been the problems militating against the successful transfer and operationalisation process of Western programs in Oman, consequently hindering the production of research outcomes that have potential for commercialisation. First, the action of transferring programs gave a simplistic view of the institutional environment. It presumed logics convergence between academia and users and overlooked the embeddedness of actors within different, often conflicting, logics. This resulted in the unbalancing between academics' and industrial logics. Second, the domination of bureaucratic logics within the TRC, MoCI, University, and non-commercial users meant that the interacting actors hardly ever discussed and negotiated the practices governing their actions in resolving problems. Bureaucracy was recognized as natural practice, which resulted in fragmented actions and policies, and the actions required to resolve problems were scattered across different governmental organisations. Despite their involvement in the governing boards, problems were still resolved independently. There were no shared or joint policies that tackled the systematic, micro-level problems in practice. As per this section's findings, actors faced joined-up problems, which could not be simply separated and divided into departments or organisations. These problems were often cross-boundary and could not be solved by one sector or department independently (Chaminade and Vang, 2006, Chaykina, 2012).

### 6.3 Intermediating and Networking

The aim of the discussion in this section is twofold: (1) identifying the creation of intermediating activities that mediate different logics as the key to enhancing the knowledge commercialisation process; (2) identifying the factors that restrained intermediating activities' within the process.

**Figure 6.1 the issue of intermediating and networking**




Source: Author's research

### 6.3.1 The Role of government as an intermediary

The cross-case analysis (section 5.1) illustrates the emergence of the government's role as an intermediary. As mentioned in section 2.4 of the literature review chapter, a key concept that could be applied to the intermediary is Burt's (1992) notion of structural holes. The establishment of a bridge spans what would otherwise be a structural hole in the surrounding network of actors within a system (Burt, 2005). The analysis in cases ***A*** and ***C*** shows that the government acted as a broker by facilitating participation and connecting otherwise disconnected actors (Burt, 2005, Howells, 2006). Its bridging role of establishing a direct interaction and communication improved the connectedness between enterprises and academics. The findings in both cases, as discussed hereafter, show how the IIC's consultant assisted in engaging enterprises (i.e. commercial users) and academics individually to obtain their inputs and discover commonalty in needs and interests (Hakanson et al., 2011). In Case-***C*** for instance, the IIC did not only collect information but also identified new opportunities for cooperation between academics and enterprises. The IIC generated value through match-making between academics and enterprises that were not previously aware of one another (Burt, 2005, Nakwa and Zawdie, 2015). In this respect, the IIC provided a compensating mechanism for weaknesses and lack of domestic capability ('holes'). Such a role was achieved as the IIC was designed to fill the gaps[22]

[22]The IIC is designed to find out and fill the gaps within both enterprises and universities. The decision of establishing the centre was mainly derived from studying and revising the Omani industry in the late 90s and early 2000. In 2007, a survey was conducted by the TRC, from which they found that many enterprises situated in Oman's major industrial estates don't conduct any research with academia *(IIC annual evaluation report, 2014)*. In addition, they were without 'in-house' investigative facilities and without channels to access universities. They didn't have access to academic laboratories, essential for conducting R&D. Additionally, enterprises lacked the qualified personnel necessary to facilitate complex industrial R&D. At the same time, the IIC also wants to encourage universities to provide these resources to enterprises by conducting applied research. So they communicated with the different universities to find out about the types of research. They found that most research was basic research rather than applied *(ibid, pg.5)*.

within both SMEs and universities. Compensating mechanisms were established as weaknesses and appeared in the form of a lack of SME competence and a lack of applied research capability in the relevant part of the academic system. In the same case, the lack of information on which academics undertake relevant research and the lack of opportunities to meet potential partners were identified as weaknesses for both to enter into collaboration. The IIC compensated such weakness by increasing the chances of both for finding a research partner, which assisted in reducing research costs (Kodama, 2008). For example, it assisted SMEs in finding solutions to problems by contacting IIC agents (i.e. ITAs) within universities, which consequently helped in obtaining local services with lower consultancy fees as well as in delivering the accurate information necessary for generating knowledge. This was done through providing SMEs with meeting opportunities and, mostly, though directly coordinating R&D consortia to bring together academics and enterprises that have the necessary knowledge, technologies, and other important resources for targeted research issues. IIC intermediation was also achieved through mediation in which it assisted academics and SMEs in exploring the benefits of cooperation and information exchange (Hakanson et al., 2011). As evidenced, both parties (academics and enterprises) in cases ***A*** and ***C*** were positioned to benefit. While the academics had the opportunity to secure a substantial amount of funds or additional income for themselves and their university, the user had the chance to generate new knowledge (i.e. new product or system development) without incurring any financial liability (i.e. free consultancy through the incentive of in-kind contribution). For more details, see cross-case analysis table 5.1 and section 5.1.

More importantly, the IIC brokerage and bridging role appeared to involve a value-added element specifically described as bridging differences in logics between academics and commercial users (Villani et al, 2017, Reich-Graefe, 2016). The building of networks through matchmaking and mediation opened possibilities for ‘knowledge arbitrage’ through new combinations of existing knowledge (Burt, 2005, Johnson, 2008), consequently converging academic

and commercial logics around complementary norms. The IIC assisted in saving the accomplishment of the Case-***A*** project, which was technically successful, through negotiating the terms of R&D projects including IP rights with academics and SMEs, it also helped in mediating their dispute and eventually acted as an arbitrator (Johnson, 2008). It is argued that the role of the mediator in conflict resolution implies that the two actors are of a different nature and that some translation of the interests of one of the actors is needed for the other actor and vice versa (Van der Meluen et al., 2005). In this respect, the IIC coordinated and negotiated the asymmetric information through giving actors the chance to talk to each other, thereby allowing them to resolve the dispute themselves. In the interim, it managed the mediation session through creating awareness about compensating mechanisms (incentives) while remaining impartial. In this role, the IIC was acting as a channel and selection aid to actors, which assisted actors in reaching a satisfactory agreement. The incentive of becoming the patent-developer satisfied the academics' logic of career progression through individual development, while the financial incentive of in-kind contribution and ownership rules satisfied the commercial users' logic of profit maximization. This assisted in reducing bargaining costs (Kodama, 2008) and bridging differences between the two logics (Lind et al, 2013, Villani et al, 2017). Hence, the gap of conflicting logics was bridged and a balance between actors' interdependency and independency (traditional role) was achieved (Etzkowitz, 2008), which ultimately facilitated knowledge co-production (Lundberg, 2013). This is evidenced in Case-***A*** by the cooperation instigated between the factory and the academics in the joint production of inventive outcomes or inventions. The IIC acted as a boundary spanner through smoothing, encouraging, and coordinating the practical interaction during knowledge production. It pooled ideas, converged interests, and ensured semantic translation of domain-specific knowledge, consequently bridging the various involved logics (Lundberg, 2013, Van der Meluen et al., 2005) of academics' curiosity and the factory's profit maximization. Given the above, the role of the government as an intermediary assisted in establishing a bridge that

spanned what would otherwise be structural holes (Burt, 2005) in the context characterised by logics incongruence. Searching and matching partners across industry and university boundaries, as well as the provision of beneficial incentives, assisted more effectively than individual actors can do on their own. When research is conducted, academics and firms are usually looking for sense-making triggers and need to face new logics. Intermediaries were found to be well situated in reducing cognitive distance as they facilitated the production of knowledge with potential for commercialisation through joining together individuals from various worlds and reconciling their different logics (Villani et al, 2017). Nevertheless, as the above findings show, the role of the intermediary was found to be only conformant to the IIAP (operated by IIC) rather than across the funding programs. This was demonstrated by the incongruity between the programs and the absence of mediating activities. As shown in section 5.1 of the cross-case analysis, in comparison to the IIAP program in cases ***A*** and ***C***, the design of programs in cases ***B*** (CIIAP) and ***D*** (ORG) is not aimed at supporting the business sectors' innovation needs or efforts. None of these programs included mechanisms to involve commercial users (i.e. local SMEs) directly in their design or performance to exploit innovation potentials from conducted research. Instead, the involvement of users was driven and controlled by the academics as per their research agenda and interests. In Case-***D*** for instance, since role of the intermediary wasn't included as a mandate within ORG, conflicting logics between the academics and commercial users (academics' logic of 'open-science' versus commercial users' profit maximization) emerged. Additionally, in Case-***B***, conflicting logics between commercial users and non-commercial users (non-commercial users' logic of budget management versus commercial users' logic of profit maximization) emerged as the role of intermediary wasn't considered as a mandate within the CIIAP institutional prerogatives.

More significantly, the analysis in cases ***A*** and ***C*** shows that the IIC's intermediating activities were insufficient. As presented in table 6.3.2 below, there is still a need for a more bridging role as academics and commercial users

negotiated and reflected upon conflicting logics. In Case-***A*** for instance, the IIC carried out its intermediating activities only when the research was conducted. Efforts for improving and correcting individuals' ways of understanding how to approach each other's logics throughout the entire process of KC (Villani et. al, 2017) were absent. Conflicting logics regarding knowledge appropriation emerged when the action of commercialisation had taken place. Although it was decided that the generated knowledge was to be owned by the user, with recognition of patent development given to academics, the user subverted such rules by refusing to go through the patenting process. As a powerful actor, the user was found likely to maintain his pre-existing logic (i.e. profit maximization for the interest/goal of family business continuation). This came into conflict with the academics' logic of building self-esteem through career progression. For academics, the disclosure of their IP to the commercial user involved the potential of losing the opportunity of gaining the perceived benefit of having the credit of becoming patent developers. Furthermore, it is argued that the role of an intermediary depends on the possibility of freeing itself from the direct interest of a specific actor (Van der Meulen et al, 2005). However, although the IIC attempted to remain unbiased, it didn't free itself from the direct interests of the commercial users as per its assigned responsibility of focusing on the achievement of SMEs' logic of profit maximization. In Case-***C*** for instance, there was a need for greater effort as conflicting logics existed, with regards to the time-scale of the research outcomes, before signing the contracts. While the commercial user sought profitable products in a short-time, academics prized excellent scientific research outcomes which only accrue in the medium to long run.

| Table 6.3.1 Government Intermediating dimensions identified in the study | | |
|---|---|---|
| | **Intermediating Dimensions (examples from the cases)** | **Consequences** |
| Compensating mechanism for weaknesses | Theme 5.1: IIAP (Case-***C***): the advantage of reducing search costs: the IIC consultants assisted SMEs in finding solutions to problems by contacting university academics. This assisted SMEs in obtaining local services with lower consultancy fees and in delivering the accurate information necessary for generating knowledge. This was done through providing SMEs with information, meeting opportunities, and, mostly, directly coordinating R&D consortia to bring together university researchers and firms that have the necessary knowledge, technologies, and other important resources for targeted research themes. While for academics it assisted them in engaging users in their academic research. | Its bridging role improved the connectedness between academics and commercial users and facilitated the diagnosing of needs and the stimulation of the search for solutions; |
| Compensating mechanism for resolving conflicting logics: Logics bridging: R&D project was formed when logics of academics and commercial users regarding KC were bridged | Theme 5.1: IIAP (Case-***A***)**:** the advantage of reducing bargaining costs to reach a satisfactory agreement between the two parties: the IIC consultants coordinated and negotiated the asymmetric information and transaction costs through creating awareness about the incentives provided for both (i.e. the financial incentive of in-kind contribution, and the incentive of becoming the patent-developer) mitigated the users' uncertainty arising from being involved in R&D and shunned the potential conflict of IP disclosure. | |

Source: Author's Research

| Table 6.3.2 The Overlooked intermediating dimensions identified in the study | | |
|---|---|---|
| | **Examples from the cases** | **Consequences** |
| **IIC, insufficient efforts**, as the mediating activities were not taken into account before signing the R&D contract; | Theme 5.3, Case-***C***: conflicting logics in knowledge creation, specifically about the type of research outcomes; While the user sought profitable products in the short-term, academics prized excellent scientific research outcomes which only accrue in the medium to long run. Hence, time was a key element for the user whereas quality was vital for the academics. | It had constrained the production of outcomes that have the potential for commercialisation, additionally it restrained knowledge commercialisation; As conflicting logics had emerged, and both academics and users were inherently incentivised towards different interests. |
| **Absence of intermediating activities,** as the role of intermediary wasn't included as a mandate within the ORG and CIIAP; | Theme 5.3, Case-***D***, conflicting logics in knowledge appropriation: (Academics' logic of 'open-science' versus the commercial user's logic of profit maximization) While the intrinsic aspect of the academics' reward system was based on establishing IP priority through publications, the user sought profit maximization by safeguarding IP through data-withholding or outcome non-disclosure. | |
| **Absence of intermediating activities,** The R&D projects were not formed when interests converged; Gaps were not bridged through transferring and adapting information and adjusting the framing to different institutional logics | Cross referencing with the issue of conflicting logics between the university and users (sub-section 6.1.1) | |

Source: Author's Research

**From the above**, intermediation is usually referred to as one of the processes of the dispute resolution spectrum in which the intermediary brings two parties together with the aim of reaching a mutual agreement throughout the process (Van der Meulen et al, 2005, Intarakumnerd (2010). Hence, it is working through logic differences, and towards a satisfactory resolution that is likely to strengthen the relationship during the project operation, which in sequence encourages norms tolerance among academics and users (Lind et al, 2013, Saad et al, 2008, Van der Meluen et al., 2005). However, as discussed above, the role of the government as an intermediary provided insufficient activities (within the IIC) related specially to bridging logic differences and nurturing cooperation. There were, however, a few positive implications, for example there was a small but explicit attempt to enhance the interaction between the academics and commercial users in cases ***A*** and ***C***, in which joint production activities and logics convergence were created initially. Minimal progress in interactions and better relations between actors were established by the IIC, but only when the research was conducted, hence, a minor change in logics' transformation was created throughout the process. When the commercialisation action was taking place, rather than reforming the interaction around complementary norms, the competition between logics led to one side winning over the other, and the arena of interaction was structured around the winning dominant logic (for more details see the above sub-section 6.1.1 of this chapter). The arrangements that offer a countervailing force to the imposition of new normative logics in order to reach convergence (Bjerregaard, 2010) were overlooked as the competing interests of actors were not disconnected or detached from the pre-existing institutional logics. Hence, it is necessary to extend intermediating activities in order to blur and overlap logics between academia and commercial users. This spans boundaries as it facilitates a short institutional distance between the parties' shared understanding and expectations.

### 6.3.2 The Role of Networking

It is argued that how and where people do things together matters (Hallett and Ventresca, 2006). The cross-case analysis, section 5.3, shows how different types of networks (informal and formal) enabled or constrained actors in undertaking different forms of institutional work. The conditions within these different types of networks motivated actors to take actions aimed at either creating complementary logics or maintaining pre-existing ones (Thornton and Ocasio, 1999, Lunberg, 2013). Evidently, as will be discussed hereafter, the conditions within the emergent informal networks assisted in enabling academics and commercial users to create complementary knowledge about their respective R&D projects' practices and responsibilities. On the other hand, the conditions within the formal networks instigated by the government motivated the academics and users (commercial and non-commercial) to maintain the status quo or preserve their pre-existing logics, as the findings show that the academics and users negotiated and reflected upon conflicting logics. The following gives more details.

***Informal Networks and bridging differences in logics:***

The emergence of an informal, un-scripted type of network facilitated the collective experimentation process, inducing actors to feel free to communicate openly and experiment. The academics and commercial users in cases ***A*** and ***B*** for instance, felt free to engage in collective activities wherein trial-and-error processes of negotiation and adaptation to new information about each other came about. When the research was conducted, the actors socialised and got to know each other and how to work together. The collective activities underlying trail-and error processes led to advantages where synergies from pooling resources and know-how became more significant than independence (Slavtchev, 2013). Hence, resources (structural and cognitive) available through the structure of networks were shared, which gave the academics and the users the opportunities to recognize their common interests in ensuring knowledge proximity, particularly, similarities in what they produced and how

they produced it. In both cases, when the research was conducted, the academics and users worked collectively in guaranteeing the congruence of the expected generated knowledge with the users' business production line. In Case-***A*** for instance, the academics shared their research labs and research experience, while the factory shared its personnel, tools, machinery, materials, equipment, research labs, and professional experience in order to ensure the congruence between the nature of the outcomes (generated recipe) and the nature of the products that were used to produce, sell, and market. This led to the development of clear role expectations (Lind et al, 2013), which form the initial structure for knowledge commercialisation. Academics, as knowledge providers, and the factory, as the knowledge user, worked jointly to ensure the production of a recipe that has potential for commercialisation.

It is argued that different institutional logics are likely to hinder knowledge exchanges between actors by causing misunderstanding and conflicts (Thornton et al., 2012, Lind et al, 2013, Siegel et al, 2003, Gassol, 2007, da Silva Campos, 2015). However, when the research was conducted, diverse actors (i.e. academics and commercial users) engaged in 'co-production' activities (i.e. ensuring knowledge proximity), which consequently assisted in the emergence of complementary, balanced norms. As academics and commercial users in both cases ***A*** and ***B*** listened and paid attention to each other, they gained an understanding of their different logics, hence becoming better able to communicate and link their diverse logics in ways that covered and redefined the demands of the new situation. Therefore, the activity of ensuring knowledge proximity worked as a basis for mutual understanding and communication (Slavtchev, 2013). Such activity helped in converging the academics' and commercial logics around complementary norms. In Case-***A***, for instance, the academics' norm of curiosity and discovery-driven research was balanced with the commercial users' norm of profit maximization. Whilst in Case-***B***, the user's norm of profit making through gaining exclusive license was balanced also with the academics' logic of individual career progression in becoming the patent owner. In this respect, the academic logic converged towards the commercial

logic as academics put their efforts into producing commercially viable knowledge, while the commercial logic converged towards the academic logic as the user allowed the academics to carry out trial-and error experimentation, shared his resources, and most importantly built up the academics' careers through allowing them to become the patent owner.

The bridging of academic and commercial logics around complementary norms during research performance helped in generating inventive research outcomes that have potentiality for commercialisation. In other words, as per Stokes (1997) 'quadrant of university-industry links', the academics and commercial user possessed complementary knowledge (Etzkowitz and Leydesdorff, 2000, Etzkowitz, 2003, Kitagawa, 2010) as knowledge was integrated by converging the different logics required for developing the requisite new products. Complementary knowledge was accomplished by generating a consensus on the domain of the actors' cooperation, which established a complementary norm of knowledge production and appropriation. Hence, uncertainty was reduced. For instance, in Case-***B***, instead of perceiving the collaborative project simply as a means to gain new technological products for profit, the SME owner utilised the network as a measure to exploit the legitimacy and goodwill produced from the project to stimulate shared meaning about the goals and objectives of the collaboration. This consequently assisted in converging the user's logic of profit maximization (i.e. gaining exclusive license) with the academics' logic of individual career progression (i.e. becoming the patent owner).

**Building on the above findings**, the study shows how the collective activities underlying the research performance (i.e. the trail-and error process) within the emergent informal networks assisted in intermediating between the academics and the commercial users. The engagement in co-production activities (i.e. ensuring knowledge proximity) made the academics' and the commercial users' previously existing logics (that were shaped by their respective institutional spheres) less salient (Thornton et al, 2012), encouraging them to try out alternative choices of actions and experiment with new activities, which in turn

shaped the likelihood of logics convergence between them. The convergence around complementary norms, in other words, the balance between academic norms (i.e. basic, curiosity and discovery-driven research, career progression through becoming the patent developer/owner) and commercial norms (i.e. profit making and maximization), was created. Consequently, complementary knowledge was generated through creating a consensus about their respective practices and responsibilities, which established complementary norms. In Case-***A*** for instance, when the research was conducted, the basic/scientific research outcome was translated into application. While a high level of scientific knowledge was required within the interaction, the commercial users' needs were identified and associated collectively during the incremental development of ideas. In this scenario, the academics and commercial users combined the diverse logics to their pre-existing logics (that previously socialised in their institutional spheres). The logics converged into a novel way (i.e. Stokes 'Pasteur quadrant, Use-Inspired basic research). Subsequently, the production of research outcomes that have the potential for commercialisation as a means to reduce the impact of conflicting logics (Thornton et al, 2012, Bjerregaard, 2010) was achieved, and the interests of both parties were best aligned (Perkmann and Walsh, 2008).

***Formal Networks as a hindrance in bridging differences in logics:***

On the other hand, the analysis in cases ***C*** and ***D*** shows that the formal, governmentally scripted nature of networks (i.e. transferred IIAP, ORG programs) obstructed the collective experimentation process, deterring some actors, and making them feel too restricted to communicate openly and experiment (Boschma, 2005). The processes within R&D projects followed a hub approach where the actors in the network interacted with the government agent, but only less directly (as in Case-***C***) or indirectly (as in Case-***D***) with each other. In comparison to cases ***A*** and ***B***, preconditions and motivations were not integrated when the research was conducted as both parties (i.e. academics and commercial users) didn't experience common interests as stimulators for

cooperation. The process of incremental development, by which the parties get to know each other and learn how to work together, as strategies necessary for reducing the impact of institutional tensions or gaps, was neglected. Therefore, as the perception of the need for collaboration was created by the government, the academics' and the commercial users' complementary norms and role expectations to the relationship (Lind et al, 2013) within such networks were likely less. In other words, as positive loops were not established in the early stages, alliance activities, as discussed hereafter, were rapidly waned due to conflicts of logics (Lee, 2011).

Although logic differences within networks enhance the need for negotiation and development of a common interpretation of the research aims and outcomes (Bjerregaard, 2010, Sauermann and Stephan, 2013), conflicting logics associated with academics' and users' norms still emerged due to the funding programs' isomorphic features and their presumption of homogeneity across institutional spheres (for more details see the above section of 6.2), and more importantly, due to the power asymmetry among actors (for more details see the above section of 6.1). This highlights the tendency of networks, that emerged through formal linkages, to pose barriers towards reciprocal partnerships as logic differences in values and priorities distorted the perception about the work of each counterpart (Boschma, 2005, Lee, 2011). As evidenced previously in section 6.1, the arena of interaction within these networks was structured around putting one appropriating logic over another. Power asymmetry emerged according to funding-IIAP and ORG-rules of waiving ownership to a particular party. Consequently, the bridging of logic differences was overlooked as one actor occupied a more powerful position than others with regards to IP decision-making. Actors were more motivated towards preserving their own logics (Thornton and Ocasio, 1999, Lunberg, 2013) in order to maintain power over ownership. In Case-***D*** for instance, according to the ORG rule of waiving the decision of ownership to the academics, the powerful actor (i.e. academics) were found likely to maintain their pre-existing logics (i.e. open science) in order to preserve their favourable exchange condition (i.e. publication). Another

example is in Case-***C***, as per the IIAP rule of waiving decision of ownership to the medium enterprise, where the GM had the power to preserve their profit maximization logic through imposing their norm of short-term applied research in opposition to the academics' norm of long/medium term basic research. This hampered the achievement of a mutual adaption as no consensus was generated on the domain of collaboration. Complementary knowledge (Etzkowitz and Leydesdorff, 2000, Kitagawa, 2010) was not possessed by the actors as knowledge was not integrated through combining different types of knowledge (i.e. Stoke' pasture quadrant, user-inspired research of basic curiosity-driven, and applied needs-driven). For evidence see sections 5.3 and 5.6 in the cross-case analysis.

Moreover, the structure of formal networks is based on actors' interdependency (Vlaar et al., 2007). Interdependence exists when one actor doesn't control the conditions necessary for the achievement of an action or for obtaining the outcome desired from the action (Pfeffer and Salank, 1978). However, power asymmetry captures the extent to which actors differ in their power to constrain each other, consequently explaining the inequality in the relative distribution of dependencies between actors. When the action of commercialisation was taking place, the logics of the dominant/powerful actors shaped how the generated knowledge could be appropriated and exploited by the involved actors. Rather than becoming interdependent (Etzkowitz, 2004, Bekkers and Freitas, 2008), one actor was less dependent on the other actor and vice versa. For example, in Case-***D***, the non-commercial user was less dependent on the academics and the commercial user, as he perceived that there were better alternatives (i.e. importing from developed countries) for obtaining the same technology (i.e. radar device) that was to be provided by the academics and commercial user. This constrained the procurement of the generated technology, consequently hindering knowledge commercialisation.

**In accordance with the above**, conflicting logics explained the inability of formal networks in overcoming major institutional constrains. The bridging of

differences and creation of mutually beneficial organizing structures, such as logics convergence, were hampered as power was socially granted (Samules, 1971, Schmidt, 1987) to an individual actor who was inclined to preserve his/her pre-existing logics over others logics.

### 6.4 Chapter Conclusion

This chapter has interpreted the findings of the cross-case analysis in the context of the existing literature with the aim of addressing the research questions posed.

Although differences in logics increase the need for negotiation and development of a common interpretation of the research projects' aims and outcomes, the findings show that bridging differences in logics is hindered by asymmetric power relationships. The power asymmetry associated with structuring interaction around one appropriating logic over another perpetuated the pre-existing conflicting logics. When the rules of the projects are established through processes of appropriating one logic over another, actors supporting that logic become more powerful. The logics that are supported by the powerful actor contribute towards preserving the status quo as they set the rules and norms for actions that guide the actor in decision-making. Hence, powerful actors have more control over decision-making and their logics come to be reflected as dominant.

The findings also revealed two dimensions of mimetic isomorphism (M.I). The first dimension is that M.I gave a simplistic view of the institutional environment. The institutionalisation and structure of western programs mean that academics and commercial users share certain concepts regarding knowledge commercialisation. Hence, it presumed logics convergence but overlooked the embeddedness of actors within different, often conflicting, logics. The second dimension is that mimetic isomorphism, more relevantly; the action of transferring cutting-edge programs from the West overlooked the institutional fragmentation within the Omani context. Fragmentation is rooted in the internal

characteristics of bureaucracy. Despite their involvement in the governing boards, actors (i.e. government, university, and non-commercial users) still recognized bureaucracy as natural practice. Their mind-sets are preoccupied with the deep rooted concepts of rigid models of interaction, which leads to fragmented actions. These two dimensions hindered the bridging of differences in logics, consequently constraining the production of research outcomes that have the potential for commercialisation.

Further insights gained from these findings established that for logics of various actors to be bridged, and for fragmentation to be minimized, an intermediating network must be designed**.** However, the findings also showed that the role of the government as an intermediary provided insufficient activities and had a minimal effect in bridging differences in logics. Minimal progress in interactions between actors was established only when the research was conducted. When the commercialisation action was taking place, conflicting logics regarding knowledge appropriation emerged. Countervailing arrangements that bridged different logics were absent. Rather, competition between logics led to one side winning over the other.

Furthermore, the findings showed how the emergent informal networks assisted in bridging differences of logics. The engagement in co-production activities made the academics' and commercial users' previously existing logics less salient. However, this happened only when the research was conducted. The findings also revealed the inability of formal networks to bridge differences in logics in both research performance and commercialisation action. This is due to power asymmetry. Power is granted to an individual actor, who is inclined to preserve their pre-existent logics over others' logics.

Insights garnered from the above contributed to the understanding of the important role of government in (1) extending intermediating activities in order to bridge differences in logics which spans boundaries as it facilitates a short institutional distance between parties, as well as developing shared understanding and expectations especially when commercialisation takes place;

(2) avoiding power asymmetry. Rather than appropriating one logic over another, funding programs could be structured around balanced logics. The role of government could also be to assist institutionalisation and the representation of all actors within its governing board. This requires deliberate efforts on the part of powerful government officials by delegating power and giving up, or devolving some of their autonomy in exchange for increased consensus, and including SMEs owners/managers. Moreover, policy initiatives that would remedy the institutional fragmentation problem are necessary.

# Chapter 7: Conclusion

Chapter five provided a discussion of findings in this study. This chapter presents the research results/findings with the aim of addressing the research questions. In addition, it sums up the study by highlighting the contributions. Accordingly, the chapter begins with a recap of the research gaps. This is then followed by a discussion of the empirical and theoretical contributions. Subsequent to that, the chapter provides the implications of the study for managerial and policy spaces. Finally, the chapter concludes with highlighting the study's limitations and outlining suggested directions for future studies.

## 7.0 Introduction and overview

University Knowledge Commercialisation research has surged tremendously over the last few decades (Viale and Etzkowitz, 2010). In this period, theoretical, empirical, and practitioner interests have risen exponentially (Duch et al., 2011). Despite this, however, there exist gaps in the literature. As such, the motive behind this study is to fill critical knowledge gaps and make contributions to UKC research. Firstly, for several years many scholars (e.g. Tuunainen, 2002, Lu, 2007, Viale and Pozzali, 2010, Fogelberg and Thorpenberg, 2012, and Ankrah et al., 2013) alerted us that research has neglected exploring methodically the implications of differences in logics at the micro-level of triple-helix interactions. This demonstrates that existing studies in UKC provide modest practical directions on how to bridge differences and nurture cooperation between actors. They don't pay sufficient attention to the role of different mechanisms that surround and exert a direct or indirect effect/influence on knowledge commercialisation. This research domain remains largely unexplored. As such, the understanding of the implications of potential mechanisms for bridging differences in logics at the micro-level interaction (i.e. contracted research) of UKC remains quite limited. Secondly, these mechanisms can involve: power, mimetic isomorphism (M.I) and intermediating. Because of its modest view of institutional convergence between academia, industry, and government, M.I overlooks the embeddedness of actors within

different, conflicting logics (Thornton et al., 2012). Despite this, very few empirical studies have attempted to study the effect of M.I on UKC. As such, there remains an unfilled gap in considering M.I as a potential mechanism in bridging differences in logics. Furthermore, although power (in linkage to institutions) is central for understanding how the opportunities provided for actors have been shaped to challenge conflicting logics, particularly the processes of appropriating one logic over another, this research domain remains largely unexplored (Hira, 2013). As such, understanding the effect of power as a potential mechanism in bridging differences in logics within UKC remains very limited. Moreover, because of its potency in explaining the ways with which to manage the conflict associated with logic differences at the micro-level interactions (Suvinen et al., 2010)**,** intermediation (i.e. intermediary and networking) is favoured as a mechanism for bridging differences in logics within UKC (Håkanson et al., 2011; Villani et al., 2017; Reich-Graefe, 2016). Despite this, however, the literature linked to UKC provided modest practical directions on how to bridge differences through intermediation (Howells, 2006; Pollard, 2006). It is worth mentioning that practical direction is context dependent, as evident from the case of Oman (i.e. where institutions are emerging rather than being already established). Although the interest of exploring this area is growing in ILP (Reay and Hinings, 2009; Suddaby and Leca, 2009; Lawrence and Suddaby, 2006), very few empirical studies have examined the ways of managing and bridging such differences at the micro-level interactions (Greenwood et al., 2011). As a result, there exists little understanding of intermediation or indeed how intermediation can assist in bridging differences in logics.

Thirdly, despite the importance of explaining logics differences within a country with an emerging institutional environment, this still remains largely unexplored. The growing body of empirical studies has focused on Western countries (in which UKC context is instituionally developed). Additionally, despite the many endeavours to fill such a gap (e.g. da Silva et al., 2012, Saad et al., 2008, and Saad and Zawdie, 2011a), the studies have attempted to examine this

phenomenon in countries depsite instituional differences (Pugh, 2014; Cai, 2015). As such, the understanding of the influence of potential mechanisms on birdging differences in logics in the context of an emerging UKC institutional environment remains quite limited.

**Overall,** the above stated gaps limit our understanding of UKC particulary in a country with an emerging instituional environment and should therefore be addressed. Filling these gaps can improve our understanding of emerging mechanisms as potential solutions for bridging differences in institutional logics within the micro-level interactions of UKC in a developing institutional context, that is, Oman. Thus, in consideration of these research gaps, this study has moved towards explaining and understanding the effects of power (RQ1), mimetic isomorphism (RQ2), and intermediating and networking (RQ3) in bridging differences in institutional logics.

### 7.1 Questions' answers/Main findings

The present study has empirically contributed to the field of UKC. This has been achieved by understanding the process of UKC in the context of an emerging institutional environment and understanding how potential mechanisms enable or constrain the bridging of differences within the micro-level interactions of its contract research. Consequently, this section discusses briefly the answers for the three research sub-questions in this study.

**The first research question** aimed at exploring and understanding the effect of power as a mechanism that enables/constrain bridging differences in logics. As a result of the analysis relating to power and institutions, the findings showed that while differences in logics increase the need for the negotiation and development of a shared understanding pertaining to research project aims and outcomes (Bjerregaard, 2010), the logics associated with actors (i.e. academics, users, and government) have been perpetuated due to power asymmetry. The rules governing the interaction within the investigated contracted research projects are deemed as being forms of power (Samules, 1971) as they were

socially granted (Schmidt, 1987). First, as findings show, power asymmetry emerged in line with funding rules of ownership, due to the fact that these rules were established around one appropriating logics over another. Instead of structuring the interactions within projects around balancing/complementary logics, the existing rules led to one side winning over the other. Since an actor had occupied a more powerful position in decision-making, the logics of this actor came to be reflected as dominant. The appropriation of knowledge was controlled by one party as there was no balance between the university's logics and the users' logics (Lind et al., 2013). On the research spectrum**,** the logics of academia were dominant as they had more control over the decisions of how to appropriate the generated knowledge. For instance, the findings show how the funding (ORG) ownership rules of waiving the decision to academics, gave them the power to inflict their academic logic (i.e. open science) towards the dissemination of knowledge through publication (Polanyi, 1962; Fini and Toschi, 2016; Siegel et al., 2007; Murray, 2010; Calcagini et al., 2016) against commercial users' logic of profit maximization. The findings also showed how the university rule of building a patent profile made KTO become gatekeeper. The department became rigorous in enforcing patent and licensing rules against commercial users' logic of profit maximization. While on the commercialisation spectrum, the logics of commercial and non-commercial users were dominant. For example, the findings demonstrated, as per IIAP fund ownership rules of waiving the decision to commercial users, how commercial users (i.e. SMEs), as powerful actors, used such rules to act upon their norms towards the profit making/maximization logic serving the interest/goal of family business continuation (RW Hiebl, 2014) in opposition to the academics' logics of open science (publication) and career progression (being patent developer) (Aghion et al., 2008; Lacetera 2009; Calcagini et al., 2016). Additionally, the findings showed, as per CIIAP and ORG fund ownership rules of waiving the decision to users, how non-commercial users (i.e. Governmental bodies- ROP and Ministry) used these rules to maintain their pre-existing logic (i.e. budget management) to maintain the protection of public resources (i.e. public funds). The logics of

academics (e.g. career progression through patent development) were completely set aside.

Second, the findings showed that power asymmetry emerged as per the government's board of governance rule of appropriating the government's bureaucratic logic over the university's and the commercial users' logics of knowledge commercialisation. This is because power was concentrated in the hands of the governmental officials (on account of those officials' high representation within governing boards), consequently allowing them to exercise power in policy-making and rule creation (Samuels, 1971). They had more control over decision-making and their logic of bureaucracy came to be reflected as dominant (DiMaggio and Powell, 1983; Thornton and Ocasio, 1999). This can be demonstrated by their taken-for-granted, bureaucratic actions of the exclusion and limited participation of actors from policy- making. The exclusion of commercial users (SMEs owner/managers) from the TRC governing board resulted in the commercial users' inability to champion their logic of profit maximization through KC. The officials used their bureaucratic role to exercise purposeful power over the involvement of other actors (Saad and Zawdie, 2005; Chaykina, 2012). This was manifested into action in view of the fact that, as per the Royal Decree, the high-level officials (i.e. the heads of the board) had the authority to appoint actors from industry. Instead of appointing SME owners/GMs, they appointed CEOs from large companies. These companies were not representative spokespersons for the needs of SMEs for whom the policies were being designed. Therefore, large companies took the opportunity to achieve their own agendas, while neglecting the excluded commercial users' need for commercialisation. The exclusion of SME representatives (i.e. owners, GMS) made SMEs feel vulnerable due to the uneven balance of financial resources. This is again manifested into action by the unclear standards of fund allocation, which are justified by the incongruity between different funding policies regulating KC, and the SMEs' lack of control over meeting their logic of profit maximization through KC**.** Moreover, governmental officials had also exercised their power over the involved board of members. While, the IIC's (as

per the representation of its parent organisation and head-committee in the TRC governing board) and the IAC's (as per the representation of its members in the university council and the TRC governing board) voices were welcomed, they were excluded from participating in making final decisions. The governing board consults with them and takes their suggestions, but do not delegate power to them to make decisions and develop policy (Abro and Benneworth, 2007; McAdam et al., 2012; Miller et al., 2014). The real decisions - those that ultimately become policies - are made by high-level governmental officials. In other words, the IIC and IAC merely rubber stamp the decisions made by those officials. This was manifested into action by the lack of transparency resulting from the opaque bureaucracy, which limited the participation of IIC and IAC representatives in the process of decision-making. The representatives felt weak because of the uneven balance of information distribution, consequently restraining their ability in operationalising the required IP and commercialisation due to the suggested guidelines.

**In short**, the power asymmetry that manifested in the rules of the investigated projects captured the extent to which actors differ in their power to constrain each other. Under this scenario, power was inevitable as powerful actors had the ability to implement their own logics when they conflicted with those of others (Schmidt, 1987). There was no logics' bridging as each actor was motivated to preserve his/her pre-existing logics (Thornton and Ocasio, 1999; Lunberg, 2013) to maintain his/her granted power.

**The second research question** aimed at exploring and understanding the effect of mimetic isomorphism (i.e. transferring institutions from the US and Canada to the Omani context) as a mechanism that enables/constrains the bridging of differences in logics. As a result of the analysis, M.I made the TRC place more attention on homogeneity across spheres (Meyer et al., 1997; DiMaggio and Powell, 1983). The funding programs transferred from the US and Canada were deemed as the only institutional order surrounding all spheres. The rules of these programs were considered the templates for action

that generate unified responses and commonality of functions among actors (Benner and Sandstrom, 2000). This consequently hindered the bridging of differences in logics. This was demonstrated by two dimensions. One dimension is that each funding program had presumed logics convergence between academia and commercial users and overlooked their embeddedness within different, often conflicting logics (Thornton et al., 2012). Mainly, this was shown by the emergence of the incongruence of the research orientation policies of the IIAP and ORG. Instead of incentivising the exchange of knowledge across spheres, the programs' rules focused on supporting one logic over the other. The research-orientation policy of the IIAP, for instance, aimed at encouraging applied, rather than basic, research. While the rule of waiving ownership to commercial users assisted in meeting users' logic of secrecy and data withholding, it prevented the academics from fulfilling their logic of 'open science' through publication. In contrast, the research-orientation policy of the ORG was encouraged basic, rather than applied, research. The rule of waiving ownership to the academics supported the academics' logic of 'open science'. Rather than assigning the user as a research partner, the academics had the chance to assign him as an industrial consultant so as to restrain his logic of data-withholding. Another dimension is that the TRC's action of transferring cutting-edge programs from the US and Canada overlooked institutional fragmentation within the Omani context. The findings showed that the responsibility of addressing problems was fragmented among the university, the TRC, MoCI, and non-commercial users (Saad et al., 2008; Chaykina, 2012). They were still locked in old logics of bureaucracy (Chaminade and Vang, 2006) as their mind-sets were much possessed by the deep-rooted concept of rigid interaction (Inatrakumerd and Cristina, 2007), which accounted for operating in isolation (Saad and Zawdie, 2005). This was demonstrated by two points. First, despite their involvement in the governing boards in an attempt to address problems jointly, the TRC, MoCI and university were self-contained when acting in response to the need of filling the gap in expertise. They believed that they could meet such a need on their own without coordinating with each other, and

they failed to fulfil the need in the end. Instead of signing a single contract, they signed separate contracts with different IP companies from different countries. This generated conflict as the different rules inherent in those contracts were copied and applied. Also, signing contracts neglected the significance of the physical presence of those experts within Oman, which impacted adversely on what happened on the ground. The guidelines necessary for academics and commercial users as pertains to inventions prototyping and patenting were constrained due to the lack of those experts' direct and regular communication. Second, fragmentation stemming from bureaucracy caused misalignment between the rules and actions of the involved governmental organisations and the national policy of either the central government or the TRC. As patent assessment was fragmented, misalignment between the actions of the IIC and the IP rules of the MoCI, with regards to patenting, was demonstrated by the collision of two IP elements (Omani Halwa Trade-Secret and Patenting). Additionally, as knowledge exploitation was fragmented, misalignment between the actions of non-commercial users (i.e. ROP and ministry) and the TRC's policy was shown by the lack of assigning R&D and innovation as a mandate for non-commercial users. These two findings explain the overbearing preference of maintaining the accomplishment of bureaucratic practices for the sake of controlling the good accomplishment of assigned responsibilities (STIP, 2014). However, such rigidity resulted in the hindrance of bridging differences between the academics' logic (i.e. career progression through patent development) and the commercial users' logic of profit maximization.

**In short**, bridging differences in logics was hindered by M.I. (i.e. transferring institutions from the West) through its (1) presumption of logic convergence (stemming from M.I), causing incongruence of the research orientation policies; (2) negligence of institutional fragmentation among the university, TRC, MoCI, and non-commercial users, which: (a) generated conflicts due to the different rules inherent in separately signed contracts as well as neglecting the importance of the physical presence of experts within Oman; (b) caused misalignment between the actions of IIC and the IP rules of the MoCI regarding

patenting as well as between the actions of non-commercial users (i.e. ROP and Ministry) and the TRC's policy regarding knowledge exploitation.

**The third research question** aimed to explore and understand the effect of the intermediary and networking as mechanisms that enable/constrain the bridging of differences in logics. As a result of the conducted analysis, the findings showed the emergence of both the government's role as an intermediary, and informal networks that appeared to involve a value-added element, specifically described as logic bridging/spanning between academics and commercial users (Villani et al, 2017; Reich-Graefe, 2016; Slavtchev, 2013; Korotka, 2015).

**With respect to the role of intermediary**, the government's (represented by the IIC's) responsibilities of building networks through matchmaking and mediation opened possibilities for new combinations of existing knowledge (Burt, 2005; Johnson, 2008), consequently bridging the academics' logic and the commercial logic around complementary norms. Through matchmaking, the IIC generated value by connecting academics and enterprises who were not previously acquainted with one another (Burt, 2005; Howells, 2006; Nakwa and Zawdie, 2015). The IIC's consultants assisted in engaging enterprises and academics individually to obtain their inputs and discover commonalty in their needs and interests (Hakanson et al., 2011). They did not only collect information, but also provided compensating mechanisms for weaknesses through increasing the chances of both in finding a research partner, which consequently reduced research costs (Kodama, 2008). Enterprises lack competence and applied capability research (IIC, 2013), and, in order to fill such weaknesses, the IIC assisted enterprises in finding solutions to problems through coordinating with IIC agents within the university (i.e. ITAs), which facilitated the obtaining of local services with lower consultancy fees and the delivery of accurate information which is essential for knowledge generation. This was achieved by providing opportunities to meet through matching research consortia with the aim of bringing together academics and enterprises possessing the required knowledge, technologies, and other important

resources for targeted research issues. Concurrently, through mediation, the IIC assisted academics and enterprises in realising the benefits of cooperation and information exchange (Hakanson et al., 2011). Both were positioned to benefit. For example, while the academics had the opportunity to secure a large amount of funds or additional income for themselves and their university, the enterprises had the chance to generate new products/systems without incurring any financial liability (i.e. the benefit of free consultancy through the incentive of in-kind contribution). Additionally, the IIC mediated disputes (Johnson, 2008) through negotiating the terms of the research projects including IP rights. Bargaining costs were reduced through negotiating asymmetric information exchange between academics and enterprises (Kodama, 2008). Parties were given the chance to talk to each other, thus allowing them to solve disputes by themselves. In the interim, the mediation session was managed through creating awareness about compensating mechanisms (i.e. incentives) while remaining unbiased/neutral (Van der Meluen et al., 2005). Given this, the IIC aided parties in achieving compromises between their two logics (Lind et al., 2013; Villani et al., 2017). For instance, while the incentive of becoming patent-developer satisfied the academics' logic of career progression (i.e. individual development through being a patent developer); the financial incentives of in-kind contribution and ownership satisfied the commercial users' logic of profit maximization. In addition, knowledge co-production of, for instance, an inventive outcome was facilitated by bridging the various involved logics (Lundberg, 2013; Van der Meluen et al., 2005) of the academics' curiosity and the factory's profit maximization.

**With respect to networking**, although different logics are likely to cause misunderstanding and conflicts between actors (Thornton et al., 2012; Lind et al., 2013; Campos, 2015), the findings showed, in comparison to formal networks, how the collective activities underlying the research process of trail-and-error within the emerged informal networks helped in intermediating between the academics and commercial users. The activity of sharing structural and cognitive resources (i.e. academic labs and research experience and users'

personnel, tools, machinery, materials, equipment, and professional experience), for instance, led to advantages where synergies from know-how became more significant than independence (Slavtchev, 2013). The academics and the commercial user recognized the common interest of ensuring knowledge proximity, particularly similarities in what they produced and how they produced it. Their engagement in co-production (i.e. the activity of ensuring knowledge proximity) made their previously existing logics (that were shaped by, and socialised in, their respective institutional spheres) less salient (Thornton et al., 2012), which encouraged them to examine alternative choices of actions and experiments, thus shaping the likelihood of bridging their different logics. Balancing the academics' logics (i.e. basic, curiosity and discovery-driven research, career progression through becoming patent developer/owner) and the commercial logic (i.e. profit making and maximization) was created through generating consensus about their corresponding practices and responsibilities (Lind et al., 2013). For example, academics, as knowledge provider, and the factory, as knowledge user, worked jointly to ensure the production of a product that has potential for commercialisation. During the incremental development of a research idea, a translation of basic/scientific outcome into application was achieved in concert with the identification of the commercial users' needs. Accordingly, the logics of academics and the commercial user were bridged into a novel way, such as Stokes 'Pasteur quadrant, Use-Inspired basic research (Stoke, 1997; Kitagawa, 2010). Consequently, producing research outcomes that have the potential for commercialisation, as a means of reducing the impact of conflicting logics (Thornton et al, 2012; Bjerregaard, 2010), was achieved as the interests of both parties were well aligned (Perkmann and Walsh, 2008).

However, the findings showed insufficient intermediating activities across the four investigated projects. **First**, the role of government as an intermediary provided less means as relates to bridging differences in logics, as countervailing arrangements (i.e. compensation mechanisms, incentives, mutual benefits) were: **(a) totally absent within the ORG and CIIAP funding**

**programs.** The role of intermediary was found to be only conformant to the IIAP (operated by the IIC). Both programs (i.e. ORG and CIIAP) are not aimed at supporting local SMEs' commercialisation needs or efforts. Particularly, there is a lack of direct involvement of SMEs in their design or performance. Rather, the involvement of SMEs was driven by academics and their research agendas and logics, which hindered the bridging of differences in logics between the academics and commercial users (academics' logic of 'open-science' versus the commercial user's profit maximization) as well as between commercial and non-commercial users (non-commercial user's logic of budget management versus the commercial user' logic of profit maximization) ; **(b) absent during knowledge commercialisation within the IIC (more specifically in the IIAP funding program).** Few, but explicit, positive implications attempts were established to enhance the interaction between academics and commercial users, in which joint production activities and logics balancing were initially created (as discussed above). Once the commercialisation action took place, the interaction was developed around complementary/balanced logics, and conflicts between the logics, with regards to knowledge appropriation, emerged. The arrangements that provide a countervailing force to bridge logics were overlooked due to power asymmetry. Power was socially granted (Samules, 1971; Schmidt, 1987) to an individual actor (i.e. structuring the arena of interaction around one appropriating logic over another), who was inclined to preserve his/her pre-existing logics against others' logics. Accordingly, the arena of interaction was controlled by the powerful, dominant logics. For example, despite the fact that an agreement between the commercial user and academics was reached at the beginning for knowledge to be owned by the user with recognition of patent development given to the academics, the user, as a powerful actor, refused to go through with patenting because the user wished to maintain his pre-existing logic of profit maximization for the interest of family business continuation. Accordingly, the academics couldn't meet their logic (i.e. building self-esteem through career progression) as they lost the opportunity of gaining the perceived benefit of having the credit of being patent

developers**.** Hence, minor changes in logics' bridging were created throughout the process and only minimal progress between the interactive actors was created when the research was conducted.

Moreover, although the findings showed that the bridging of differences in logics was enabled by the emerged informal networks, this only happened when the research was conducted. Again when the commercialisation action was taking place (i.e. after formal networks were instigated by the government during research performance), the logics of the powerful academics or users (i.e. due to the power asymmetry associated with funding rules of waiving ownership to a particular party) shaped the way in which the generated knowledge could be appropriated and exploited. The academics and users were inclined to maintain power over ownership in order to preserve their own logics (Thornton and Ocasio, 1999; Lunberg, 2013). This indicates that formal networks posed barriers to reciprocal partnerships as their rules captured how actors differ in their power to constrain each other (Boschma, 2005; Lee, 2011). As the academics, for instance in ORG, occupied a more powerful position than the commercial users with regards to IP decision-making, they were found likely to maintain their logic of open science to preserve their favourable exchange condition of publication. Instead of becoming interdependent (Bekkers and Freitas, 2008), the powerful actor was less dependent on the other actor. For example, non-commercial users (e.g. ROP) were found to be less dependent on the commercial user and academics as they perceived importing technologies from developed countries to be a better alternative, which subsequently constrained the procurement and commercialisation of the generated knowledge.

**In short**, although the emergence of the government's role as an intermediary, as well as networking, appeared to involve a value-added element described as bridging differences in logics between the academics and users, there is still insufficient intermediation. The efforts of intermediation were either totally absent or absent during knowledge commercialisation. Such efforts were

evident and carried out only when the research was conducted, but they were neglected when the KC action was taking place. The absence of the role of intermediary as a mandate within ORG and CIIAP and the minor changes, or minimal progress, in logics' bridging within IIAP calls for the necessity to establish (within ORG and CIIAP) and extend (within IIC-IIAP) intermediating activities in order to bridge logics between academia and commercial users, particularly, during knowledge commercialisation. This could bridge the differences in logics as it might facilitate a short institutional distance between parties' shared understanding and expectations. Moreover, and in comparison to informal networks, the absence of intermediating activities (that resulted from power asymmetry) within formal networks explained how actors differ in their power to constrain each other, consequently posing a barrier to bridging differences in logics. This calls for the necessity to establish symmetric power. Instead of appropriating one logic over another, formal network (i.e. funding programs) could be structured around balanced logics.

## 7.2 Research Contributions

This study contributes to the theoretical and empirical domain of University Knowledge Commercialisation in several ways. These are discussed hereafter.

### 7.2.1 Contribution to the Theory

This research has made theoretical contributions to the applied/used theories, particularly, Institutional Logics Perspective (ILP), Academic Capitalism (AC), and Triple-Helix Model (THM).

First, this study is the first to examine the concept of power within the Institutional Logics Perspective domain. The introduction of such concept contributed to ILP theory and followed a novel approach by calling for the need to adopt arguments from two general institutional scholars (i.e. Schmidt, 1987, and Samuels, 1971). Although these scholars are not approaching the issue from ILP literature, they have also taken the institutionalist perspective. The application of their arguments helped in analysing the findings of the study,

more explicitly, in linking institutions with power, and viewing their causal sequencing on KC. Such a link has been considered significant for understanding actors' behaviour (Shapira 2004; Lacetera, 2009; Hewitt-Dundas, 2012; Miller et al., 2016; Mathieu, 2011; McAdam et al., 2012, etc.). As the analysis showed, power was inevitable when logics conflict. Power asymmetry emerged as power was socially granted. The rules of projects were established around appropriating one logic over another. Actors supporting the appropriated logic became more powerful and their logic came to be reflected as dominant. In other words, powerful actors had the chance to preserve their own logic as they had more control over decision-making compared to those without power.

**Second,** the study contributed to ILP, AC, and TH theories by introducing the intermediation concept as essential within UKC (Yusuf, 2008; Swan et al., 2010; Lundberg, 2013; Villani et al., 2017, etc.). The introduction of such concept provided practical directions on how to bridge differences and nurture cooperation through intermediary and networking mechanisms. This has contributed to understanding how such mechanisms made the academics' and the industry's previously existing logics, that were shaped by their respective institutional spheres, less salient (Thornton et al., 2012) when the research was conducted. Sufficient attention given to the role of the government as an intermediary has generated insights into how the IIC's intermediation through matchmaking and mediation opened possibilities for bridging the academics' logics and commercial logics (Johnson, 2008). Through matchmaking, the IIC assisted in connecting academics and enterprises that were not previously aware of one another (Howells, 2006), consequently reducing research costs (Kodama, 2008). Compensating mechanisms for weaknesses were provided by increasing the chances of both in finding a research partner. While it assisted enterprises in getting consultancy services with low fees, it also helped academics in ensuring the knowledge's industrial applicability. Through mediation, the IIC helped academics and enterprises in recognizing the benefits of cooperation (Hakanson et al., 2011). While academics were positioned to gain the benefit of securing research funds and additional income, the

enterprises gained the benefits of free consultancy (through the incentive of in-kind contribution) which helped him/her in generating new products/systems with less financial liability. Consequently, bridging the commercial user's logic (i.e. profit making) and the academics' logic (i.e. curiosity and discovery). The IIC's mediating activities also assisted in reducing bargaining costs (Kodama, 2008). The potential dispute regarding IP rights was managed through creating awareness about compensating mechanisms (i.e. incentives). The academics' logics of career progression and academic curiosity were reached through the incentive of becoming patent developer, while the users' logic of profit maximization was reached through the incentives of in-kind contribution and ownership. Furthermore, the introduction of the intermediation concept gave attention to the role of networking in generating insights into how informal networks opened possibilities for bridging academics' logics and commercial logics around complementary knowledge (Kitagawa, 2010). The activity of sharing resources (i.e. academic research labs and experience and users' personnel and professional experience, etc.) made the academics and commercial user engage in co-production (i.e. the activity of ensuring knowledge proximity or similarities in what they produced and how they produced it). The users' needs were clearly identified for translating basic/scientific research into application, subsequently shaping the likelihood of bridging the academics' logics (i.e. basic, curiosity and discovery-driven research, career progression through becoming patent developer/owner) and the commercial user's logic (i.e. profit making and maximization) in a novel way (i.e. Stoke's Use-Inspired basic research).

### 7.2.2 Empirical Contributions

The Omani experience has contributed in two ways in enhancing the understanding of the UKC phenomenon. First, it contributed to understanding the effect of non-commercial users' logics in determining UKC. Over the last decades, UKC scholars have sought to explore logics differences among diverse actors as a constraining/enabling factor for commercialisation of knowledge (Lind et al., 2013; Bjerregaard, 2010; Siegel et al., 2003; Gassol,

2007). This has been considered vital for understanding these logics and the challenges of bridging them (Lind et al., 2013) through potential mechanisms. However, the existing UKC literature has, to date, paid little attention to the logics of non-commercial users (i.e. governmental bodies and other public organisations). A growing body of empirical studies are focusing on academics and commercial users (e.g. Sauermann and Stephan, 2013, Bentley et al., 2015, Aghion et al. 2008, Lacetera, 2009, da Silva Campos, 2015, Fini and Lacetera, 2010, Lacetera 2009, Murray, 2010, Vallas and Kleinman, 2008, and Calcagini et al., 2016, etc.) without reference to non-commercial users. This study has contributed and filled this gap by exploring a context where non-commercial users have a great influence in determining UKC. The study results showed that the Omani context gave the non-commercial users the chance to exert power over the academics and commercial users. This is due to the government funding's rule of waiving ownership to the non-commercial users, which gave the Ministry and ROP the power to constrain the application and procurement of the technologies generated by academics and enterprises. As powerful actors, they were motivated to preserve their logic of budget management for the sake of controlling the good use of public funds. They were risk-averse. Rather than making changes, the Ministry rejected the introduction of R&D as a new practice within its institutional prerogatives. Rather than exploiting the generated knowledge, the ROP circumvented the deviation from their routine practice of importing or procuring ready-made solutions from developed countries. For more details, see section 6.1, in the discussion chapter. This has contributed to understanding the complexities of the non-commercial users' logics in shaping UKC as well as providing important implications for issues such as commercialisation activities in the public sector, and frictions/resistances in the interactions between the three sectors.

Second, the Omani experience contributed to a better understanding of the government's intermediation role in UKC. It provided empirical evidence of the expansion of the Industrial Innovation Centre's (IIC's) role from the traditional practice of provision of funding (Argyris and Liebeskind, 1998), planning and

regulating (Lawton Smith, 2007), towards supporting and operating the processes of UKC cooperatively with academics and commercial users (Lu, 2007; Leydesdorff, 2009). This is because the IIC's role is viewed as being a response to the under-exploitation of university generated knowledge by commercial users (Siegel et al., 2003; Johnson, 2008). Rather than viewing the IIC as exogenous to the KC activities (Sohn et al., 2009) providing only funding and policy contexts for the establishment of relationships between university and industry (Leydesdorff, 2009; Guerzoni et al., 2014), it was also perceived as an intermediary (Intarakumnerd et al., 2010; Nakwa and Zawdie, 2015, 2016). Its role in searching and matching partners across industry and university boundaries assisted more effectively than academics and commercial users can do on their own (Hakanson et al., 2011). This reduced search and bargaining costs (Kodama, 2008) and assisted in bridging differences in logics (Villani et al., 2017). For more details, see the above section 7.2.

## 7.3 Implications of the study: for managerial and policy spaces of the study

This section now draws out the implications for the Omani policy-makers. It provides recommendations for Oman as an oil-based economy with the desire to diversify its economy and capitalise on a knowledge-based economy.

Insights garnered from this study's main findings (see the above section 7.2) resulted in understanding the role that can be played by the government in enhancing UKC. First, the role of government could be triggered to assist institutionalisation and symmetric power between all representatives of all actors in decision-making**.** This is because power in the context of UKC is not always thought about in terms of its use by one party over another party, rather it is motivated by the power to do. Hence, the government needs to revisit the structure of its governing board to open up and delegate participation, through giving up or devolving some of the high-level government officials' autonomy to low-management representatives in exchange for increased consensus. Moreover, the role of government could be triggered to also assist

institutionalisation through the representation of all relevant actors. There is a need for a policy setting where inclusivity is given more emphasis. What we have in Oman is up-bottom rather than bottom-up (Al Harthy, 2014). We need engagement and voice coming from the bottom and that is the voice of SME Owners/GMs. Supporting low-level management substantive participation and SMEs' inclusion means that all involved actors commit to sharing information, giving their opinions on goals, and developing an agreed upon set of actions (Saad et al., 2005). This leads to a clear goal, a flexible and fast decision-making process, and a balanced choice approach between actors' logics. Secondly, the government needs to introduce an intermediary within the ORG and CIIAP as well as initiate more intermediating activities within the IIAP, especially during knowledge commercialisation. These funding programs have to be customized through considering ways of bridging differences in logics. The government, for instance, should design shrewd intermediating activities where logics of involved parties are balanced. This can be suggested, for instance, by avoiding power asymmetry. Rather than appropriating commercial users' logics (i.e. profit maximization) over academics' logics, the IIAP could be restructured around balanced logics, and, a similar thing can be suggested for the ORG and CIIAP. Within the university, more intermediation can be suggested by establishing flexibility and a low degree of formalisation within the KTO's contractual arrangements. In order for the KTO to mediate the distance of commercial exploitation of knowledge, it needs to govern commercialisation by organizing a collective institutional arrangement with commercial users - cross-fertilisation formats through bridging two different logics to achieve fairness and better results (e.g. exclusive royalty-free commercial license). By doing this, the government could ensure the dynamic interplay between logics, which might generate shared and tacit understanding about the research project (Villani et al., 2017), which could establish the foundation for stimulating development of commercialised products following, for instance, both the market logic of profit-maximization and the academic logic of producing publishable research outcomes (Lind et al., 2013). Third, we need policy

initiatives that would remedy the institutional fragmentation between governmental organisations/bodies. Hence, a central role is assigned to the government. Instead of having different contracts, the government could suggest that the university and MoCI sign a single contract in order to tackle the issues of repetition/redundancy and incoherency of policies. As the overemphasis on professional interference is still a common practice, the government also needs to ensure the physical presence of borrowed/rented experts within Oman. This would assist in safeguarding direct and regular communication and IP guidance (i.e. inventions prototyping and patenting) to academics and users. Moreover, the government needs to ensure total alignment between the actions of the IIC and the IP rules of the MoCI regarding patenting as well as between the actions of non-commercial users (i.e. ROP and ) and the TRC's policy regarding knowledge exploitation. This again can be done through designing an intermediating mechanism that could develop stable, interactive relationships between the main actors, specifically, the governmental bodies. These suggestions should be supported by the development of a culture of partnership and collaboration and the removal of the rigid boundaries and bureaucracy between organisations. This calls for a comprehensive orientation program, and hence for the active role of the government to increase the interaction between actors with less restrictions, consequently encouraging the development of joint policies and actions.

Generally, the influence of the above three suggestions for the Omani context can be summarized into several outcomes. These are: stimulating a commercialisation mind-set and culture among the relevant actors and consequently among the entire Omani society; creating more jobs through producing innovative SMEs, which contribute to the national Omani economy, which also contributes towards solving the unemployment issues in Oman. Furthermore, knowledge commercialisation would enhance innovation and knowledge based activities, which could bridge the gap between the universities' outcomes and the industry sectors' requirements through bridging differences in logics, which will build strong collaboration activities, consequently

enhancing the knowledge- based industry in Oman. This optimizes the successful interaction that manages to balance between different logics and socio-economic demands.

### 7.4 Limitations of the Study

This research study is not without limitations. One limitation stems from the selection of a qualitative research strategy. The study was also carried out using a limited sample size, and the limited number of investigated projects and participants inhibits generalisation. However, given that the study is not intended to achieve a statistical generalisation, but rather analytical generalisation, such limited sample size is acceptable since theoretical saturation is attained (Yin, 1994). As this study is focused on the knowledge commercialisation process, an enormous amount of data relevant to understanding this process in each of the cases was gathered and analysed. The level of depth of analysis carried out in each case certainly compensate for the limited size of the sample.

Another limitation is that even though cases were selected through a rigorous purposive sampling process, there can be potential for some bias. The respondents could harbour some bias as they may rationalise a particular interaction with institutions or a sub-activity they conducted based on the favourable or unfavourable effect it had on them. This is despite the best efforts of this researcher to (i) sample only those projects that invovled investigating logics from multiple instituional perspectives (i.e. knowledge producer, knowledge user, and knowledge manager), (ii) sample projects that allowed the emergence of common patterns, consequently assisting in identifying important similiarities and differences, (iii) projects that initiated synchronization with the commencement of different innovation programs at the national level, (iv) use the triangulation of data sources through supplementary interviews as well as documents. These measures will, to a great extent, control for potential bias of the cases. Also, the researcher’s bias may influence the interpretation of the findings. This was however controlled by devising a coding framework which

emanated from the interview data and was then strictly applied. Since it was the codes that yielded the themes used in arriving at the findings, efforts were made to ensure that the researcher did not attempt to understand and interpret what respondents mean at the level of coding.

Finally, the breadth/scope of the study was de-limited in four major ways. First, the scope of the study was restricted to knowledge commercialisation in the context of the public university (i.e. SQU). As such, the why and how potential mechanisms influencing, for instance, private universities in bridging differences in logics has been excluded. This is on account of different paths followed by each type of university. Each individual university might witness different policy orientations towards KC. Second, while the major purpose of this study is to understand which and how, potential mechanisms bridge differences in logics, that describe the rules of the game within the micro-level interaction of publically contracted research projects affected UKC, the macro-level actions also typically driving this interaction remain outside the study's scope. Third, the scope of the study was also delimited to the UKC within the context of only three of the public government funding programs (i.e. IIAP, CIIAP and ORG). This limitation is in the view that TRC funds and supports a range of innovation programs, which might be governed by more diverse logics, rules, and norms. Fourth, the data sources used for this study impose a number of limitations. More specifically, the study centred on a specific geographical setting (i.e. the Capital-Muscat) with significant implications for our ability to draw generalisable findings: on account of the diverse paths followed by individual universities and industrial areas and their differential distribution across space.

### 7.5 Future Research Avenues/opportunities

The abovementioned limitations open up some empirical avenues and directions for future research. In addition, there are other several future research avenues that would be advisable from this study.

First, the study examined the influence of mechanisms on bridging differences in logics from an emerging institutional UKC context of Omani projects. This approach limited the countries examined to one single emerging market (Oman). As a result, there is an opportunity for future studies interested in UKC in emerging institutional environment to incorporate multiple countries (Bruton et al., 2010) in their analysis. This will no doubt benefit the field of KC research. For instance, an in-depth comparative study case between Oman and other Gulf Arab countries can be done in order to investigate UKC activities within their emerging institutional environment. Additionally, and with reference to the first limitation mentioned above, a future study can be conducted comparing two universities, one from the public sector and the other from the private sector, can be done according to the available records of KC. A pattern of matching can be maintained between these two cases by suggesting criteria of comparison such as dividing in terms of their size, location, governance structures, years of establishment, motive funding, etc. Second, as the results show, the development potential of UKC in the case of a country like Oman brought to the fore considerations of power and intermediation. Power and intermediation matter in the differential logics of actors occupying different positions (knowledge producer, knowledge user, and knowledge manager). More research in this empirical setting, therefore, opens new opportunities for development in UKC. Hence, research into these mechanisms, and their contextualisation in the specifics of Oman, is very important in informing policy action.

## 7.6 Final Conclusion

Appreciating that there is a need to improve the understanding of UKC in a country with an emerging institutional environment, this study conducted an in-depth case study of Omani contracted research projects. The research's aim was to investigate the implications of the potential mechanisms that can be used to bridge differences in institutional logics within University Knowledge

Commercialisation. This gave rise to the following research questions; (a) what is the effect of power in bridging differences in institutional logics? (b) What is the effect of mimetic isomorphism (i.e. transferring institutions from the West) in bridging differences in institutional logics? (c) What is the effect of intermediating and networking in bridging differences in institutional logics?

The main findings of this study depicted that bridging differences in logics within UKC was hindered by: asymmetric power relationships, mimetic isomorphism (M.I), and insufficient intermediating activities. First, power asymmetry associated with establishing projects' rules around appropriating one logic over another perpetuated the pre-existing conflicting logics. Accordingly, the logics of powerful actors contributed to preserving the status quo. Their logics come to be reflected as dominant as they had more control over decision-making. Second, the M.I presumption of logics convergence has overlooked both (a) the embeddedness of actors within different, often conflicting logics, consequently hindering the production of research outcomes that have potential for commercialisation; (b) institutional fragmentation within the context of the Omani governmental bodies as their mind-sets are still locked in old logics of bureaucracy, and deep-rooted concepts of rigid models of interactions, which led to fragmented actions. Third, the role of government as an intermediary, when the research was being conducted, provided insufficient activities with regards to bridging differences in logics. When the commercialisation action was taking place, competition and conflicts between logics regarding how to appropriate the knowledge generated emerged due to power asymmetry. Furthermore, despite the fact that the emerged informal networks assisted in bridging differences of logics, this happened only when the research was conducted. Finally, the study has far in filling the critical knowledge gaps and providing empirical and theoretical contributions to UKC literature as well as the institutional logics perspective. The study has offered managerial and policy-making implications that enhance the study of UKC in countries with emerging institutional environment and has offered further research directions to advance this field of scholarly research.

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## Appendices

### Appendix-1 – Within Case-Analysis

**Introduction:**

This appendix presents case studies concerning university knowledge commercialisation in Oman. It further explores the institutions governing the relationships between the involved actors within the case, and the actions taken by actors involved in the Knowledge Commercialisation in relation to the influence of the institutions explained. Interview narratives of case participants, institutional actors and consultants were critically analysed. Further evidence was also gathered from documents. There are four cases contained in this within case analysis. Each case has been anonymised and code named as Cases A, B, C and D respectively. The within-case culminates in a detailed and comprehensive account of each case study.

**1. Case Study-A:** Low fat Halwa Project

**1.1 Background of the project:**

The project was linked with research initiated by academics and an overseas PhD student from the Department of Food and Nutrition Science, in CAMS College of Agriculture and Marine Sciences, in 2008. The collaboration with the factory was initiated by academics after the research outcome (new recipe) was scientifically generated by them. It was funded by the Commercial User Public Fund of the Industrial Innovation Assistance Program (IIAP).

The research was on the subject of ‘characterizing low fat Omani halwa’. Though halwa is famous at home and abroad as a symbol of traditional Omani hospitality, it may be categorized as an unhealthy food, on account of its fat and sugar content. This encouraged academics to develop a healthier variety of Omani halwa. This could be developed with reduced input of fat and sugar and the addition of other functional compounds beneficial to health.

The research was preceded by two stages of engagement with users and manufacturers. In the first stage they used structured surveys to study consumer preferences, while in the second stage they visited some factories to classify the different types of halwa available in the market by studying the physiochemical sensory and textural characteristics. The outcomes of these two aspects were published by the university in internal and ranking journals in 2011.

### 1.2 Governance Structure:

This section explains the formal governance structures of the institutions that govern the relationships between the actors involved within the case. Initially, the relationships between actors were governed by the rules of the Commercial User Public Fund of IIAP, which are found to be incompatible with the university's rules and regulations.

#### 1.2.1 University Rules:

The academics and commercial users signed the 'research contract agreement form' through a consultancy and contracted the research under the Research Department (SQU, 2015). As the university considers the projects coming from IIC as consultancy services, the research is driven by the industry (commercial users) requesting the academics' advice and seeking solutions for their problems from the university, and ultimately paying them for the services.

The form states clearly the responsibilities of both parties. The academics are responsible for knowledge production as per the user requirements, while the user is responsible for funding knowledge generation. The form also mentions that all rights and titles to Intellectual Property (IP) arising from a project shall vest i.e. come into the possession/ownership of the University. Such IP will include copyright of the reports, documents and computer software prepared by the University under the project, as well as any new development of products or processes and any improvements to publicly known products or processes. The

Sponsor shall have a non-exclusive and non-assignable license to use such intellectual property.

According to the disclosure rule, the university requires academics to disclose the intellectual properties through the element of compulsion. Also, if the academic research (basic or applied) outcome contains IP which is considered by the university to be of substantial commercial value (from licensing royalties), no invention disclosure for a third party should be taken before assessing the option of seeking IP protection through the university's Innovation Affairs Department *(SQU, 2014).*

Rules governing the actions of the university's innovation affairs department aim to maximize patent generation. 'Building patent profile' is stipulated as one of the department's main responsibilities in coordinating the IP protection through patent registration and maintaining up-to-date databases for all university generated patents *(ibid).* Additionally, to ensure the ability of the department to generate patents, they state it clearly as one of the Principle Investigator's (PI) responsibilities within the university research rules and regulations. The PI's responsibility is to 'ensure the report of any intellectual property arising from research projects to the Deanship of research and particularly to the Department of Innovation Affairs' to assess its patentability *(ibid).*

### 1.2.2 Industrial Innovation Center Rules:

The academics and the factory signed a proposal research contract (IIC-1, 2010), which is based on a consultancy model. According to this model, the idea (or the problem to be solved) must be initiated by a Subject Matter Expert (SME) first. These ideas are pursued further with the help of the consultants and client managers, who are responsible for visiting the industry first in order to come up with ideas, through brainstorming, and then to communicate with the researchers through the Technology Transfer Agent in their university. According to one of the IIC consultants

*“The idea should be started by the enterprises and not by academics. We (consultants and client manager) visit them to find ideas with them, and what we come up with is a research idea. We forward the idea to the TTA responsible for nominating researchers, so the researcher than contact me (consultant). I review them to make sure we have the right person for the job.” (PFO2, IIC)*

In this model, the fund is considered as if it were issued by enterprises and the academics should be considered as subcontractors. Therefore, the academics are responsible for knowledge and its production, testing, and application with the help of the factory as well through the usage of the university’s chemical labs and technicians. They are considered as research experts (consultants) who help enterprises in generating outcomes that can be transformed into tangible products. While the enterprises are considered as the main funder and are responsible for supporting the academics in transforming/bringing the scientific outcomes (recipe, in this case) into a tangible product through the provision of the required resources, such as HR, tools, ingredients, and space to achieve the product’s commercial viability.

Additionally, within the section-10 of the form-2, the two parties have to decide about the ownership of any expected invention. A mutual agreement has to be reached with regards to how the outcome from the project is going to be protected. In this case, the IIC (IIAP) rules encourage enterprises to retain all rights to the IP for any technology/knowledge developed by the supported project, and to be responsible for protecting any IP through patents, copyrights, industrial designs, trademarks, plant breeders’ rights, trade secrets, or any other available means *(IIC-2, 2010)*. To do so, the center assists the enterprises in getting IP by filling a patent application through the Ministry of Commerce and Industry IP office, where the enterprises have to pay a registration fee of 200 OMR.

Moreover, the relationships between actors were governed by the IIC developed financial incentives. In this regard, the IIC encourages enterprises to collaborate in R&D with academics in terms of incentivization. The enterprise involved in the

project can concurrently make its own R&D contribution/investment by paying only 25% of the knowledge production cost with 75% coming from IIC (through IIAP). Additionally, this contribution can be either in cash or in-kind through providing the raw materials and resources (i.e. HR) required by academics for production. As stated by the IIC Client Manager:

*"We made some changes in form-6. I mean some terms and conditions. Before the percentage that the factory supposed to contribute in the project was 50%, we increased our contribution to be 75% so the factory will pay only 25% and this 25% is not a condition to be in cash, it can be in-kind anything that is non-financial that provided by the company related to the project and this counted according to its value." (PFO4, IIC)*

### 1.2.3 Patent Rules (PR):

Besides, the relationships among actors were governed by the underlying contradiction between the IIC developed and the university's underdeveloped incentive of patenting for academics' IP disclosure. The IIC encourage academics to disclose their IP to enterprises in terms of incentivization. In this regard, and while the enterprises have the right to own, use, manufacture, apply, and commercialise the knowledge generated; the academics and their university still hold the right as the expected patent developers. From the IIC's perspective, this helps in raising the academics' profile as industrial R&D specialists, which consequently will be in the interest of their academic promotion. It also helps in enhancing the university's contribution in developing industrial patents for the benefit of the country's economy. According to one of the IIC consultants:

*"What I say to the researchers is the patent is registered to the enterprise but the researchers and the institute are named as the patent developers. Now that way the researchers are happy, because when they try to climb the ladder in the universities and they are going to their professorship they have to prove and justify why they want a professorship and if they can say that they have*

*developed a patent and that's will help them to get promotion and the university can say it contribute to the development of the patent development of industry which is good for improving country's economy." (PFO2, IIC)*

On the other hand, the university encourages academics to disclose their IP through the element of compulsion. This is as per the universities' underdeveloped financial incentive of patenting. The development of IP is still not included in the criteria of academic promotion. A proposal is drafted by the Innovation Affairs Department to the university's higher level, but is not yet approved. The only criterion for academic promotion is publication in internal and internationally high ranked or referred journals. Recently, the development of IP has been incentivized through management recognition only as a way to encourage academics to disclose their research outcomes with potential patents. The academics' efforts are recognized by means of non-financial incentives such as rewarding a certificate of appreciation. As argued by the University's Innovation Director:

"*The university is encouraging now because there are innovations, industrial collaborations, patenting and IP… but the incentive for patented innovation is still not there and we are looking at it in promotion. We proposed this to the higher level but it is not approved yet. But we do recognize this through awarding them a certificate as an appreciation for their efforts.*" *(UO2, SQU)*

### 1.3 Knowledge Production:

This section focuses on the actions/activities taken by the involved actors in the process of knowledge production. These actions include: (1) collaboration establishment and the actors' reasons/motives for being involved in such collaborations; (2) The formal and informal institutions enabling/supporting the process of collaboration.

#### *1.3.1. Academic Initiated Collaborations:*

The outcomes of the early engagement with users, described in the background section, helped the academics in identifying the ingredients that help to improve the health aspect and quality of the original recipe of halwa. The next action involved developing and formulating low fat halwa by substituting fat-mimicking natural ingredients that resulted from the earlier engagement. Practically, this involved a trial in one of the factories alongside the use of the university's labs. Thus, collaborating with an enterprise was necessary in a curiosity driven process of taking the research outcome to application. This motivation was in line with their Department and College objective of serving the community through finding solutions to issues through research with the goal of improving the health quality of life. According to the Principle Investigator:

*"Halwa may be categorized as an unhealthy food we as food scientists need to make it healthy for people. the collaboration with halwa factory helped us to learn from them in the real world how they are doing it and also transforming science knowledge through their products..." (Ac1, SQU)*

This alignment of Departmental and College Objectives with the motivation of academics was important in establishing the collaboration. In response, the academics started to communicate directly and informally with the factories they networked with in the early engagement of their research. After less than one month, they identified one of the most popular halwa factories in Oman. The GM of the factory was cooperative as the factory did not incur any financial cost except providing academics with the required information and materials to apply their science in the development of a product. As argued by the Principle Investigator:

*"We contacted many factories that we communicated with in the second phase of our research. We could get a response from one famous factory. Actually the GM was motivated since he didn't need to pay any penny. All what we needed were to provide us with resources. So he liked the idea and he allowed us to use all his piloted plans and facilities and we are taking all the ingredients and other things." (Ac1, SQU)*

In addition to the reason of non-financial liability, the factory's decision of participating in such project (or in producing the new recipe) was influenced by two other factors, which emerged from its individual motives and benefits.

The first factor is related to the nature of the research outcomes generated by the academics. The GM of the factory considered the outcomes as having significant commercial potential. There is a similarity between the nature of the outcomes (generated recipe) and the nature of the products that were produces, sold, and marketed. Additionally, there is potential profit as the generated formulation of the recipe can produce the same profit with less production cost and expenses since the materials (the natural low fat-mimicking ingredients) to be used cost less that the traditional/original one. According to the factory's GM:

"*We are producing similar product. So there was no loss as I said we just gave the resources which we are already using and available, in addition of using low fat materials which were less in cost." (CU1, SMEs)*

The recipe was also expected to provide a similar taste to the original high fat halwa. Furthermore, a potential profit will be gained as there is an expectation of achieving local market demand successfully. This results from the academics' and the factory's previous action of ensuring market feasibility through studying consumer preferences during the process of generating the recipe. As argued by the University's Principle Investigator:

*"The natural fat-mimic ingredients are expected to provide similar mouth feel as high fat halwa… You know he can make more profit from this with less cost. Also demand will be there because when we (academics and factory) studied the consumer preferences in the second stage we found people having positive response. They liked it same as the original one" (Ac1, SQU)*

The second factor is related to the short time expected to produce the product tangibly and launch it in the market since the recipe was already generated and required to be developed by academics. This is related to the factory's attribute of preferring short-term, focused projects that yield quick return. In this respect,

the factory found it time efficient as they were able to avoid going through the long process of academic R&D. This is with reference to its unwillingness to participate in R&D. Evidence of this argument is the statement by the Co-investigator:

*"What motivated the factory, I would say there is a short-term view such as having a problem and it needs to be solved next week very soon. That was the Halwa project for instance it was a very good idea, very focused one and took little time to apply. You know they don't want to waste their time in research…the research was done by us before we approached them." (Ac2, SQU)*

The academics' decision to collaborate with the factory coincided with the birth of the IIC. The IIC provided them with an opportunity to access public funds, securing additional income for themselves and their Department/College. Within the rules of the funding program, academics were treated as subcontractors to the factory in return for a consultancy fee. According to the university rules, a high percentage (60%) of the fee was allocated to the academics while the remaining 40% was retained by: the University (20%), the College (10%) and the Department (10%). Thus, while academic curiosity was important in driving the early engagement of the collaboration, financial rewards, as well as contribution to the organisation, were important in motivating the academics to engage with the IIC funding scheme:

*"One aspect that motivates me to collaborate in IIC project is purely financial and when you have a contract with them you can claim some of your time as money, you can have them pay for your time…so for us it is beneficial to get such collaboration to gain money for us and our university" (AC2, SQU)*

In accessing the IIC funding, academics were confronted with resistance from the IIC, whose rules necessitated that the problem to be solved (by academics) must be initiated by the user (SMEs). In response, the SME suggested discussing the matter with the center's client manager, who was convinced of

the factory's willingness to adopt their research outcomes when they were reached. As argued by the IIC's Client Manager:

*"Yes our direction is from industry to academia and that's what makes us different. We work in favour of the industry... But there are some cases approached directly from academia such as the halwa project. We accepted these and took them further and discuss with the concerned factory. We didn't face any difficulty because we found the factory was willing to participate." (PFO4, IIC)*

The Client Manager's ability to change the direction in an indirect way is linked to the nature of the IIAP as an experimental trial with a five-year experiment, because the IIC needs to learn how to achieve their main goal of encouraging local SMEs to participate in R&D and adopt research from academics to embed the importance of knowledge innovation within their businesses. This can be done by depicting the benefits and beauty of R&D to their businesses. According to him:

*"It doesn't matter the direction of the research; the most important thing is that we could convince enterprises to do R&D and implant the knowledge of innovation within the industrial sector here. We want just to show them the way, we won't be always there for them to fund. They need to try and see the beauty of it and see the benefit. We are just an experimental program provided by TRC. It is temporarily program." (PFO4, IIC)*

The change of direction in the research is also supported by the action taken by the center's CEO in shifting the center's policy towards assisting academics in their applied research whenever there is an opportunity of making the most out of good ideas or outcomes initiated by academia for the benefit of local SMEs. This shift is related to his need for making changes each time they are gaining benefits for their clients (SMEs) in order to achieve their goal of injecting innovation into them. Evidence to support this argument is seen in a statement made by the Center's Chief Executive Officer himself:

*"I built a policy where we should be as much aid to anybody…originally we used to turn down researchers when they bring their projects; I told them 'no go away'; then we gave them the chance, to see what type of ideas they have; to see what they can do for the factories, unless we get benefit from them, so our policy, whenever we get benefit and achieve our goals, we need to make changes" (PFO1, IIC)*

The factory's decision in collaborating with IIC was influenced by the in-kind contribution incentive developed by IIC and particularly the non-financial cost of involvement. This is affected by the developed funding incentives, done by IIC (the fund operator), where the factory contributed only 25% of the production cost with 75% coming from IIC. In addition, IIC gave the factory a chance to cover the remaining 25% through contributing in-kind instead of in-cash, where they could contribute in the form of providing the required materials and resources for academics. Therefore, the factory wanted to utilise the opportunity of getting consultancy services with less cost. As argued by the factory's General Manager:

*"It was funded by the innovation Centre and they had to pay certain fees to the university and we only gave the materials and time as an investment. So this is also how they are funding the project…. we are getting service and the IIC gave money to the university not us. For us it was in-kind investment by time and providing the materials, tools, space and so on." (CU1, SMEs)*

**In summary,** this sections shows that the successful collaboration was assisted by the motives of the involved independent actors (academics, factory, IIC), which resulted in transforming the research outcomes into commercially tangible product. As these motives differ (as per actors' cultural and institutional diversity), both actors are positioned to benefit, though this benefit was found to be different for each party because of the IIAP funding, particularly the institutional financial incentives developed within the fund. In this regard, the academics perceived the opportunity of generating revenue for themselves and their organisation by securing additional income through consultancy. Likewise,

the user perceived the opportunity of getting consultancy services without incurring/experiencing any financial cost (e.g. IIC in-kind contribution incentive). For the IIC (as a fund operator), collaboration was encouraged as it constitutes the core justification for the existence of their organisation.

The analysis also identifies the positive effect of informal networking that contributed to the decision of the user to engage in collaborative activities with academics during the conduct of research. For him collaboration appears to involve relatively little cost, aside from the time and usage of existing resources involved in helping academics in developing the recipe. Whilst this was viewed as being considerably beneficial because of the attributes of the knowledge to be produced: The congruence of the generated outcome with his business production line, and the parallelism between the short time expected for knowledge production and his goal of quick financial return, etc.

In this section, it is worth mentioning the positive effect of the IIC relaxed management process in supporting actors' interactions in developing an informal collaboration arrangement characterized by greater flexibility. This was influenced by the institutional nature of IIC as an intermediary in facilitating the collaboration by permitting its officers to reduce bureaucracy in the process (e.g. made changes in research direction). This consequently reduced the costs of searching for a formal partner.

### 1.4 Knowledge Appropriation:

This section focuses on the actions/activities taken by the involved actors in the process of knowledge appropriation. These actions were enabled and constrained by the formal institutions related to transferring knowledge through IPR.

#### 1.4.1 IP Disclosure: The Academic Choice of disclosing their expected IP to the factory and the university's inability to appropriate the research outcomes:

The relaxation of the IIC rules by the IIC Client manager allowed the factory to submit an application as if it were the one who initiated the project. In parallel, the academics submitted their completed proposal through their College IIC Technology Transfer Agent (TTA). This meant that the relationship between academics and the factory was governed by two formal contractual agreements. From the university's side, they signed the research contract agreement form under the consultancy section of the Research Department, while from the IIC side they signed the proposal research contract.

In case of a potential invention, and in accordance with the IPR rules of the research proposal contract, a mutual agreement by both the academics and the factory, regarding how the outcome from the project is going to be patented, was ensured by the consultant. This was done for the purpose of preventing any future conflict regarding patenting as the involved parties will become committed to fulfilling the formal agreement. As argued by one of the IIC's Consultants:

*"It is my role to ensure that an agreement is reached jointly between the participated enterprise and the academics. You know research proposal is a commitment and everybody have to cooperate and if we don't agree in patent there will be no project and will not be any continuation for that conversation. See I am quite straight forward about that because otherwise there will be definitely conflicts in the future." (PFO2, IIC)*

After negotiation, the academics decided to disclose the expected IP to the factory. Consequently, a conflict had resulted between the university's innovation director and the academics. Although they were familiar with the university's IP disclosure rules, the academics, especially the PI, did not discuss and report the expected IP (or potential patented outcomes) to the Innovation Director before disclosing it to the factory through the IIC. This action was found to be inconsistent with the university's IP disclosure rules, which was stated as one of the principle investigator's main responsibilities (as mentioned above). This hindered the university's appropriation through protecting it as a patent. According to the University's Innovation Director:

*"It is important to not disclose the invention to a third party in order to protect it…. Our department should be in the picture in negotiating with researchers about IP. What is happening is that they are not negotiating and contacting directly. It shouldn't come from IIC and it should come from the researchers. They have to appreciate that there is a value in their negotiation with the factory, but they are not coming to us" (UO2, SQU)*

The academic decision of disclosing their expected IP to the factory was influenced by many reasons. These reasons emerged from the existent rules (incentives) and regulations followed by the IIC and the absent/underdeveloped IP rules (incentives) of the university.

From the academics' perspective, the main reason for their action is related mostly to the underlying contradiction between the IIC developed (existent/present) and the university's underdeveloped (nonexistent/absent) incentive of patenting for academics' IP disclosure, as mentioned in the governance structure. In this respect, the academics found it more beneficial to disclose the IP to the factory than to their university's Innovation Affairs Department. From the IIC side, they wanted to use/benefit from the patenting incentive provided by the IIC. As mentioned above, even if the IP was disclosed to the factory, the academics and their university would still be considered the patent developers. This was in addition to the other two aforementioned benefits/reasons i.e. getting salaries/consultancy fees and developing their outcomes into a product. This incentive was found to be consistent with the Principle Investigator's motive of 'individual academic development' through getting the credit for IP development, which has more weight than publications. Therefore, the incentive gave the involved academics the motive to become more persistent in developing their generated research outcomes and making them novel in order to patent them. According to one of the academics:

*"Patenting is important for the researchers to get the credit that they have innovative ideas…Patent is different way of innovation than publication. It gives*

*more weight for us within not only our career but also within the industry." (Ac1, SQU)*

On the other hand, they found it costly to disclose their IP to their university as there was a lack of tangible return, especially a lack of 'patenting incentive'. Patenting is absent from the criteria of academic promotion, which is due to the university's underdeveloped IP incentive. As per the university system, the promotion is based only on the number of publications. Therefore, the academics found it more beneficial to disclose the IP to the factory, as it allowed them to become the patent developer, in addition to the other stated benefits/reasons. Thus, the benefits of disclosing it to the factory maximized the cost of not disclosing it to the university. According to the Co-Investigator:

*"Here (in SQU) for us the promotion is based on only publications, publications, publications whether we have patents or not it doesn't really matter or whether we have a two million contracts with a company it doesn't count at all; But if we have five papers out of that contract that carries more weight in promotion." (Ac2, SQU)*

Moreover, there were two other reasons which influenced the academics' decision. These emerged from the IIC developed IP rules. The first reason was that the academics were worried as there was a possibility of rejecting their application, which consequently hinders them from achieving their goal of transforming their outcomes into a tangible product, which was the essence of this collaboration. This is related to the enforcement action taken by the IIC consultant, as per the IIC rules where the consultant is responsible for guaranteeing that the ownership of any expected IP must be disclosed to IIC in order for it to be owned by the participated factory. This is related to the nature of the IIC model as consultancy based, where the fund is considered as if it were issued from factory. Subsequently, the ownership of the research outcomes, even if an invention was discovered, is excluded for the factory. It is also related to achieving fairness to the participating factory, which contributed towards the cost of the knowledge production. The other reason is that the IIC

found that the factory was driven in participating in their system by means of IP so as to be able to get the exclusive right of manufacturing, using, and commercialising the generated product in the future. *According to one of the IIC consultants:*

*"if the industry (user) contributes towards the cost of the project, product development and the remaining of the cost come from the innovation center and researchers are acting as subcontractors to do the research, then it is in my opinion, the patent should belong to the factory… let us face it, if they are not driven towards IP then they will not see the need to go through the system from the beginning. So they have the right to be able to produce and market the product." (PFO3, IIC)*

The second reason, and in addition to their aforementioned motives of securing an additional income, was that the academics found the disclosure of their expected IP to the factory to yield better benefits. Although they are against the formal publication of the research outcome, the IIC and factory were found to be receptive with regards to public disclosure. They allowed the academics to disclose the general aspect of their research outcomes to the public through the media (national and international newspapers). This is consistent with the academics' motive of awareness creation and their purpose of educating people about their healthy product. This is in relation to their background as Nutrition Scientists (role of discipline in improving the health and quality of the community life). This can be evidenced in the following statement given by the Principle Investigator:

*"We can publish (disclose) it to public. They (IIC and factory) don't have any problem in publishing (disclosing) the Omani Halwa and it comes in the media. We could publish in many newspapers…. we are in nutrition because we want people to be aware. The awareness for us is essential and so we want people to be aware." (Ac1, SQU)*

**In summary,** the underlying conflict between the IIC developed and the university's underdeveloped patenting incentive for academics resulted in the university's failure in appropriating the knowledge generated by its academics, consequently, hindering it from achieving its goal of building a patenting profile. For academics, the fund IP disclosure incentives appeared to involve considerable benefits (e.g. securing additional income for conducting further research, public disclosure receptiveness, and gaining credit for being the patent developer); while the absence of IP development as an incentive in their academic promotion appeared to involve the potential of losing the opportunity of gaining those benefits.

This finding resonates an important issue. The academics' decision of disclosure was strongly affected by the perceived personal remunerations from the complementary benefits embedded within IIAP incentives. Hence, a conflict emerged between academics' logics and their professional obligation of disclosure to the university. This makes one reasonably question whether the academics' decision of disclosure was affected by their logics. Yet, it is a loss to the university to remunerate a private party for a research result that has utilised university resources (e.g. labs). Hence, there is a need to rectify this issue by changing the system through introducing alternative IP incentives arrangements, where the university can employ the system to deal with the transfer of IP of its faculty members.

This section has also demonstrated the role of IIC as an intermediary. The consultant ensured a mutual agreement regarding how the outcome from the project is to be patented. Bargaining costs were also reduced as both the academics and the factory reached a mutual agreement due to IIAP provided incentives.

### 1.4.2 Academics' and the factory's failure to patent the generated knowledge (inventive recipe):

After the two parties agreed about the IP and their responsibilities, the consultant submitted the signed proposal contract to the IIC board of directors for approval. The fund was granted successfully and the academics got a payment of 7,424 OMR as a ‘consultancy fee’. The payment was given in installments after achieving each decided stage of the project.

The project made significant progress in the form of prototype completion and market viability testing. The academics and the user worked collectively to make sure that the generated recipe was close to being patentable and commercially exploitable by the factory in the market. To ensure the safeguarding of the ownership right for the factory, the IIC consultant selected the project as one of the best showcases at the IIC INFOM exhibition in 2011. During the exhibition, the generated knowledge (new recipe) was disclosed to the public, but at the same time was registered with the local IP Office at the Ministry of Commerce and Industry. The IP application was filled by the concerned academics according to their formal agreement in disclosing the IP to the factory.

However, the patent application was rejected by the Ministry of Commerce and Industry (MoCI), particularly by its IP Director. The main reason for this rejection was that the generated new recipe was found to be inconsistent with the ministerial decree number 2004/104 which was developed by the ministry for the concern of protecting the local standards/criteria of making Omani halwa. The special specifications issued for Omani Halwa were derived from special Omani descriptive measurements. This is because Halwa is considered as an Omani traditional local product that was stipulated to Oman. The reason for protecting the original recipe is also emphasized by the House of the Omani Heritage: different halwa producers would prepare the product with different results (taste) and this would keep each family’s recipe secret so that it can pass from generation to generation. Thus, there is no relation of the international IP rules/principles (such as IPRs) as there is a need for it protected because it reflects the identity of the Omani local industry. Evidence to support this argument is seen in a statement made by the MoCI IP Director himself:

*“Ministerial decisions are organisational matters and there is no IP right for any party. And the decision is about the way of making halwa. This is because halwa is an Omani traditional product which specifically represents Oman, so there is no need for international rules to be applied here.” (Government Officer, MoCI)*

The decree was intended for considering the Omani measured criterion number 2004/1635 concerning the specifications of the Omani Halwa for protecting this industry from any intervening additions in order to increase its quality. In this regard, certain criteria (ingredients or components) are to be compulsorily applied by all local halwa-making factories. Each factory is responsible for ensuring that the production of halwa complies with these defined criteria in order for them to bear the name of ‘Omani halwa’; otherwise they will be subject to legal liability. *As argued by the MoCI IP Director:*

*“The factories have to follow the standard measurements. They can change the cooking tools and equipment, but should not change the protected recipe such as using new ingredients or components/elements. For example, using vegetable oil than natural ghee and others; otherwise they will be subject to legal liability. For the halwa to be called as an Omani halwa it has to be under the decided measured standards.” (GO, MoCI)*

Thus, as the academics and the factory replaced the defined ingredients into fat-mimicking ones, which altered the defined specifications, the main issue of rejection was in producing the same name as an Omani Halwa. Consequently, the director asked the factory and the academics to not patent it elsewhere or publish unless they changed the name of the product. As stated by the Principle Investigator:

*“The issue is in producing the same name of the product, producing it as an Omani halwa is the issue; we should give a different name such as sweet halwa or totally different name. Because they said the new recipe changed the original one which is against the rule.” (Ac1, SQU)*

The academics didn't expect that the application would be rejected. They were bound to fulfill the agreement (IIC Research Contract Proposal) signed with the factory, and were not aware of the rules (ministerial decree) at the national level. These rules were found to be unexposed to the public electronically, and only known within the ministry by the officers and the concerned users (such as Halwa Factories), who are entrusted with the original formula in order to obtain an economical advantage. Thus, protection must be sought from the MoCI, where a factory is not allowed to change the recipe and own it by itself.

The factory's action of not informing the academics about the rule of the original recipe as a trade secret was taken naively. The factory's GM lacks patent knowledge and knowledge about the complicated process of patenting, as he did not have any past experience in patenting. This was the first experiment, which yet again was initiated by IIC as a way to encourage the GM to become involved in the system as a way of protecting his factory's ownership rights. Therefore, the GM was unable to realise the importance and benefits of patenting and took this matter for granted as he was driven mainly by his motive of commercialising the generated knowledge after transforming it into a real commercial product. As argued by the University's Innovation Director:

*"They are not aware of patenting. They don't know how to process it and don't know how the process is complicated…and it is normal that they will take things for granted. They are in commercialising rather than patenting." (UO2, SQU)*

The lack of patent knowledge can be related to the gaps within the IIAP process. The IIC is not responsible for creating awareness about patenting among enterprises. As per the IIC IP rules, the protection of IP through patenting is the responsibility of the factory. The IIC consultant is only assisting him in getting IP by asking academics file a patent application through the MoCI IP Office, as they have better knowledge about the patenting process. They were the ones who produced the knowledge scientifically and have the full description of the generated knowledge. *According to the IIC's CEO:*

"*We are noticing that local industries are not that much relying on patenting, that is why we encourage them to patent. Of course we are there to guide them but it is their responsibility to file an application with the help of academics through the ministry of commerce and industry." (PFO1, IIC)*

In summary, there is a misalignment between TRC and MoCI. The collision of two IP elements (Omani Halwa Trade-Secret versus Patenting) resulted in the user's failure in appropriating the knowledge generated (e.g. inability to use the name). Hence, such collision caused a loss to the user. Similarly, better results were not attained for the IIC, as they didn't retain the value of their fund investment nor did they succeed in ensuring SMEs competitiveness. Thus, the negligence of such opportunity by IIC and MoCI, as well as misalignment merit exploring. This can be explored through the lens of institutional fragmentation.

Yet, there was a commercial assessment of what is a very different commercial opportunity, because of the inability to use the name. For him, changing the knowledge name involved the potential commercial cost of local demand risk, consequently impeding him from achieving profit maximization, which was one of the important motives for his collaboration with academics. Thus, the negligence of such opportunity by the user also merits exploration.

### *1.4.3 The factory's refusal to change the name of the generated recipe to patent it:*

As the main reason for the MoCI rejection was the name of the product, a chance was given to the academics and factory by the ministry's IP director to change the name of the generated recipe to a totally different one in order to patent it. However, since they disclosed the IP to the factory, the academics did not have the authority to make any changes unless they got the permission from the factory. Therefore, the decision was left to the factory, which was reluctant to change the name. According to the Principle Investigator:

*"The ministry people asked us to change the name to go for patenting... We had the intention that we will work with the factory and the factory will be producing*

*and give different aspect (different name), but we didn't receive any response from the factory." (Ac2, SQU)*

The factory's GM, considering that the generated recipe yields good benefits for the factory, was concerned about commercialising the product. He was persistent in convincing the MoCI to allow him to at least produce and market the generated product with the same name and without filing a new patenting application. However, the ministry refused and commercialisation was discouraged by the higher authority, especially the Royal Court. The MoCI instructed the GM to not produce or market the product unless he changed the name to be in compliance with the national rule. As argued by the Co-Investigator:

*"As far as I know the GM discussed many times with the ministry to permit him to commercialise it in the same name and without going through patenting. But the ministry refused and the GM was disappointed. You know because changing the name breached the national rule of halwa. It is a trade secret. So he had to make changes." (Ac2, SQU)*

The reason for the GM's determination towards commercialisation was because he found it costly to change the name to a totally different one, on top of bearing the expense of patenting registration fees. From his perspective, changing the name will not add any financial value to its business, which is entirely about the production of halwa under the traditional name of the 'Omani Halwa' that is well-known/recognized by consumers in the local market. So, there is the risk of the local market's lack of demand for a newly named product. This was also influenced by the factory's attribute of 'resistance to change' and resistance in taking a new path where success was not guaranteed. It resisted changing something that has worked for many years and has consistently yielded reasonable profit. The factory's aim was to commercialise the generated product to gain profit, and this was their reason for collaborating with academics, and ultimately their reason for not allowing the academics to file another patenting application with a different name. As argued by the Principle Investigator:

*"They were happy with the status quo. They resist change. And why they should change something if it uses to work for the last 100 years. They would need significant increase in profit or potential benefits to suddenly change the question of patenting and this cannot happen… They would say why we bother ourselves to go through patenting process. So what is the benefit of patenting to them? Nothing! I mean they got profit so why should they spend money in patenting and changing the name. There is no commercial return from their point." (Ac1, SQU)*

**In summary,** conflicting logics between academics (individual career development through patenting) and the user (maximizing profit through commercial exploitation) resulted in the academics' failure to appropriate the opportunity given by MoCI. For them, the user's refusal (e.g. resistance to change) inhibited them from reaching the benefits perceived from IP disclosure (e.g. enhancing their academic prestige through 'Patent developer' fund incentives). The user's negligence of the available opportunity of patenting, merit exploration as this was a new product that could have helped the user gain a better competitive advantage over the local market competitors by introducing a new innovative production line with less cost.

### *1.4.4 The factory' refusal to allow the academics to patent the generated recipe through their university:*

Because of the factory's reluctance to change the name, the academics (and particularly the principle investigator) decided to make use of the situation. He decided to take another direction for their research, which would enable them to change the name of the generated knowledge. He was persistent in enforcing and achieving his motive of patenting. Therefore, he decided to get support from the Innovation Affairs Department at his university. This is in line with the department's responsibility in coordinating the IP protection process (with the help of the US law company) through the fund provided by the university for the purpose of protecting and registering patentable research outcomes. However, the academics couldn't go through with the process as the factory (which had

the ultimate authority as the owner of the generated recipe) was reluctant to give the academics the chance to change the name and patent it through their university. The factory's refusal was for two stated reasons.

The first reason is that it will be costly if the university patents the generated knowledge because there is a possibility that the university, after patenting it, would sell it at a high price. It will not be able to commercially manufacture, use, or sell the generated product without getting a license from the university. Thus, it prefers to do things at a lower cost rather than bearing the expense of licensing. As argued by the University's Innovation Director:

*"We are facing problem with patenting as they want things with less cost than going for high expenses, so patent will raise a price. They don't go for the university to patent the invention, because they know that it will be in a high price." (UO2, SQU)*

The second reason is that there is potential risk as the university will probably sell or license the protected patent to its competitors in the local market. It is one of about 10,000 factories in Oman producing halwa commercially. Therefore, they found it costly for the recipe to be taken by their competitors, especially since they already contributed towards the cost of knowledge generation. *Evidence of this argument is the statement given by one of the IIC Consultants:*

*"They (university) may sell it to competitors. So there is a potential risk … they are contributing to the cost, don't want the competitors take their ideas, so it makes sense that the industry to be the patent holder." (PFO3, IIC).*

**In summary,** the conflict between the university and the user about IPR and royalty payments from the patent created a barrier for successful knowledge appropriation. For the user, the university's prevailed patent-licensing arrangements involved considerable costs: The 'non-exclusive license', and the risk of licensing the outcome to existing local competitors, the high royalty payment and inability to bear the cost due to financial incapability; while for the university it appeared to involve the significant benefit of gaining additional

revenue (e.g. patent licensing income). Yet, and by the rigorous enforcement of such arrangement, the university neglected the opportunity of patenting, and thus lost the chance of gaining better results (e.g. building patent profile and increasing the scientific productivity of their academics by reaffirming the novelty and usefulness of their research outcomes).

**2. Case (B):** Radar Device Project

**2.1 Background of the project:**

The project was linked with research initiated by two academics from the College of Economic and Political Science, Department of Information Systems in 2011. The collaboration with the non-commercial and commercial users was initiated by academics after the research outcome (radar device) was generated scientifically by them. It was funded by a public fund of CIIAP-Community and an Individual Assistant Program under the TRC's Innovation-Hub[23].

The idea for the project began in 2009, the same year which His Majesty Sultan Qaboos gave a Royal Speech on the issue of road accidents, where he emphasized the need for the community (all sectors of society) to unite and collaborate in finding solutions to reduce and prevent accidents which result in deaths or permanent disabilities. Since then, the academics began developing new ways to prevent and reduce road accidents in the Sultanate. They studied the issue of the high rate of accidents. After months of research, they decided to come up with a new device to be installed inside cars to monitor the speed level. *According to the Principle Investigator:*

[23]The CIIAP program is run independently by the Innovation Hub. Funded and facilitated by TRC, the program encourages a culture of innovation and entrepreneurship in Oman. It was set up in 2013 in response to Royal Decree 54/2005, which requires TRC to address issues relating to supporting individual innovations within local communities, such as universities (TRC, 2014).

*“As researchers have skills in this area and after all hearing HM speech when he instructing all people in Oman to come up with a solution to stop the rate of accidents in Oman, we decided like to work in such a project. The main goal is to come up with a new radar system to encourage car drivers to reduce their speed.’’ (Ac3, SQU)*

The research was preceded by studying the different existing devices, both nationally and internationally. The academics distinguished their idea by enhancing and refining the existed ones by adding better characteristics. Thus, the scientific design of the device was proposed by integrating different existing technological components in an innovative way, evidenced by the following statement given by the Principle Investigator:

*‘’we first find whether this idea is existed or not, if yes then how can I add to the idea so I can distinguish mine from others…I have to enhance it and refine it, add some more features, if it is differing by 15% from the existing one and works fine then it is an innovation.’’ (Ac3, SQU)*

## 2.2 Governance Structure:

This section explains the formal structure of the institutions that govern the relationships between the actors involved within the case. Initially, the relationships between actors were governed by the rules of the Public Fund of Community and Individual Innovation Assistant Program (CIIAP) and University IP rules.

### 2.2.1 University IP Rules

According to the disclosure rule (*and as mentioned previously in Case A*), the university requires academics to disclose intellectual properties through the element of compulsion. Also, if the academic research (basic or applied) outcome contains IP which is considered by the university to be of substantial commercial value (from licensing royalties), no invention disclosure to a third

party can be taken before assessing the option of seeking IP protection through the university's Innovation Affairs Department (SQU, 2014).

Rules governing the actions of the university's innovation affairs department aim to maximize patent generation. 'Building patent profile' is stipulated as one of the department's main responsibilities in coordinating IP protection through patent registration and maintaining an up-to-date database for all university generated patents *(ibid).* Additionally, to ensure the ability of the department for patent generation, it is stated clearly as one of the Principle Investigator's (PI) responsibilities within the university's research rules and regulations. The PI's responsibility is to 'ensure the report of any intellectual property arising from research projects to the Deanship of Research and particularly to the Department of Innovation Affairs' to assess its patentability *(ibid)*

A budget of 20,000 OMR per year is allocated by the University Council for assessing and registering only 5 IP disclosures. While a budget of 250-500 OMR per IP disclosure is allocated for the evaluation process, which varies according to the complexity of the invention and the country of the patent office. The total amount is approximately 22,500 OMR per year. This fund is allocated exclusively for the purpose of registering patentable outcomes. Thus, IP is protected through patenting as an exclusive right granted for an invention. From to the university's perspective, an invention is defined as the first occurrence of an idea for a new product or process, which would be normally suitable exclusively for patenting. The innovation is considered after the protection is granted. *The following statement by the University's Innovation Director gives evidence:*

*"If there is any IP raised from the academic research that needs patent registration, then we (the university) fund the process. The assigned budget is tentatively 20,000 OMR annually for registering 5 IP disclosures for patent protection. While for evaluation process 250-500 OMR per IP disclosure… We are concerning about protecting patentable research results only. What I mean by results here is the generation of novel new product or process for the first*

*time. The innovation comes later after protection. If there is a chance to commercialise I mean." (UO2, SQU)*

The disclosures are evaluated by a US international IP company (Becker and Poliakoff Law) in accordance with its used international patenting criteria of: patentable subject matter; novelty; exhibiting a sufficiently inventive step (this means that the invention must not be an obvious development of something that has come before it); it also must have some utility and usefulness, for example, it must be industrially applicable and useful *(SQU, 2014).*

The reason for dealing with this firm in carrying out the process is that the department lacks the experts and the expertise in how to search patent databases as well as assess inventions. The Innovation Department also lacks numbers - It only has four employees, who also lack capability as they don't have prior experience in IP law and processes. *As stated by one of the University's Officers:*

*''at the moment in the innovation department we have only four staff who are not qualified. We need people who have legal background and we are missing in the university. We don't have employees specialised in the IP especially in patenting… Now we are using patent databases, because we don't have really expert people in how to search. We are dealing with the US firm to do the process.'' (UO1, SQU)*

Although the fund allocated by the university is for patenting, the IP disclosure process within university is still unclear. The patenting process with the international US Company is operated internally by the department, and is not exposed to academics. There is no channel for academics to apply within the department. There is also no existence of clear written guidelines that guide the academics in the process of disclosure. The Innovation Director simply gives verbal directions to academics as a way of coordinating their IP matters with the department whenever there is a possibility for an expected IP. More clarification would subsequently be given under the knowledge appropriation section.

*Evidence of this is the following statement given by one of the University's Officers:*

*''we are developing the IP and that we are missing in our university. So we are in the process of actually raising the first draft of IP policy in which we are developing the IP procedures on how receiving the disclosures from academics. In a system where there is a channel academics can apply and with the innovation department… Now what we do is that we are giving verbal directions in how to process their application… So if they want patenting then we will support them with the initial system screen and sign an agreement with the US firm. We are planning to place these guidelines in the website or in written in the future." (UO4, SQU)*

### 2.2.2 CIIAP-Community and Individual Innovation Assistance Program Rules:

TRC, through CIIAP, encourages individual innovators to retain the full ownership rights to the intellectual property of their generated knowledge. The IP is protected through the category of industrial property which includes not only patents for inventions but also patents for innovations. This is as per the TRC goal of building the innovation capacity within the country. As stated by one of the TRC's Officers:

*"They (innovators) can protect it through industrial property category if they want. Say for instance they can get patent for their innovations. Patent is not only related to inventions… By this we try to find the suitable type of IPR for building our capacity of innovation. So we need to move beyond current ways of conducting researches so we can get innovative outcomes, but at the same time choose the appropriate IPR." (PPMF1, TRC)*

It assists the innovators in getting IP by filling an application through an American IP Office while commencing pre-commercialisation actions (production of generated research outcomes). In case there is a need for creating awareness about IP, TRC ensures the provision and involvement of

international IP professionals as IP professionals are lacking nationally. The professionals are responsible for guiding individuals in the process of protection, in addition to examining and studying the weaknesses and strengths of their expected IP. Evidence of this is given by the CIIAP Innovation Director:

*“The individuals (academics) have the right to get the full IP ownership and we do facilitate and support the IP and even contact them to the IP agencies. And we coach them through the process from A to Z until he/she owns the full patent. We don’t have people experienced in IP. They are missing nationally. So we are dealing with the American IP Office to help us in assessing and coaching the individuals in the process of protection." (PPMF1, TRC)*

The mandate of the fund is to support individual innovators until pre-commercialisation, for example, when they own their functional prototype and can embark on a business start-up. The prototype can be produced by either local or international producers. The number of prototypes is based on the scope of the CIIAP budget, which should not exceed 100,000 OMR. *As stated by one of the TRC Officers:*

*‘’We also support them to do their innovation through prototyping either in Oman or outside Oman, if he knows the agency that will do the prototype for him it will be good if he doesn’t we will contact him to a producer and best organisation that materialise his innovation into functional prototype and this all depends on the scope of the budget. It shouldn’t exceed 100,000 OMR. We can produce as many prototypes as we can or products for each individual" (PPMF1, TRC)*

After production, successful innovations/inventions are bridged to full commercialisation by linking individuals to the national stakeholders (from public and private sectors) responsible for supporting, incubating, and funding SMEs. The stakeholders’ responsibility is focused on funding the commercialisation process of the generated knowledge. While the individuals are responsible for establishing and running their own start-ups through using the sources of funds provided by those stakeholders (TRC, 2014).

## 2.3 Knowledge Production:

This section focuses on the actions/activities taken by the involved actors in the process of knowledge production. These actions include: (1) collaboration establishment and the actors' reasons/motives for involvement in such collaborations; (2) The formal and informal institutions enabling and constraining the process of collaboration.

### *2.3.1 Academics initiated collaborations:*

AS per their motive, described in the background section, of developing a new radar device, the academics wanted to take their research outcome further, to transform it into a tangible product that is useful to society. They didn't approach their university as the internal funds (seed money) were limited, and were allocated only for the purpose of academic research, which, therefore could not ultimately cover the cost of their high tech research outcome. Therefore, they needed to get an investor to invest in their new proposed device. In 2013, they approached the Royal Oman Police (ROP) as it is the only entity that has the ultimate authority in deciding whether to implement the proposed device or not. However, they faced difficulty in convincing them. The ROP was not looking for theories and wanted to see the final tangible device in order to understand the difference between the proposed device and the existing solutions/devices. They wanted to see how the device worked in practice before deciding whether to invest in it or not. *As argued by the Principle Investigator:*

*"See look at the beginning they (ROP) said we see only papers, a proposal. We want to see an item, see a product, because these guys don't know anything about the research papers. They want to see final products. So they said to us don't tell that you are going to do this, Show us! Let us go in reality and test it. This is gona to convince them." (Ac3, SQU)*

Therefore, the academics decided to search for a fund to develop the device into a tangible product (a prototype) in order to show its practicality. They managed to raise a small fund from one of the national popular telecom companies as a donation and as part of its social responsibility. Consequently, they signed a contract with an experienced international producer from Belgium to develop a sample prototype as per the fund raised. After the prototype was produced they approached the ROP to test it in one of the vehicles to show them how the device worked. The ROP was somehow convinced but again refused to adopt the device, as they found it risky to inject such a device into their system because the device is new to the world and there is a possibility of loss. This is related to the ROP's common practice of getting ready-made solutions, which had already been applied successfully in developed countries such as the UK and other European countries. Therefore, they resisted replacing the existing solutions as they had already paid a large amount of money for them. They asked the academics to present the real life device after testing it in a developed country. The following quote provides supporting evidence:

*''They say look we don't want your experiment, we want you to go to UK and other European countries and apply it for 4-5 years then come to us with the results to make our final decision… because it is gona to replace the other solutions that they have and paid money for, and for them it is still new! And the main concern was that there is no country in the world that has this device, so we are the first." (Ac3, SQU)*

The academics were eager to find a way to convince the ROP to allow them to inject the real life device into different local vehicles. Therefore, they decided to seek a public fund that supports their research outcomes. Their search coincided with the inauguration of different TRC innovation initiatives for the purpose of resolving problems of national concerns. Road accidents were one of the concerns that TRC was willing to resolve, as was imparted within the HM's speech in 2009 as mentioned in the background section. Thus, the

academics were directed by TRC to disclose their research outcome under the fund of the CIIAP-Community and Individual Innovation Assistant Program.

In accessing the CIIAP fund, the academics were able to convince the ROP to adopt their device in the future. The ROP's decision to participate in such a project was influenced mainly by the benefit that emerged from the developed financial incentive provided within the CIIAP. In this respect, the ROP felt more secure that the generated knowledge would be funded and operated totally by TRC as its national mandate indicated in the program itself. Thus, the implementation of such a device appeared to involve no financial cost apart from the time of integrating the new device into the existing system to generate fines when the speed is high. *As argued by the Principle Investigator:*

*''They (ROP) are not going to pay a penny. They don't do anything. We don't need anything from except just can you please generate a fine if the speed is high? … We are trying also to see it with them by telling them okay with very less involvement and very less effort from your side there is no problem anyway. TRC is going to fund this prototype so let us implement it in certain number of vehicles and let us see the results.'' (Ac3, SQU)*

On the other hand, in accessing the CIIAP fund, the academics had to make a decision about the commercialisation aspect. However, they were confronted with the difficulty of fulfilling the CIIAP commercialisation rule, which necessitated that the commercialisation (selling and marketing) of the generated device should be the responsibility of the academics as they are required to establish their own business/start-ups after production. As aforementioned in the governance structure, commercialisation is only facilitated by bridging the successful innovations (after production) to full commercialisation through linking them to national stakeholders (from public and private sectors) responsible for supporting, incubating, and funding SMEs. Thus, the stakeholders' responsibility begins after the knowledge is generated and is mainly focused on funding the commercialisation process (start-ups fund), while the academics were responsible for establishing and running their own

business/start-up through using the funds provided by those stakeholders. Nevertheless, the academics were unwilling to embark on business. This is because they possessed information regarding the knowledge production process and the knowledge produced. They lacked business experience and knowledge of the local market. Thus, they preferred to remain as the producer of knowledge and raised the need for getting a partnership with local enterprise. This is evidenced from the following statement by the Principle Investigator:

'*'well I am the researcher. I just come up with the idea. It is not my job to do business. Actually I don't have experience and I don't want to follow that path. I just want to do research and come up with good ideas… that's why we need to have a partnership with a local company to sell and market the product.'' (AC3, SQU)*

Hence, the academics negotiated with TRC the possibility of involving a commercial user to handle the business aspects (e.g. production negotiation, selling, and marketing the generated device) for them in the future. The academics didn't experience any resistance from TRC or the Innovation Director of CIIAP who was found to be understanding in giving the academics the chance to involve whichever local commercial user they found relevant to fulfill their target. The Director's ability to change the rules of commercialisation is linked to the nature of CIIAP as one of the TRC's experimental programs. As argued by him:

*"See all TRC programs are experimental. So rules are still under modification. They are not final… We adjust them according to innovators needs. So why don't we give them the chance. If they think this (collaborating with an enterprise) is the right thing to achieve the commercialisation goal let it be then." (PPMF1, TRC)*

The relaxation of the TRC's rules by the Innovation Director allowed the academics to get a partnership with a local medium enterprise after disclosing their outcomes to the public through the media (TV and local newspapers).

Here it is worth mentioning that the CEO of the enterprise turned out to be an acquaintance of the Principle Investigator. They had previously worked together on different projects through informal networking mainly initiated by academics. Therefore, they were able to negotiate fairly the responsibility of each party. It was decided that the partnership was to be governed by a 'formal contractual agreement' through a legal consultant assigned by the academics via the CIIAP fund. The agreement stated clearly that the generated knowledge should be jointly carried out by the academics and the enterprise who agreed to participate. While the academics' main responsibility is to produce the research outcomes, the enterprise's responsibility is to bring the generated knowledge into a real testing product that can be applied successfully by the ROP. The Principle Investigator found this to be beneficial as it would help them in performing and following up business tasks. According to him:

*"We published our idea through newspapers and TV shows. A lot of local companies approached us. CEO of an enterprise I know called me personally to tell me he is interested to have a partnership with us…. As I said before we don't have any business experience and by partnering with a local company, we don't need to bother ourselves about business tasks anymore. They will do it for us. We are only responsible to generate the device as per our research knowledge." (AC3, SQU)*

*''our responsibility is purely bringing that product into an active and actual product which can be utilised and used by ROP and final consumer. We do all the business. They (academics) are responsible to create the device according to what is there in the latest researches." (CU2, SMEs)*

In addition to his personal acquaintance with the enterprise's CEO, the decision to involve him in this project was influenced by two other factors.

The first factor emerged from his own individual business individual motive/benefit of no risk and similarity of business product line. In this respect, he found the involvement of his enterprise in such a collaboration to involve no

risk as there exists a definite local demand for the generated knowledge (radar device). This is influenced by the agreement of the ROP in participating in the project. There was also no risk because the user found similarity between the nature of the generated knowledge and the nature of products that he used to sell and market nationally and internationally. Additionally, there is a similarity between the nature of the generated knowledge as an innovation and his motive of competitive advantage. The generated knowledge would add more value to his product line, which consequently makes his business unique and allows it to outperform its competitors in the local and global market. According to him:

*''From business point of view there is no risk. As I said from our side we are doing similar line of business and similar line of products … So there is demand. There is market. There is buyer in the market. There is a need for such a solution, so I don't see any risk in investing in such an idea…. actually the motivation of this idea is actually saving the life of people…. I am sure there won't be any risk in bringing this idea into the market since ROP with us.'' (CU2, SMEs)*

The second factor emerged from the CIIAP's production incentive. It is related to the involvement of non-financial production costs. He also found that the collaboration appears to involve no financial production cost expect the time and expertise they would invest in producing and marketing the product. This is as per the TRC's pre-commercialisation incentive of covering the expenses of generating the final device for real life testing. The fund provided a production budget of 100,000 OMR. The enterprise, along with the academics, found the budget to be sufficient for covering the high cost of production as the device required high-tech equipment and materials. They could produce a couple of thousand sample items for real life testing. As argued by the enterprise's CEO:

*''They sponsored us with an adequate amount of money…. that's would really help us in our project to at least produce our product in couple of thousands of sample items; for the people to do real life testing, then to start selling them. I*

*mean **innovate** such a product requires a lot of money, because it is very costly." (CU2, SMEs)*

**In summary,** the motives of the involved independent actors resulted in successful knowledge production. Despite the actors' different motives, they all stood to benefit. However, this benefit was found to be different for each party due to the CIIAP funding incentive (coverage of production cost). In this regard, the academics saw the opportunity of engaging with the non-commercial user (ROP), which increases the potential of the application of their research outcome. Likewise, the commercial user saw the opportunity of avoiding the huge cost of outcome production, as well as the guaranteed potential future local market demand due to the involvement of the main buyer (ROP). Similarly, the non-commercial user saw the opportunity of implementing the generated outcome without financial cost involvement, apart from the effort and time of integrating the new device into the existing system.

The analysis also identified the positive effect of informal networking, which contributed to the decision of the commercial user to participate in collaborative activities with the academics at an earlier stage. For him, collaboration appears to involve a considerable benefit because of the attributes of the knowledge to be produced: The congruence of the generated outcome with his business production line.

Moreover, the conflict between the funding commercialisation rule (i.e. transferring outcome through start-ups) and the academics' business incapability (i.e. lack of business experience) was resolved by the TRC's relaxed management process. The process facilitated the actors' interaction in developing a collaboration arrangement characterized by greater flexibility. This was influenced by the institutional nature of CIIAP as being experimental in supporting the effective commercialisation of the generated innovations by permitting the fund manager to make changes to the process (e.g. allowing academics to get a partnership with a local commercial user). However, it is

important to mention that the involvement of the user was initiated by the academics rather than by funding. Hence, the users' involvement merits exploring.

### 2.4 Knowledge Appropriation:

This section focuses on the actions/activities taken by the involved actors in the process of knowledge appropriation. These actions were enabled and constrained by the formal and informal institutions related to transferring knowledge through IPR.

#### *2.4.1 IP Disclosure Theme: The Academics' Choice of disclosing their expected IP to their university and their inability to protect their research outcomes:*

As per the university's rules of PI responsibility in coordinating the IP protection process for their research generated outcomes, the academics asked TRC about the possibility of disclosing their outcomes to the university's innovation affairs department before signing the contract with the enterprise. The academics again didn't experience any resistance from the CIIAP innovation director. The director, in line with the nature of the CIIAP as an experimental program, was aware that the university provides a fund for the purpose of protecting the good outcomes of research conducted exclusively by its academics. He argued:

*"Yes we are mandated to protect their outcomes, but we give them the freedom. So they (academics) can protect their outcomes through their university why not. As far as I know the university has allocated a fund for protection." (PPMF1, TRC)*

The department reviewed the disclosure carefully through the US international IP Company. However, the academics' application was rejected by the company and consequently by the university's department. This was, as mentioned in the background section, in relation to the academics' production of

knowledge by making a contribution to an existing product in order to reach innovation where novelty was not maintained. Therefore, the research outcomes were found to be inconsistent with the international criterion of 'inventive step' as the academics' outcome was an obvious development of what had gone before. This criterion, as mentioned in the governance structure, is reflected as a general patentability requirement according to US patent international laws where an invention should be sufficiently inventive. Evidence of This argument is evidenced by the statements given by the Principle Investigator and the University's Innovation Director:

*"We couldn't patent it through our university. They (Innovation Department) said it is not an invention. They said combining many ideas together and coming up with a new one, adding like 15% extra is not acceptable." (AC3, SQU)*

*''combining different existing tools and devices in a logical manner way would as a rule not be patentable…we are looking for novel ideas and inventions to patent.'' (UO2, SQU)*

The academics' failure to patent their outcome through their university was influenced by the university's underdeveloped rules within the IP disclosure application process, mentioned in the governance structure above. For academics, the reason was related to their unawareness of the allocated fund's sole/limited goal of invention protection. There is an absence of exposing the international patenting invention criteria to academics. The criteria were stated only verbally (unwritten) by the Innovation Director of the Innovation Affairs Department and were not stated explicitly in (the research regulations) or in the process of IP disclosure (in the university website). This is as per the absence of written guidelines (such as the patent criteria) that guide the academics in the process of IP disclosure. As argued by the Principle Investigator:

*''See we were not aware of the criteria. We thought the fund protects all the good outcomes of researches. That's what we understood…If they are looking*

*for inventions why they don't state this in our research laws so we understand what they mean." (Ac3, SQU)*

This is supported by the University's Innovation Director, who pointed out that the cause of the academics' lack of awareness was the lack of communication (information exchange) between the department and the academics. The Innovation Director faced difficulty in communicating with the academics as there is an absence of KT professionals within the department, who can inform academics about the criteria and who are sufficiently competent to advise them on the possibility of taking their research outcomes further by developing them into new ways of doing things that can be patentable and can reach the international criteria required by the US company. Therefore, there is a difficulty of role achievement as the absence of KT professionals hinders the department's ability to fulfil its main responsibility of liaising and negotiating with the academics (especially the PI-Principle Investigator) to provide support in the IP application process. According to the University's Director:

*"there is a lack of qualified staff who can advise in patenting and IPs in business studies and market assessment and commercialisation… who can go and negotiate with academics, particularly the PI about the outcomes of their researches and advise them in how develop it (research outcomes) to go through the IP process." (UO2, SQU)*

In this case, a significant cause for academics' failure regarding the exclusion of innovative research outcomes from the university's IP protection fund emerged. This was explained by two different perspectives and beliefs (Academics vs. University).

From the academics' perspective, and particularly the PI, the rejection of their IP application was unfair and they felt that the exclusion of their innovations from the IP protection fund was unreasonable (irrational) as the university could also benefit from these innovations by generating income through licensing them to industry after protection, which would ultimately help in building the university's,

and the academics', industrial reputations and networks. On the other hand, they didn't find it beneficial to conduct their research for the purpose of achieving inventive outcomes as there is an absence of incentive, in relation to patenting, within their university's academic promotion system. Evidence of this argument is given by the Principle Investigator himself:

*''This is funny! They rejected our application for no clear reason. I don't how these people are thinking!! Why inventions why not innovations or both. Innovations are also good outcomes for universities. They can protect and then license and sell them to the industry. By this they can build good networks and image with industry… See even if we listened to them and came up with inventive outcomes, what is the incentive? This is not included in our promotion. So from my view what they are doing is unacceptable really." (Ac3, SQU)*

From the University's Innovation Director's perspective, the rejection was fair as this was in compliance with the university's management patenting goals. In this respect, the university aims to improve its image and global ranking by building its own patenting profile. This, and as mentioned in the governance structure, is stipulated as one the innovation affairs department's main responsibilities, as well as allocating limited funds in which the international patenting criterion of 'inventive step' is enforced. Hence, the goal of the university' management influenced the innovation affairs director's decision in utilising the limited funds to avoid bearing the cost of rejection by the US IP company. As claimed by the University's Innovation Director:

*''The university is actually looking for putting the university in high rank. Good ranking and to compete for it. So patents are very important. So we need to build our profile in patenting…So giving us an opinion from a US patent lawyer and what is recommended to know if it is there or not, if not why we waste our money to patent it, so we are trying to avoid rejection by doing this. The budget is limited so we have to be selective." (UO2, SQU)*

**In Summary**, the conflict between the way knowledge was created by the academics and the appropriation mechanism used by the university (patenting invention) hindered the academics' ability to protect their research outcomes. This conflict is partly influenced by the university's weaknesses: absence of operationalisation and dissemination of IP disclosure guidelines and lack of IP experts, and predominantly by the conflicting logics of the actors (knowledge providers: academics and university). The latter can be justified through the costs and benefits of the exclusion of innovation from fund protection. For academics, restricting the funds to patenting only appeared to involve considerable cost (e.g. inability to protect and retain the value of the research outcomes). For the university, represented by its Innovation Department, the exclusion was encouraged as it constitutes the justification for the existence of one of its main responsibilities, which stemmed from the university's strategic plan and reflected the goal of building a patent profile. While the former can be justified by the costs generated by the university's weaknesses: lack of academics' awareness (e.g. non-exposure of patenting funding criteria and absence of written guidelines); university departments' inability of role achievement (e.g. lack of communication and lack of IP experts). Despite the university's initiatives in developing its IP infrastructure, guidelines still seem to not be operationalised successfully. This merits exploration.

### *2.4.2 Academics' choice of protecting their research outcomes through TRC: enablers and constraints:*

As the academic's application for patenting was rejected by their university, the academics decided to file an application through the CIIAP. As mentioned in the governance structure, this is because the opportunity provided by TRC through CIIAP allows for flexibility in deciding the type of protection (e.g. innovation patent) as per the outcome's nature since the academics couldn't meet the inventive step requirement. It is also because TRC coaches them through the process by involving international IP professionals to guide them in the process of patenting as well as examining and studying the potential of transforming the outcomes into patents, if possible, or if not, trying to find

another way to protect the research outcomes. Evidence of this is given by the following two statements:

*"We submitted our complete research proposal and their task is to study the proposal and see whether this is qualified for patenting or not and if not how can we protect it… so they work through proposals to find ways to protect the ideas if possible." (AC3, SQU)*

*"In our fund we give the academics the freedom to decide about the way they protect their ideas. This is because we are not focusing on one type of protection. It depends on the nature of ideas… And we are not like university looking for patents. We are more on building innovation capacity within society." (PPMF1, TRC)*

Before filing an IP application, and since the involvement of the commercial user was initiated by the academics themselves, the Director asked the academics to sign a formal contract with the enterprise in order to ensure a mutual agreement regarding how the outcomes would be protected. This was done for the purpose of avoiding any future conflict regarding protection as the involved parties would become committed to fulfilling the formal agreement in the future, especially considering that the high tech device was expected to yield significant revenue. Due to familiarity with each other, as aforementioned, the IP was negotiated fairly. After negotiation, both parties decided jointly that the academics would hold the rights as the patent owner and that the user's accessibility to the generated knowledge would be through exclusive licensing.

*''We agreed the ownership should be for me and my colleague and the company will have exclusive license. Because we are the one who produced the outcome. They didn't mind as were understandable'' (Ac3, SQU)*

*'Giving the ownership to academics helps in their career advancement. See as they gave us license we don't have any issue. We are still gaining profit…The outcome is innovative and similar to our production lines. 'This is our first project with academics here. We want to build our skills in how to collaborate*

*with academics and by this we establish stronger relation with them.'' (CU2, SMEs)*

However, the academics couldn't fill the IP application as they were confronted with the issue of fulfilling the requirement of prior art search. This was due to their previous action of 'public disclosure' in searching for a commercial user. Some of the creative aspects related to their research outcome were copied by the public which destroyed the protection of the knowledge. As argued by the Principle Investigator:

''*To be honest with you, some of the creative aspects related to our research are copied by others, because of the media, if you go in public people copy you and a lot of people copied our idea…* Now what I see, some of the secrets of our idea are in the market, it is really hard, why did they do that?'' (Ac3, SQU)

The academics' action of public disclosure was naive. Although they were aware that such a thing could happen, they didn't know that disclosing their outcomes publically should not be done before assessing the option of seeking IP protection. This was caused by their lack of knowledge about the 'prior art' rule instilled within IP. Therefore, they took it for granted as they were influenced mainly by the concern of involving a commercial user for accelerating the possibility of bringing the generated device into application to resolve the local problem of accidents. Evidence for this is given in the following statement:

*''my concern was to get solution whether by me or by another person; just to help the citizens here in Oman. So I was not really concerned about or afraid if someone copy me; but my concern was the solution must be applied by ROP as soon as possible to help the citizen.'' (Ac3, SQU)*

This is influenced by the lack of recruited local experts (within the CIIAP) who have IP knowledge and who can point the academics' attention towards the negative consequences of public disclosure before getting protection for their outcomes. IP awareness is ensured by the temporarily engagement of

international IP experts, as aforementioned in the governance structure. As the academics required working more on developing the IP of their outcome as per the international requirements, the proposed copied device was already in production. This is in relation to the TRC rules of commencing pre-commercialisation action in parallel to the IP registration process. Consequently, the academics and enterprise shifted their attention towards commercialising the unprotected device. A contract was signed by the enterprise with an international producer from Belgium to produce large quantities of the proposed device in order to be able to do real-life testing with ROP. According to the Principle Investigator:

*"Yes the secrets of our device were copied but we don't have any other option rather than going on the production of the device. We already have a contract with Belgium Company and a huge amount of money was paid by TRC to produce large quantities. After this we will sell it to ROP for real-life testing." (Ac3, SQU)*

**In summary,** although the flexible rules of the funding (protection as per the nature of the outcomes) gave academics the opportunity to protect their innovative/uninventive outcomes, the absence of IP experts within TRC hindered academics from knowledge protection. The academics' naïve action of public disclosure during the knowledge production phase, for the purpose of commercial user inclusion, resulted in depriving the validity of granting IP (i.e. failure to meet the patenting criterion of 'prior art'). The fund's effort of engaging international IP experts was organized after the outcome was generated and disclosed to public. Hence, the absence of permanent local experts who can guide academics throughout the process (from production to appropriation) merits exploring.

In this section, another issue emerged pertaining to the potential hindrance of successful innovation, specifically the absence of formal contracts (as an obligation) between actors, which might result in the uncertainty of knowledge utilisation by the non-commercial user (ROP). This argument is attributed to the

user's institutionalised practice of considering technology transfer as trade-based (imported and always being seen as better based on its existing successful application in developed countries). Hence, there is a conflict between the type of knowledge purchased by the non-commercial user and the type of knowledge produced by the academics and the user. Consequently, considerable costs for the academics and the user might occur: for the user, the inability to reach its logic of profit gain through securing local demand, while for academics, the inability to achieve their logic of academic curiosity knowledge implementation as the ROP has the ultimate authority on the knowledge adoption decision.

## 3. Case Study-C: Energy Saving Project

### 3.1 Background of the project

This project was linked to a research idea initiated by a local medium sized enterprise with help from one of the IIC consultants. The collaboration between a local medium sized enterprise and academics from SQU was established in 2011 through the mediation of the IIC[24]. The practical production of knowledge was funded by the enterprise (through in-kind contribution) and financially supported by the Commercial User Public Fund of Industrial Innovation Assistance Program (IIAP).

The research is in relation to the national concern of energy saving with the aim of achieving a social cost benefit. Most of the local electricity companies are facing a problem in cutting the cost of expanding the transmission and

[24]The IIC is designed to find out and fill the requirements and gaps within both enterprises and universities. The decision of establishing the centre is mainly derived from studying and revising the Omani industry in the late 90s and early 2000's. In 2007, a survey was conducted by TRC, from which they found that many enterprises, situated in Oman's major industrial estates, don't conduct any research with academia *(IIC, 2014)*. In addition, they were without 'in-house' investigative facilities and without channels to access universities. They don't have access to academic laboratories, essential for conducting R&D. Additionally, enterprises lacked the qualified personnel necessary to facilitate complex industrial R&D. At the same time, the IIC also wants to encourage universities to provide these resources to enterprises by conducting applied research, so they communicated with the different universities to find out about the types of research. They found that most research is basic rather than applied *(ibid, pg.5)*.

distribution utilities, especially during off-peak demand (summer time). This, alongside a solution developer, encouraged the enterprise to try to find a solution for its clients through developing a new product (smart boards) that implements cutting edge technology in managing power consumption within premises by means of prioritizing power demand. As argued by the Enterprise's General Manager:

*"There is a need for energy saving from the country point of view. It means social cost benefit. Our clients (local electricity companies) face a problem in saving energy during summer as electricity consumption trebles. This requires the utilities to expand generation, transmission and distribution capacities, which is costly for our clients and the revenue is restricted with the off-peak demand. This can be solved by creating smart electrical boards that help in saving energy." (CU4, SMEs)*

**3.2 Governance Structure:**

This section explains the formal structure of institutions that govern the relationships between the actors involved within the case. The relationships between the actors are governed mainly by the rules of the Commercial User Public Fund (IIAP) and minimally by the university's IP rules.

**3.2.1 University Rules:**

The academics and the commercial user signed the 'research contract agreement form' as a consultancy and contracted the research under the Research Department. As the university considers the projects coming from IIC as consultancy services, the research is driven by the industry (commercial users) requesting the academics' advice and solutions for their problems from the university and ultimately paying them for the services.

As mentioned previously in Case-A, the form states clearly the *responsibility* of both parties. In this case, the academics are responsible for knowledge production as per the user requirements, while the user is responsible for funding the knowledge generation. The form also mentions that all rights and

titles to Intellectual Property (IP) arising from a project shall vest in, i.e. come into the possession/ownership of, the University. Such IP will include copyright of the reports, documents, and computer software prepared by the University under the project, as well as any new development of products or processes and any improvements to publicly known products or processes. The Sponsor shall have a non-exclusive and non-assignable license to use such intellectual property.

Moreover, and again as mentioned previously in Case-A, the university encourages academics to disclose their IP through the element of compulsion. This is as per the universities' underdeveloped financial incentive of patenting. The development of IP is still not included in the criteria of academic promotion. A proposal is drafted by the Innovation Affairs Department to the university's higher level, but has not yet been approved. The only criterion for academic promotion is publication in internal and internationally high ranked or referred journals. Recently, the development of IP has been incentivized through management recognition only as a way to encourage academics to disclose their research outcomes with potential patents. Therefore, the academics' efforts are recognized by means of non-financial incentives, such as a certificate of appreciation.

### 3.2.2 Industrial Innovation Center Rules:

The enterprise and the academics signed a proposal research contract (IIC-1, 2010), as in Case-A, which is based on a consultancy model. According to this model, the idea (or the problem to be solved) must be initiated by a Subject Matter Expert (SME) first. These ideas are pursued further with the help of the consultants and client manager, who are responsible for studying the industry first to come up with an idea through brainstorming and then communicating with researchers through the Technology Transfer Agent in their university[25].

[25]Technology Transfer Agents are IIC focal points who appointed by the university. They are responsible for: (1) forwarding the e-mails sent from the consultant of the IIC research opportunity to academics; (2)

In this model, the fund is considered as if it was issued from enterprises and the academics should be considered as subcontractors. Therefore, and as per this case, both should work collectively in transforming the generated research outcomes into a tangible product. The academics were responsible for scientific knowledge and its production. They are responsible for translating this scientific knowledge into a language that is understandable to the user. The enterprise was responsible for supporting the academics by in-kind fund contribution through the provision of the required resources (HR, tools), as well as by providing the necessary information about their clients' requirements. It also has to guide the academics through the process by using their technical expertise to achieve the product's commercial viability. The following quote from one of the IIC consultants provides supporting evidence:

**''***the generation of outcomes should be jointly carried out by the enterprise and academics…the academics are expected to produce the outcomes according to the enterprise requirements who is on the other hand responsible to contribute either in-kind or else and also to provide technical feedback because they are the one who got their eyes on the ground and it is their business." (PFO3, IIC)*

Additionally, within section-10 of the form-2 and as mentioned previously in Case-A, the two parties have to decide about the ownership of any expected invention (IIC-1, 2010). A mutual agreement has to be reached with regards to how the outcome from the project is going to be protected. In this case, the IIC (IIAP) rules encourage enterprises to retain all rights to the IP for any technology/knowledge developed by the supported project, and be responsible for protecting any IP through patents, copyrights, industrial designs, trademarks, plant breeders' rights, trade secrets, or any other available means (IIC-2, 2010). To do so, the center assists the enterprises in getting IP by filling a patent application through the Ministry of Commerce and Industry's IP office, where the

finding and nominating academics who are interested in taking a part in the research and inform the consultant about them.

enterprises have to pay a registration fee of 200 OMR. The assessment of patent protection is done through a contracted Egyptian IP firm. The office is responsible for assessing the applications to be patented within Middle Eastern countries. The reason for dealing with this firm is that the office lacks professionals with sufficient expertise in how to search and assess patents. As argued by the Ministry IP Director:

*''We don't have patent examiners. There are only three admins in patenting and they only specialised in receiving applications for patent disclosures. And the number of applications increasing and nothing is new. No guidance is there yet to help them and they don't have the experience and the abilities to handle those applications and we shouldn't blame them…that is why we had now a contract with an Egyptian IP office to do the process for us.'' (GO1, MoCI)*

Also, the relationships between actors were governed by the IIC's developed financial incentives. In this regard, the IIC encourages enterprises to collaborate in R&D with academics in terms of incentivization. The enterprise involved in the project can concurrently make its own R&D contribution/investment by paying only 25% of the knowledge production cost with 75% coming from the IIC (through IIAP). Additionally, this contribution can be either in cash or in-kind through providing the raw materials and resources (i.e. HR) required by the academics for production[26].

Moreover, the IIC encourages enterprises to commercialise the generated knowledge as discretionary, which is due to the IIC's underdeveloped (absent) commercialisation incentive. Commercialisation is still not included as one of the IIC's duties or KPIs. A proposal has been drafted by the IIC Board of members

[26]The development of in-kind contribution incentive was made by the IIC to ensure the success of the IIAP model as the enterprises were reluctant/or unwilling to pay. The enterprises' reluctance to pay is in relation to the difficulty faced by the IIC in fulfilling the IIAP objective (one of the Key Performance Indicators) in encouraging enterprises to undertake R&D with academia. The enterprises' boards were found to be unwilling (quite skeptical and resistant) to participate in R&D as they had a lack of R&D capabilities and skills. They were afraid of taking a risk in involving R&D as there is a possibility of failure and money loss.

to the TRC, but it has not yet been approved. Therefore, the enterprise is responsible for commercially exploiting the protected/unprotected generated outcomes in a way that they find yields profitable commercial returns (IIC-2, 2010).

### 3.3 Knowledge Production:

This section focuses on the actions/activities taken by the involved actors in the process of knowledge production. These actions include: (1) establishment of collaborations and the actors' reasons/motives for involvement in such collaborations; (2) The formal and informal institutions enabling/supporting the process of collaboration.

#### *3.3.1 IIC Collaborations Establishments:*

The enterprise's concern for solving its clients' problem through the development of a high-tech product, described in the background section, necessitates conducting R&D. The GM, because of its enterprise's lack of in-house research skills, capabilities and professionals, approached many international world-class consultancy companies for help. However, he found dealing with these companies in developing such innovative technology incurred a very high cost. Therefore, he decided to search for local relevant consultants. He argued:

*"We don't have R&D in our company. Normally when we have an issue we solve it through international experts, but this time is different, the solution is supposed to be high-tech product and this includes high cost. So we need to do it locally so we can afford the cost." (CU3, SMEs)*

His search for a local consultancy firm overlapped with the birth of the IIC. He became acquainted with one of the IIC consultants through the visits and seminars conducted by her and the client manager for the purpose of awareness creation. The IIC provided them with an opportunity to access public funds and secure consultancy service money for solving their clients' problem

locally. Within the rules of the funding program, the enterprise was treated as if it were the one who issued the fund, where the other party (e.g. academics) were treated as subcontractors to the enterprise, in return for a consultancy fee. Additionally, the enterprise contribution (of 25%) was considered to be in-kind, which involves non-financial cost. In this respect, the enterprise contributed through providing the required resources (HR, tools/devices, and required information). As stated by the enterprise's GM:

*''IIC provided us with consultancy service and allowed us to have in-kind contribution and provide 25% from the total cost. They provided us 75/25 and told us to contribute. They asked us to use our staff, equipment in buying the materials, and they are okay with it.'' (CU3, SMEs)*

In accessing the IIC funding the enterprise also gained another opportunity. This opportunity is embedded within the IIC objective of industrial development of generating new products through engaging directly with knowledgeable local consultants, such as academics. The GM found the face-to-face engagement to be encouraging in delivering accurate information and the requirements necessary to generate a technological design that can be tailored later as per its clients' requirements to achieve commercial viability. He also found it useful for establishing good networks for lower-cost future research collaborations (e.g. consultancy services). The following quote by the Enterprise GM provides supporting evidence:

*"I found this promising! The IIC encourages us to engage directly with academics. This helped us in delivering our requirements accurately which was helpful in creating our design to be tailored afterward to be suitable for our clients. By this also we could build good relation with academics that we can use in the near future when we have another problem to be solved with less cost. We don't need to go outside.'' (CU3, SMEs)*

In order for enterprise to access the fund and local consultancy service, the consultant approached many academic institutes in Oman through their

Technology Transfer Agents. After reading and assessing the submitted general proposals, an SQU group in the field of 'electrical engineering' was selected by the consultant due to their positive response and strong initial research proposal. The academics' decision to participate with the IIC and enterprise is influenced by different reasons, which emerged from their personal motives as well as from the opportunities provided by the IIC within its developed incentives and process. The first reason, as in Case-A, is related to the financial incentive provided by the IIC. The IIC provided them with an opportunity to access public funds, securing additional income for themselves and their Department/College. Within the rules of the funding program, the academics were treated as subcontractors to the enterprise, in return for a consultancy fee. According to the university rules, a high percentage (60%) of the fee was allocated to the academics while the remaining 40% was retained by the University (20%), the College (10%), and the Department (10%). Thus, financial rewards and contribution to their university were significant incentives in engaging with the IIC funding. As argued by one of the Co-Investigators:

*"We are getting salaries actually as an incentive. We can use it for doing other researches, for buying equipment for college and department workshops and so on. Even the university is getting a percentage. So we are raising fund by this." (Ac6, SQU)*

The second reason is related to the opportunity provided by the IIC in increasing the academics' and their students' industrial research capabilities through smoothing the process of engagement with industry, especially SMEs. The academics usually face problems in convincing local enterprises to participate in their academic research. Therefore, this collaboration gave them the chance to interact and communicate their ideas directly with the enterprise. The following statement by one of the Co-Investigators gives evidence:

*"They (enterprises) are not willing to spend time to listen about ideas and knowledge. That is a big challenge for us … The IIC made it easy for us in*

*getting enterprises involve in our researches. Now they are keen to listen to us." (Ac7, SQU)*

In this respect, it helped the academics apply their scientific research outcomes practically for the purpose of furthering their research through knowledge advancement and contribution to the national requirement in developing manufacturing within the energy sector. This motivation was with respect to their personal interest in gaining practical industrial experience that can be transferred to their students in classes. They were eager to use the enterprise's resources and technical expertise to learn how to transform the scientific research outcomes into tangible products, useful to the enterprise's clients in the local market. According to the Principle Investigator:

*"We contribute to the design, advancement in the knowledge… for me it is important to learn how to create the design practically by using their resources and expertise. I also want know how the design is implemented and my knowledge is transferred in the real world…beside that we learn something new that we can transfer to our students." (Ac4, SQU)*

Moreover, it helped them involve their final year undergraduate students in the project, consequently, saving the academics a lot of time and effort. This opportunity exists as per the IIC's capacity building objective of introducing students, especially the local ones, to innovative thinking and involving them in resolving real life industrial challenges. As stated by one of the Co-Investigators:

*"It (collaborating with IIC) definitely helps us in building our students' research capacity by giving us a chance to include them in the same project. by this we could save a lot of time. You know they help us in our research." (Ac6, SQU)*

**In summary,** the successful transformation of research outcomes into a tangible product (a product that has the potential for commercialisation) was supported by the collaboration motives of the involved actors. Although these motives differed, both actors were in a position to benefit. Yet this benefit

differed between actors due to the prevailing institutional funding incentives (financial and non-financial). For the user, the collaboration appears to involve relatively little cost apart from the time and usage of existing resources involved in developing the product; this was viewed as beneficial because those incentives assisted him in achieving his goal of 'new product development'. These incentives included coverage of the consultancy service financial expenses (in-kind contribution incentive) and the opportunity of accessing the university's resources (e.g. labs and scientists). The former was viewed as significant in covering his weakness of bearing the high costs of high-tech product development, while the latter was viewed as being beneficial in generating the required technology, concurrently improving the chance of building future research networks. For academics, the collaboration appears to involve the opportunities of: generating revenue for themselves and their organisation by securing additional income through consultancy service; solving the difficulty of establishing industrial networks, hence, gaining insight into practical industrial trends; and yielding positive effects on their student education. For the IIC **(**as a fund operator), collaboration was to be encouraged as it constitutes the core justification for the existence of their organisation.

### *3.3.2 Academics' and the Enterprise's Dissimilarity of logics: Divergence between academics' research capabilities and the enterprise's requirement of product development:*

After academics were selected by the consultant, a final research proposal was developed by the academics which was evaluated thoroughly by the consultant and the enterprise to ensure that it reached the expected criteria of: realism, time appropriateness, cost effectiveness, and most importantly solving the enterprise's proposed problem. However, the enterprise found the time-frame of two years, suggested by the academics, to be too long and asked the academics to reduce the time-frame to no more than one year. Consequently, a conflict resulted between the academics and the enterprise. The academics found the time-frame of one year to be insufficient for instilling the basics before

developing the technology required by the enterprise. From their perspective, and in order to achieve the goal of translating their scientific knowledge into a language that is understandable to the enterprise, there is a need to revisit and understand the basics in order to assess the reactions of basic concepts in producing such a technology. Their logic is that the development of basic outcomes into industrial products requires time. However, this was not absorbed by the enterprise in the same degree. The enterprise's main concern was just to get a final commercial product (within a short-period of time) in order to solve its clients' problem and gain a quick commercial advantage. It didn't pay much attention to the way the academics actually developed such a technology. According to the Principle Investigator:

*''there is mismatch between the industry's needs and our capabilities. And the research for us is mainly basic research and for industry means a product; I want a product and you can do a research to do that. See the product has to be created but not at the cost of basic sciences. We need to revisit the basics first to get the knowledge from gross root to implement it. But they want to get a final product quickly which I found it improper to do." (Ac4, SQU)*

The enterprise's unwillingness to give the academics more time for instilling basics was influenced by its logic of considering basic research as time consuming as it requires more time for the solution to come (or to be obtained), this in addition to the probability of failure in getting the required, successful solution. Moreover, the length of conducting research may affect the successful commercialisation of the generated technology as there is a possibility that it can become obsolete because other enterprises/competitors in the market might come up with better technologies within a shorter period of time. Therefore, the GM was afraid of taking the risk associated with long-term research, where success and immediate profit were not guaranteed. According to him:

*''It is timewasting because you are trying to say I am doing research now and I am expecting to get the return maybe after two years' time or more to start*

*coming and we are not sure if it comes. And when the time the technology comes to us to commercialise it becomes obsolete because someone else came with the same or something better. So, there is a risk of taking long time to do it because we cannot guarantee success." (CU3, SMEs)*

This is associated with the IIC's goal of focusing on fostering short-term partnerships between enterprises and academics. As mentioned in the background section, IIC projects are mainly oriented towards conducting applied research for the purpose of answering enterprise's specific questions through coming up with solutions that have direct applications. In this respect, and according to the IIC rules, the projects are considered as 'development projects' that are directed mainly towards using existing scientific knowledge to address specific product problems. The IIC's decision of focusing on applied research is driven by fulfilling the enterprises' preference of considering IIC projects as short-term solutions for their proposed problems, rather than long-term R&D. This is can be explained by the enterprise's common practice of looking for temporarily, rather than permanent, solutions. A solution that allows it to survive for a while (or for a period of time) in the local market. The following quote by one of the IIC consultants gives supporting evidence:

*''Enterprises look at our (IIC) projects as a solution not as an R&D. They used to look for a company to give them solution even if it is a temporarily solution. It is a solution that makes them live for a while. So they don't wait for theories to come and solve their issues. They are looking to the practical (applied) side and therefore it is better for academics actually come and see what is happening at the industrial level." (PFO3, IIC)*

As the enterprise is unwilling to give academics more time and the IIC is driven by its goal in achieving the enterprise's preference of short-term applied research, the academics had no choice but to agree to develop the required technological design within the agreed time-frame of one year, and according to the information given by the enterprise, in addition to the existing scientific literature and knowledge. As argued by one of the Co-Investigators:

*''we don't have any option. There is a contract that we have to sign, in which we abide to it in obligation in terms of design within this time frame. Even if we are not satisfied about the time, we have to be able to design, build, and test the required panel within the time (one year) suggested by the company…. We need to design it in line with company requirements and by using whatever available information from publications and reading materials." (Ac5, SQU)*

**In summary,** there is an apparent conflict between the academics' and the user's logics regarding the types of research outcome. While the user seeks saleable/profitable products in a short period of time, academics prize excellent scientific research outcomes, which only accrue in the medium/long run. Hence, time is a key element for the user, where quality is vital for the academics. The user's requirement was satisfied by the fund's institutional condition of short-term research partnership (e.g. applied research in favour of getting quick commercial return), which accordingly generated considerable costs for academics (inability to instill basics and skewing the research agenda towards marketable research at the expense of fundamental research). This meant that the academics had no choice but to compromise their academic values to comply with the funding rules in order to retain the perceived benefits of the collaboration. Hence, the trade-off between conducting basic research and fund benefits was inevitable.

While the main concern of industrial research is time-effectiveness and marketability, the assessment of the academics' quality gives less importance to such concerns as the measure of quality is the scientific standard. Yet, the allocation of the IIAP fund is not governed by the consideration of scientific criteria, but rather by industrial concerns and priorities. For the fund, giving sufficient freedom for academics and long-term prospects for users is not preferable, because users are hesitant to collaborate in the programs of scientific and fundamental research. This is due to competition, which forces the user to avoid the costs of the activities of long-term research (e.g. longer time to get the outcome and the risk of commercialisation obsoleteness).

Therefore, the dissimilarity between the user's motive (time) and the academics' motive (quality) merits exploration.

### 3.4 Knowledge appropriation:

This section focuses on the actions/activities taken by the involved actors in the process of knowledge appropriation. These actions were enabled and constrained by the formal institutions related to transferring knowledge through IPR (e.g. patenting) and Commercialisation.

#### *3.4.1 The academics' choice of disclosing their expected IP to the enterprise and the enterprise's inability to patent/protect the generated technological design:*

As there is a possibility of developing an innovative technology, there is a potentiality for an IP to be generated. Therefore, and in accordance to section-10 of the research proposal contract (as mentioned in the governance structure section), both the academics and the enterprise have to reach a mutual agreement regarding how the outcome from the project is going to be protected. After negotiation, the academics decided to disclose the expected IP to the enterprise. Their decision was influenced mainly by the IIC's IP developed rule. Since they are familiar with the university's IP disclosure rule, the academics, especially the Principle Investigator (as per his responsibility), didn't find it applicable to discuss and report the expected IP to the Innovation Director as the research outcome was not generated scientifically yet. Therefore, and in accordance with the action enforced by the IIC consultant in safeguarding the ownership for the enterprise - mentioned in Case-A, the principle investigator and his co-investigators understand, as they agreed from the beginning, that they would collaborate through receiving a consultancy fee, and the IP would be disclosed legitimately to the enterprise. According to him:

*"See the outcome was not generated at that time to disclose to our university and since we agree that we are getting this much of money then we agree at the*

*beginning itself that the ownership of the IP will be for the company…we are still getting a lot of benefits as I told you.'' (Ac4, SQU)*

After reaching mutual agreement on project time-frame and IP, the relationship between the academics and the enterprise was governed formally by two formal contractual agreements (as mentioned in the governance structure above). From the university's side, they signed the 'research contract agreement' under the consultancy section in Research Department, while from the IIC's side, they signed a proposal contract. The project went well and a new technological design was generated collectively within the specified period of time and as per the information received from the enterprise's GM and operational managers. To ensure safeguarding the ownership right for the enterprise, the IIC consultant asked the academics to fill a patent application, since they were the ones who developed the design scientifically and have patent knowledge. Afterwards, the consultant left the decision to the enterprise's GM to submit the application and either to pay the registration fee through the MoCI-Ministry of Commerce and Industry's IP office or any international IP Office. The reason for leaving the decision to the enterprise is linked to the absence of an IP/Patenting fund within the IIAP. This can be explained by the boundary (parameter) that defines the scope of the processes or activities followed by the IIC, which are influenced by funding knowledge production in reference to knowledge appropriation in which a patent has taken part. The IIC's responsibility finishes the moment that the outcome's prototyping (pre-commercialisation) is achieved. Therefore, they don't anticipate patenting to fund research. In other words, patenting is not considered as a direct outcome for academics and enterprise to participate in R&D since it is not carried out by the IIC. The following statement by the IIC CEO gives supporting evidence for the above:

*''It is down to the industry to protect the outcomes of the research. This is because we don't expect that those researches result in patents because we don't fund patenting. The way I recommend at the beginning if you come up of something and you think is going to be patented, you should protect it, and this*

*is up to the industry. They can go to the ministry of commerce and industry to get protection through applying to the MoCI IP department or they can protect it by themselves via any international office." (PFO2, IIC)*

In response, the enterprise's GM decided to file a patent application through the Ministry of Commerce and Economics' IP Office as he found it costly to protect the generated design internationally. He didn't want to bear the high financial cost of international registration. Also he preferred to keep IP protection within Omani borders because of their unfamiliarity with the IP international rules and their aim to market (manufacture and sell) the generated technological design locally. The following two quotes by the GM and one of the IIC consultants give supporting evidence:

*''Of course we cannot do it outside because it is costly for us, it requires money time and we also don't know the rules outside. And the main idea is to make it as an Omani product so we need to do it in Oman.'' (CU3: Ln 98-100, SMEs)*

*''If they (enterprises) want to protect it internationally, they face cost issue and … most of SMEs in Oman they don't have the capital to register patent in Europe and in China, everywhere around say they tended to keep it to Oman'' (PFO2, IIC)*

However, the enterprise was slow in processing its patent application. To date, an official recognition of the patent is still pending (for almost two years or more). This is because, as explained previously in the governance structure section, the absence of the patenting process and professionals within the MoCI IP Office. The GM found this unacceptable as he wasn't aware that the patent registration in the ministry is a timely process. As stated by the Enterprise GM:

*''No still is not. We submitted our papers to the ministry of commerce to get the patent through them… Now almost two years or more since we applied for patent and nothing yet came. I didn't know the process in the ministry will take very long and they said it maybe will take more to get it which I think is too much.'' (CU3, SMEs)*

**In Summary,** the absence of a patenting process and recruited patent experts within MoCI, in addition to the absence of a patenting fund as one of the IIC's responsibilities hindered the user from reaching his goal of quick exploitation of the knowledge generated (e.g. failure of securing quick IP ownership). For him, the implications of such deficiencies confronted him with the costs of: knowledge commercialisation obsoleteness and difficulty of achieving appropriate returns on time. Hence, time is a key element for the user. For him, the best way of achieving a competitive advantage in such markets is to accelerate the introduction of the generated technology in order to meet his logic of profit making. This reveals that 'time is important as changes in technology and customer demand generate changing markets in which a product becomes obsolete by the time it receives protection (e.g. slowness of patenting process). Yet, the weaknesses of the prevailed patenting arrangements, as well as the absence of a patenting fund, create longer lead times which negatively affect the speed of technology market launch.

### *3.4.2 The enterprise's refusal to allow the academics to patent the generated technological design through their university:*

The academics knew that the enterprise faced difficulty in patenting the generated design because of the slowness of the process within the MoCI IP, in addition to its inability to endure the high cost of international patent registration. Therefore, they decided to make use of the situation. The Principle Investigator, as per the issue of dissimilarity mentioned above, found this as an opportunity to have more time to develop the design further to make it novel and patentable. Although he knew that patenting was not included in their promotion as an incentive, the Principle Investigator wanted to get the credit and recognition from his university. Evidence of this is the following statement given by him:

*''Yes it (patenting) is not written (as a promotion criteria) but by having a patent we are getting the credit not only in our career progress but also recognition from our management here as they are looking for such result…Yes there is no*

*financial award, but I believe a certificate of recognition is enough to build our academic profile. so we are still gaining benefit.'' (Ac4, SQU)*

Therefore, he decided to get support from the Innovation Affairs Department at his university. This is, as in Case-A, in line with the department's responsibility of coordinating the IP protection process (with the help of the US law company) through the fund provided by the university for the purpose of protecting and registering the expected patentable research outcomes. The University's Innovation Director, to avoid conflict, asked them to get the agreement first from the enterprise as it has the ultimate authority as the owner of the generated design. However, the academics couldn't go through the process, as the enterprise was reluctant to give the academics the chance to patent it through their university. The enterprise's refusal was influenced by the reason that, as mentioned in Case-A, it would be costly if the university patents the generated design because there is a possibility that the university, after patenting it, would sell it at a high price. This will hinder the enterprise from having the ultimate authority to manufacture and sell the design to its clients. Therefore, the GM didn't want to bear the expense of licensing and preferred to keep it unprotected. The following quotes from the Principle Investigator and the University's Innovation Director give supporting evidence:

*'We asked them if it is possible to let us protect the design through our university so we license it to them, but it was not allowed by the company. For commercial purposes they said not possible. They want to have it so they can sell it to their customers... Actually, yes they were afraid that the university will charge them high for the license.'' (Ac4, SQU)*

*"We are facing problem with patenting as they want things with less cost than going for high expenses, so patent will raise a price. They don't go for the university to patent the invention, because they know that it will be in a high price." (UO2, SQU)*

**In summary,** the conflict between the university and the user regarding ownership and royalty payment resulted in the failure of knowledge appropriation. For the user, the university's licensing arrangements involved bearing the potential cost of high royalty payment (due to his weakness of financial incapability); while for the university it involved the benefit of generating additional revenue (e.g. patent-licensing income). However, the rigorous enforcement of such an arrangement made the university overlook the opportunity of patenting, consequently losing the potential of achieving its goal of building a patent profile and supporting its academics in transforming their outcomes into inventions.

### *3.4.3 The IIC consultant's refusal to allow the university to patent the generated technological design:*

Since the enterprise refused to allow the academics to patent it through their university, the Innovation Director approached the IIC consultant involved in the project to negotiate the possibility of convincing the enterprise to allow them to protect the generated design. From her perspective, it is not a win-win situation and the enterprise's refusal was not reasonable as it prevented patenting because of the above-mentioned reasons. Consequently, this resulted in the university losing the opportunity to patent the outcome generated by its academics. *According to the university's Innovation Director:*

"*We had several meetings with them (IIC) to modify the agreement with the enterprise and came up with another agreement that is fair to the university. We told them it is not a win-win approach…. we are giving the patent for them and we are not sure if they will patent it or not because it is not their mandate. Another thing is that it is slow to do it in MoCI. They don't have expert staff … the industry cannot pay for the patent. So by leaving the patent disclosed to them, the university will not take advantage of it." (UO2, SQU)*

However, the IIC consultant refused to discuss the matter with the enterprise because they didn't find IP negotiation with the university to be reasonable for

one main reason that it would be non-compliant with the IIAP funding rules. The IIC have made the aspect of IP clear from the beginning to academics and their university. They have a clear process, developed nationally for the benefit of local SMEs. So safeguarding the IP for enterprises is its mandate since, the participating enterprises contributed to the cost of the design generation and the center paid the consultancy fees for the academics. Thus, the university doesn't have the right to claim the IP. It also doesn't have right as the university with their academics are still registered as the developers of the expected patent, thus, raising their profiles as industrial R&D specialists. As stated by the IIC consultant:

*''they (university) think that it doesn't matter who paid and they are not contributing to the cost and got the idea, they still have a slice of the pie!! This is against our policy. We have been developing projects, where the industry is the one who is the owner since it contributed in the cost and idea. The patent is registered to them; with an institute and its researchers to be named as the developers, so we still rewarding them. The financial gain and IP goes to the industry. We made this clear from the beginning to all.'' (PFO2, IIC)*

**In Summary,** conflicting logics between the university (e.g. university's ownership for patent profile development) and the IIC (e.g. user's ownership for commercialisation) resulted in the university's failure in appropriating the knowledge generated. For the university, leaving the IP disclosed to the user hinders it from achieving its goal of building a patent profile; While for the IIC (as a fund operator), leaving the IP disclosed to the user represents the justification for one of its mandates (e.g. role enforcement of safeguarding IP for user). Yet, the university didn't have the right to claim for ownership, as a prior IP contract negotiation was missing**.** The IIC communicated directly with the university's research department, specifically with the consultancy and contracted the research department where the two parties (academics and user) signed a single form in which the aspect of IP was not negotiated by the department officer. The decision was left to both parties. The missing of such 'prior IP

negotiation' merits exploring as it resulted in the university losing the opportunity of patenting the outcome generated by its academics. Despite the university's initiatives in developing its IP infrastructure, guidelines are still not operationalised successfully.

### *3.4.4 Commercialisation Theme: The enterprise's failure in achieving its choice of commercialising the unprotected technological design:*

The slow process of patent application created a threat for the enterprise in terms of successful and quick exploitation of the generated design. They didn't want to wait such a long time as the possibility of guaranteeing successful patenting was not ensured, and at the same time the academics and their university were trying to make use of the situation. They were also worried about losing their idea as there was a possibility that commercialisation of the generated design could become obsolete by the time protection was achieved, thus hindering them from gaining the expected appropriate commercial returns on time. According to the enterprise's GM:

*''The process is taken very long. And they said it maybe won't be protected. They are not sure. We are afraid that we will lose the idea … when the time the protection come to us to commercialise the design it become outdated because technology doesn't wait and maybe others from the market will come with better design. So there is a risk involved and we will not be able to commercialise it successfully." (CU4, SMEs)*

Therefore, the GM decided to start commercialising and bringing the unprotected generated design into the local market. His decision was also influenced by two other factors, which emerged from the IIC's underdeveloped IP and Commercialisation rules. The first factor is related to the IIC's rule of leaving the decision of commercialisation up to the enterprise. This is linked, as mentioned in the governance structure**,** to its underdeveloped (or absent) rules of commercialisation and can be interpreted again by the boundary that defines the scope of the process or activity followed by the IIC within IIAP. The process is influenced mainly by the goal of achieving knowledge generation as a way to

encourage enterprises to adopt innovations/inventions generated by academics to be used for their own benefit. In this regard, commercialisation is not involved in the interaction as one of the IIC responsibilities (or KPIs) in accomplishing the goals of IIAP. As stated by the IIC Client Manager:

*''When we reached the final stage (prototyping) our role is done and it will be the enterprises responsibility not us to take it further towards commercialisation… it has the right to commercialise or not. We don't interfere in commercialisation now maybe in the future." (PFO4, IIC)*

The second factor is related to the IIC's consideration that filing a patent application is sufficient for use as protection for the generated design. This is in relation to their aim in finding ways of safeguarding the ownership for enterprises to enable them to prevent others (particularly academics, universities, and competitors) from using, selling, manufacturing, or otherwise copying the generated design without permission. Therefore, IP protection through patenting was not an issue for enterprises as they still have the ultimate right to produce, use, and sell the generated design locally. According to the enterprise's GM:

*''The IIC doesn't mind and said go ahead with your marketing. We registered our application through the ministry and they think this gives enough protection from being copied by other. So we still can use it of course and produce and sell it to our clients." (CU5, SMEs)*

To commercialise, the enterprise needed first to find a client interested in adopting the design in order to sell it after tailoring it as per their requirements. To do so, the GM, along with the academics, demonstrated the generated technological design to the concerned clients of local electrical SMEs through a workshop. Although the clients' feedback was positive, they refused to invest. After determining the cost of production in order to evaluate the ratio of profit, they found it too costly to buy the generated technological design as it incurred high capital cost. They considered it as fundamentally perilous (risky) as it

required a great deal of investment for buying electrical fittings in order to tailor it according to their system requirements. They usually deal with calculated risks where risk premiums can be calculated and built into the cost of the money. Their decision was also in relation to the size of their enterprises as small/medium, as their main aim is to survive in the market. Thus, they didn't want to take the risk of spending a significant amount of money for buying and adopting such design where profit was not granted. The following quote from the GM of the enterprise gives supporting evidence:

*"Cost is an issue here. They are not willing to invest in our energy saving design because the capital cost of implementation is very high and they said that they cannot afford it. To tailor it they need a lot of investment in electrical fittings…They are medium enterprises and they need to look for profit ratio in order to survive in the market. So it is not viable for them to invest unless they ensure risk premium." (CU3, SMEs)*

This necessitated the enterprise's GM and his clients to search for an alternative funding source. Thus, they decided to approach large local investors. However, they faced difficulty in convincing them to invest. They are reluctant to invest in innovative outcomes that generate locally and consider it as a cost rather than as an investment. The GM attributed this to these companies' common practices of importing readymade technologies, which were applied successfully in developed countries. Therefore, they were not willing to invest in such a project because they didn't believe that they could earn a massive return on their investment in case the innovative design was a success. According to the GM:

*"See we are always struggling here to source finance support in commercialisation process…They (large companies) consider it as a cost not as an investment… They see it as an expense for producing such new design… and because most of these companies are importing technology and producing and not investing in technology that developed locally." (CU4, SMEs)*

**In summary**, the commercialisation of the unprotected knowledge was assisted by the fund's relaxed IP rules (e.g. sufficiency of patent application as a tool for safeguarding ownership from others). However, the user's activity of commercialisation was impeded partly by the financing constraints in its local business institutional environment (e.g. the absence of venture capitalists and the lack of large companies' structure in supporting SME innovation projects financially); and predominantly by the absence of a commercialisation assessment as one of the IIC's institutional prerogatives (e.g. discharging responsibility to the user by giving him the freedom of either commercialising the unprotected knowledge or not). For the user, the implications of such weaknesses are disadvantageous and resulted in his failure of securing investments for achieving his choice of commercialising the unprotected generated knowledge, hence, resulting in an inability to grow - such weaknesses merit exploring.

**4. Case (D):** Quality Assessment Software Project

**4.1 Background of the project:**

The project was linked with research initiated by four academics in 2011. Two Academics (the PI and Co-PI) came from CAMS College of Agriculture and Marine Sciences, Department of Soil, Water and Agricultural Engineering, in addition to two post-doctoral fellows from the same department and one academic from the College of Engineering, Department of Electrical and Computer Engineering. It was funded by The Research Council's (TRC) Open Research Grants (ORG)[27]. The collaboration with a small local enterprise was initiated by academics during the knowledge production to run pilot testing.

[27]ORG has been developed in 2009 as part of the country's national research strategy, which was introduced by TRC in 2008. ORG was based on the allocation of small to medium sized research grants for short and mid-term projects resulting from academics' open research initiatives. Its main aim is to enhance research capacity in the country through promoting open research proposals triggered by individual, or groups of, researchers (academics) based upon their research areas of interest (ORG, 2014).

The research was on the subject of using an existing computer vision technique in assessing date quality in Oman. Despite the high production of dates in Oman, the annual export average is only 2.5 to 3.5 % of the total production. A problem of quality composition and packaging has been common for Omani dates to compete globally. The research was preceded by two actions of engagement with the relevant users. In the first action, they visited many local commercial date processing factories to understand the current analytical methods used in processing dates. They found most of the methods to be time consuming, laborious, expensive, and of a destructive nature. They were using visual inspection, which is considered as a subjective method of testing, where results vary from one person to another. This encouraged the academics to design and develop an automated quality assessment system for the different stages of the supply chain in Oman in order to be able to harvest dates at precise stages and monitor the quality during handling, processing, and storage. In the second action, they obtained grade standards from two factories in order to determine the efficiency of the computer vision system with a color camera for detecting the surface cracks on dates. The outcome of this aspect was published in the university internal journal as well as through a workshop in 2011.

### 4.2 Governance Structure:

This section explains the formal governance structures of the institutions that govern the relationships between the actors involved within the case. Initially, the relationships between the actors were governed by the rules of the ORG Public Fund and the university IP rules.

#### 4.2.1 University Rules:

According to the disclosure rules, and as in Cases A & B, if the academic research (basic or applied) outcome contains IP, which is considered by the

university to be of substantial commercial value (from licensing royalties), no invention disclosure for a third party can be taken before assessing the option of seeking IP protection through the university's Innovation Affairs Department (SQU, 2014).

The rules governing the actions of the university's innovation affairs department aim to maximize patent generation. 'Building a patent profile' is stipulated as one of the department's main responsibilities in coordinating the IP protection through patent registration and maintaining an up-to-date database for all university generated patents *(ibid).* Additionally, to ensure the ability of the department for patent generation, they state this clearly as one of the Principle Investigator's (PI) responsibilities within the university research rules and regulations. The PI's responsibility is to 'ensure the report of any intellectual property arising from research projects to the Deanship of research and particularly to the Department of Innovation Affairs' to assess its patentability' *(ibid).*

Moreover, and as in Case-B, a budget of 22,500 OMR per year is allocated by the University Council for assessing and registering IP disclosures. Within this fund, the IP is protected through patenting as an exclusive right granted for an invention. The assessment of patent protection is done through a US international IP company (Becker and Poliakoff Law). As per the contract, the disclosures are evaluated according to the company's used international patenting criteria of: patentable subject matter; novelty; exhibiting a sufficient inventive step, this means that the invention must not be an obvious development of what has gone before; it also must have some utility and usefulness, for example, it must be industrially applicable and useful *(SQU, 2014).*

### 4.2.2 Open Research Grants (ORG) Rules:

The relationship of University, Academics, and TRC within this project is governed by 'The Research Grant Agreement'. The agreement states that,

unless specified otherwise, the ownership of Intellectual Property, and responsibility for its exploitation, rests with the university. In this regard, TRC gives the university the freedom to retain the ownership of the generated knowledge either through publications or patenting. As argued by one of the TRC's Officers:

*"We give the involved university the freedom to decide about how to own the outcome of their academics researches. It is either to publish or to patent and they can exploit them nationally if possible. So we don't interfere and leave it to them." (PPMF2, TRC)*

In this respect, the agreement established the IP rights and responsibilities of the three parties. The academics were responsible for the knowledge and its scientific production, in addition to, disseminating the full account of their research findings, provided that such dissemination does not preclude the ability to file for a patent where the research project leads to a potentially valuable invention (ORG, 2014). The university was responsible for ensuring the following: (1) Significant scientific advances are published in open literature without delay, unless such publications stand in the way of patent protection; (2) Appropriate efforts are made to exploit such advances of the research outcomes for the benefit of the economy or society (ibid). TRC was responsible for ensuring that the outcomes of the academics' research provide accurate and properly reported information.

The relationship between academics and commercial user is governed by a formal contract agreement. In case the user is selected by academics as a research partner, a suitable agreement should be reached before applying to TRC. The agreement might include reasonable delays in disseminating outcomes to allow any means of protecting the user's commercial advantage. In case the user is hired as a research assistant, the cost of the contract personnel must include all costs associated with their participation based on mutual agreed labour rates. Moreover, the relationship between Academics and TRC was governed mainly by the researchers' incentives program, established

in 2009, exclusively for researchers conducting ORG research. In this respect, the program provides financial incentives for both academics and students. The students are given salaries (e.g. Master students: 1000 OMR; PhD student: 2000 OMR); while academics are given rewarding funds, per se, for their contribution in research capacity building through attracting and graduating Omani postgraduate students (TRC, 2014).

### 4.2.3 Publication Rules:

The relationships among actors were governed by the underlying/fundamental consistency between the ORG and the university's developed incentive of publication for academics IP disclosure. Both entities encourage academics to disclose their IP to the public in terms of incentivization. In this regard, and while the university has the right to own the knowledge generated through patenting, the academics still hold the ultimate right/decision to disclose it through publication (e.g. publishing in journals, conducting workshops, attending conferences, etc.). From the TRC's side, and as per the established program of 'researchers' incentives', the academics are rewarded with 1,500 OMR when they publish in a referred journal (i.e. SCOPUS, SIJ, etc.), 500 OMR when they publish a chapter in a book, and 2000 OMR where they publish a book (TRC, 2014).

Correspondingly, and as per the publication rules of raising academics' research profile, the university encourages and promotes the publication output of its academics in international journals by offering financial awards. These awards complement the recently introduced Best Researcher awards (outstanding researcher) and Best Paper awards (distinction in research) in the university's journals to a broader community of its researchers. This initiative aims to encourage higher standards of research publications and thus promotes the university as a reputable international research institution (SQU, 2013).

### 4.2.4 Patenting Rules:

In addition, the relationship between actors was also governed by the underlying contradicted IP rules within the university itself. It encourages academics to disclose their IP to the Innovation Affairs Department through the element of compulsion. As in Case-A, this is as per the universities' underdeveloped (absent) financial incentive of patenting. The development of IP is still not included in the criteria of academic promotion. A proposal has been drafted by the Innovation Affairs Department to the university's higher level, but has not yet been approved. Recently, the development of IP has been incentivized through management recognition only as a way to encourage academics to disclose their research outcomes with potential patents. Therefore, the academics' efforts are recognized by means of non-financial incentives such as rewarding a certificate of appreciation. On the other hand, it encourages academics to disclose their IP to the public through the element of incentivization. In this regard, and in addition to the publication rewards mentioned above, the university puts publication in internal and internationally high ranked or referred journals as the only criterion for academic promotion.

### 4.3 Knowledge Production:

This section focuses on the actions/activities taken by the involved actors in the process of knowledge production. These actions include: (1) establishment of collaborations and the actors' reasons/motives for involvement in such collaborations; (2) The formal and informal institutions enabling/supporting the process of collaboration.

#### *4.3.1 Academics' Initiated Collaborations:*

The development of such quality system, mentioned in the background section, requires the involvement of the relevant user. They needed to develop the system as per the requirements and carry out trial in one of the local date factories alongside systematic testing using their university's lab. The involvement of the factory was encouraged as a way to ensure the practical applicability of the research outcome in solving the problem of concern. This

was influenced particularly by the Principle Investigator's curiosity of learning how they can automate the new scientific algorithm in real life. He believes in the importance of involving industry to gain practical experience, which consequently advances their industrial image/reputation and adds to their academic profile. This can be evidenced from his past industrial experience, which he argues:

*''because I am coming from industrial experience background I believe the practical experience is very important. I don't perform any projects without industry. That is why I work with industry in most of my researches because I believe it is essential to get practical experience. It builds our profile and reputation among companies." (Ac8, SQU)*

The principle investigator's curiosity regarding practical applicability was important in establishing the collaboration. In response, they communicated with the factories which they engaged with earlier during their research. After a few weeks, an opportunity existed to work collaboratively with one of the small relevant local factories to assist them in carrying out the development and application of an automated quality evaluation system for handling and processing dates. The GM of the factory was supportive since involvement in the project will help them enhance the quality of date processing by detecting the dates' surface cracks without encountering any financial cost. As claimed by one of the project's co-investigators:

*"You know we visited many factories before, so the communication was easy. One of the factories was interested to help from the beginning. The GM found the idea stimulating because the system will help them in detecting the surface cracks on dates which increase quality. So they were looking for a system like this. We didn't ask them to pay a penny. We didn't need that. All what we wanted was to give us their time and share data and know-how.'' (Ac8, SQU)*

Simultaneously, the conduct of such research with national relevance, corresponded with the inauguration of many of the TRC's public fund/grants.

The academics found a consistency between their driven research topic and the issues within the 'Environmental and Biological Resources' sector, which is proposed by TRC in Open Research Grants as one of the national priorities. They found this to be an opportunity to gain access to funding, securing additional income for their college. Within the rules of the funding program, academics are granted funds according to the project's required expenditure. The academics, with their college, wanted to establish a lab for computer vision technology. Therefore, they targeted ORG to provide them with the capital required for buying relevant equipment and facilities. As argued by one of the Co-Investigators:

*"What motivated us in collaborating in ORG researches is the huge amount of money allocated for such researches. Yes, salaries are omitted here, but we can buy equipment and other facilities by using this money. As I told you we are planning to establish a computer vision lab. So such money can help us to buy the required equipment in the future." (Ac9, SQU)*

*"it is purely financial and when you have a contract with them you can claim some of your time as money, you can have them pay for your time…so for us it is beneficial to get such collaboration to gain money for us and our university" (AC2, SQU)*

In accessing the ORG funding, the academics particularly the PI, also gained a unique opportunity to effortlessly attract and recruit postgraduates (PhD and Masters Fellows) to assist them in the research. This opportunity, as mentioned in the governance structure section, exists as per the developed incentive structure of capacity building which is embedded within the ORG researcher's incentive program, where students are rewarded by either a scholarship or stipends/salaries. The PI found this extremely beneficial as it provided them with another opportunity to gain personal financial awards and incentives as pocket money, for every postgraduate they recruited in their research. According to him:

*"In this project we could achieve a good capacity building… We could easily attract 5 MSc students who wrote their thesis in the same area; and two PhD students. You know we needed them to assist us in our research. We also get better incentives and at the same time. TRC rewarded us a pocket money for every student we involved and graduated in the project which is really stimulating." (Ac8, SQU)*

The academics submitted a research proposal application through their university's TRC institutional focal point. The application was accepted. Before signing the Research Grant Agreement and granting the funding, and as the factory was involved from the beginning, TRC requested the academics to reach an agreement with the factory's GM about the nature of his involvement within the project (either as a research partner or a research assistant). After negotiation, the academics decided to recruit one of the factory's experts as an industrial research assistant. Their decision related to the freedom given by TRC to accomplish the research proposal criterion of 'economic impact'. The TRC's non-interference is combined with the fact that the process is influenced mainly by generating knowledge according to the academics' interests and motives, where the decision and nature of user involvement is left to the academics. The academics wanted to grab the opportunity of adding more value to their research by addressing the criteria in a practical way and without the user's interference in their right of appropriating the outcome in the future. This can be evidenced from the statement given by the Principle Investigator:

*"TRC gave free hands you know without interfering in anything. They were supportive and agreed in any initiative we took… they gave us a chance to involve one factory as an assistant research that didn't have any right to interfere in the way we deal with our research outcome. So they give us the freedom which I found encouraging." (Ac8, SQU)*

The academics' decision of user non-interference in their research outcome is linked to their anxiety in involving him as a research partner. Within the rules of the funding program, and considering him as a partner, the factory's GM had the

right to pre-screen the proposed publications before publishing. Moreover, he would have the full right to delay publications to allow for protecting commercial advantage. Therefore, they preferred to avoid partnering with the factory where secrecy and withholding data was included, which would consequently hinder them from imminent appropriation of generated outcomes through publications. This is evidenced through the statement of one of the Co-Investigators:

*"No! The factory wasn't considered as a research partner. It was recruited as a consultant only after the contract with TRC was signed… You know if we have an industry as a partner in the project there is a possibility that they won't allow us to get use of our outcomes properly. For example, in ORG they will have right to withhold publications or information dissemination." (Ac9, SQU)*

**In summary,** the successful collaboration was facilitated by the motives of the involved actors, which resulted in transforming the outcomes into a useful system. Despite their different motives, all the actors stood to benefit. However, such benefit was perceived to be different for each actor because of the institutional financial incentives developed within ORG funding. In this respect, the academics saw the opportunity of generating revenue: for their organisation through securing funds for establishing a laboratory (e.g. equipment, research assistants) which can be used for further research; and for themselves through securing personal income (e.g. reward funding for every student they involved in the project). Likewise, the user saw the opportunity of securing additional income through industrial consultancy.

The analysis also identified a positive factor that contributed to the decision of the user to engage in collaborative activities with academics. For him, collaboration appears to involve relatively little cost apart from time and usage of the existing resources (e.g. HR) involved in helping the academics develop the recipe. This was viewed as considerably beneficial because of the attributes of the knowledge to be produced: New technological development and implementation for enhancing date quality. For ORG, collaboration was to be

encouraged as it constituted the core justification for the existence of their organisation/fund.

### 4.4 Knowledge Appropriation:

This section focuses on the actions/activities taken by the involved actors in the process of knowledge appropriation. These actions were enabled and constrained by the formal institutions related to transferring knowledge through IPR.

#### 4.4.1 IP Disclosure Theme: The academics' choice of disclosing their expected IP to their university and the university's failure to appropriate the generated outcome:

After an agreement was reached, a Research Grant Agreement was signed by the three parties (academics, university, and TRC) and a fund of OMR 109, 100 was granted successfully. A formal contractual agreement was signed by the academics and the factory involved. The contract included the recruitment of the factory's dates-quality-expert as an industrial research assistant subject to a fee of OMR 2000 per year (or OMR 35/hour) allocated by the academics as part of the project's direct costs/expenses. The project made considerable progress in the form of system development and testing viability. The academics and the factory's expert worked collectively to make sure that the generated system was new and confirmed the required grade quality standards of dates.

As the user was excluded from protecting the generated system for his own commercial advantage, and in accordance with the ORG rule of conferring the ownership to the university, the academics, with their university, have the ultimate right to either disseminate or not the full account (including the scientific aspect) of the research findings. To ensure dissemination doesn't preclude the ability to file for a patent, the University's Innovation Director negotiated with the Principle Investigator the opportunity of assessing the potentiality of patenting for their generated quality system. She asked him to file a patent application

before any scientific description of the potential invention was disclosed through publication. This is, as mentioned in the governance structure, as per the right given by TRC for the university to delay publication if it stands in the way of patent protection so that exploitation can be achieved through licensing afterward. As argued by the Director herself:

*"We are trying to say don't publish. We are searching by our team in the innovation department by going to the principle investigator as he getting the benefits of 1,500 OMR of publication. We asked him to file a patent application before publication. I prefer for patenting not to go that way and better to wait for one and half year, it might patent and nobody knows about it at that time.'' (UO2, SQU)*

After negotiation, and as per his responsibility of reporting any intellectual property arising from his research project, the Principle Investigator decided to disclose the IP to his University's Innovation Department, which consequently assessed the potential patentability of the generated system through the US IP Company. However, the application was rejected by the company. This is in relation to the action taken by the academics in knowledge production, of using and applying an existing computer vision technique in the Omani context. The Principle Investigator also used his past experience of using the same technology as he had previously implemented it successfully in other international agricultural products. Therefore, novelty was not maintained. The generated system was found to be inconsistent with the international criterion of 'inventive step' as the academics' outcome was an obvious development of what had come before. This criterion is a general patentability requirement of US patent international laws, according to which an invention should be sufficiently inventive. Evidence of this argument is the statement given by the University's Innovation Director:

*''We evaluated the system. It was not recommended for patenting because it didn't reach the criterion of inventive step. The academics just developed and*

*applied an existed system in new context. So it was not an invention.'' (UO2, SQU)*

The academics', particularly the PI's, action of developing their outcome away from patentability was influenced by the fact that the academics derived the research conducted primarily for the purposes of publication. In this respect, he didn't believe that they should appropriate their generated system by patenting. He believed that this was not their job as scientists and preferred that they do their routine academic job of conducting research for the purpose of knowledge dissemination and awareness creation through publication. Therefore, he found it costly to go through the long process of patenting as it delayed publications, evidenced in the following statement given by him:

*''I am not a patent person. See I am not interested in patenting at all, because I like to disseminate as much as possible. If you take that root you will scarify and compromise many things such as carrying on publication. I don't want that. I am very happy with the routine academics; I am fine and I don't want to take that patent root.'' (Ac8, SQU)*

In addition to their beliefs, the academics' action was influenced by many other factors. These emerged from the developed (publication) and underdeveloped (patenting) incentives of the university and the developed rules (incentives) and regulations followed by the TRC/ORG. From the academics' perspective, the main reason for their action is related mostly to the underlying contradiction of IP incentives within the university, mentioned in the governance structure. In this respect, the academics found it costly to go through the patenting process as their academic promotion is based only on publications and specifically on the number of published papers rather than on patenting or IP development. There is a lack of tangible return, especially a lack of 'patenting incentive'. This can be evidenced more by the fact that the system of research in the university has been approved to provide incentives, such as 'publication awards', for researchers to carry out research with the aim of publishing, as publishing is the only way for them to achieve promotion. Therefore, going through the process of

patenting will not add any value to their professional profile within the university. Evidence is given by the following two statements:

"*You know publishing papers is important for our promotion…having patent it doesn't have any weight in our promotion here (in SQU). So going through such a process (patenting) from my view doesn't yield much benefit as publication.'' (Ac10, SQU)*

This is supported by one of the university's Officers, who relates the academics' action to their preference of gaining publication incentives in opposition to patenting, which is absent as an incentive for their academic promotion. Therefore, during knowledge production, the academics were not concerned about developing their research outcomes towards invention. He argued:

*''They (academics) don't want to go through the path of IP, they get the money and publishing his work and get promotion… The incentive for patented innovation is still not there…They would say why I bother myself to go through IP process, so what is the benefit of patenting to academics, nothing.'' (UO3, SQU)*

Moreover, and from their perspective, the other reason for their action was related to the underlying/fundamental consistency between the ORG and the university's developed incentive of publication for academics' IP disclosure, as mentioned in the governance structure. In this respect, and in the absence of patenting incentives, the academics found it more beneficial to use their time and effort in utilising opportunities that make them focus on disclosing their outcomes through publication. From the ORG's side, they wanted to make use of the publication incentives provided by TRC within the ORG's Researcher Incentive Program. As mentioned above and in addition to its intention to provide funds for publishing (e.g. books, chapters in books, and in referred journals such as SCOPUS), TRC acknowledges academics' roles in knowledge production by granting them personal financial incentives as rewards whenever the academics took initiatives to publish the outcomes of their ORG research.

This is in addition to the other aforementioned main reason of securing additional income. Similarly, the academics wanted to make use of the publication incentives provided by their university. The university recognized its academics' best research efforts by providing them with financial awards such as 'outstanding researcher' and 'distinction in research'. The academics found these incentives more beneficial as they give them better credits for their research efforts. They are consistent with their motive of 'achieving research productivity' by gaining credit for publishing their outcomes through different channels, thus increasing the number of publication in their research profile, and fulfilling the criterion for their academic promotion. As argued by one of the Co-Investigators:

*"Even TRC has omitted to that (salaries), if you publish a paper you get some money, books chapters these are more sufficient you know… we got publication, supervision for students, books and all credits are coming to us.. It is very motivating because this additive to our research profile which help in accelerating and achieving condition for our promotion." (Ac9, SQU)*

**In summary,** there is a conflict between academics' logics of 'openness' and university's logic of 'secrecy', which is promoted by 'patenting'. For academics, secrecy through patenting appears to involve significant costs of publication delay and publication rights infringement, which is important for their academic promotion (in which invention development is not included). As academics are driven by the incentive of promotion, the university needs to rectify this issue by modifying the system, for instance, through introducing 'the development of invention' as an incentive for academic promotion. Yet, there is a likelihood that the academics' decision of creating knowledge away from invention was strongly affected by their logic of 'openness' or 'open science', hence, even if the university introduced such an incentive in promotion, the achievement of their motive of 'secrecy through patenting' will not be achieved, due the academics' norms of knowledge dissemination. Moreover, the academics' decision can be potentially affected by their personal remuneration from the

complementary benefits embedded within the publication incentives provided by the fund (e.g. securing additional personal income through students' involvement and publication actions, publishing books and journals, etc.); and their university (e.g. outstanding research financial awards).

In this section another issue is discussed. The absence of invention assessment during the knowledge production phase resulted in the university's failure of directing its academics' research action towards inventive outcomes, consequently, hindering it from appropriating the knowledge generated. This was partly influenced by the fund's prevailing institutional procedure of permitting the engagement of the university's innovation department after the knowledge was generated, predominately, by the absence of operational guidelines. Hence, the opportunity of directing the creation of knowledge toward invention while conducting research was neglected. For the university, the absence of such an assessment throughout production appeared to involve the loss of time and money. While for ORG, the absence of such an assessment stemmed from its organisation's (TRC) objective of building research capacity (increasing number of researchers and publications) in areas of national priority.

### *4.4.2 Academics' and TRC's action of exploiting the generated system: The non-commercial user's refusal to implement the generated system within local factories:*

Since the university was unable to appropriate the generated system through patenting, the academics pursued their purpose of publication. They could publish, through TRC/ORG, ten articles in ten high ranked international journals, three book chapters, and a full book, in addition to refereed conference proceedings and 18 posters. As per the agreed responsibility of the university in making appropriate efforts to exploit the advances of the published research outcomes, mentioned in the governance structure, the academics, with their college, decided to demonstrate the generated system through a workshop funded by TRC. They invited relevant commercial (private sector) and non-

commercial (public sector such as ministries) users to the workshop, and they educated people by showing them the practicability of their proposed system, which is part of their role to improve the quality of agricultural products by creating knowledge awareness to ensure its application. This can be evidenced by the following statement given by the Principle Investigator:

*''we disseminated our quality assessing system through workshop. There were people from the public sector such as ministries, Muscat municipality and some private industries. It was a full day workshop and it was very full received because it was about dates. See as agriculture scientists we want people to be aware about the system. Creating awareness is important so they know how to use it in solving dates quality problem.'' (Ac8, SQU)*

The users' feedback was positive. Thus, TRC asked the concerned governmental entities overseeing 'date' issues to adopt the system and implement it in existing local factories. It also asked the academics to submit a full account (final reports, CDs) of their generated system to the same entities. However, the entities were hesitant to adopt the system and asked TRC to implement and cover the cost of implementation, since the system was generated through researches funded by their ORGs. One of the TRC's Officers found this unacceptable as their responsibility ended the moment the academics submit the final report with the proposed system to the main stakeholders. This concern can be demonstrated by the parameter that defines the scope of the process followed by TRC within ORG, which is influenced by the goal of achieving knowledge generation as a way to encourage academics to participate in research to find solutions to national issues. In this respect, TR is not responsible for implementing the research outcomes (e.g. generated system) as this is not considered to be a funding objective within the ORG's knowledge generation process. Therefore, the responsibility of implementation was left to the stakeholders. As argued by him:

"*Now who is responsible to implement the recommendations (generated system)? The governmental organisations said TRC. No it is not TRC job to*

*implement these, so our job is to fund researchers to come up with these recommendations. They said if you want us to implement these recommendations you have to fund us. We say look we are not a funding agency to do your job! This is an example of disagreement. It is financial and also implementation of course." (PPMF2, TRC)*

In addition to the financial cost, and from the TRC's Officers perspective, the stakeholders' hesitation of implementation was influenced by their lack of R&D policy. They already have other assigned national administrative priorities. These priorities have been relatively well defined and distributed to all units in which R&D is not included. This can be evidenced by the effort taken by TRC, during system generation, in involving entities informally in the negotiation meetings of the project committees, as a way to make them accountable for the application of the outcomes. Therefore, TRC was not intended to impose implementation and left it to the ministry to decide whether to apply the generated system or not. According to him:

*"In the project negotiation meeting we tried to include somebody from those units in the team of research. But we do not see anybody from there… In governmental units such as ministries research is not on their table!! This is not something that they are interested to do. And if they are not interested they will not. So this was a way of KT and implementation, but impose or force implementation no." (PPMF2, TRC)*

**In summary**, the exclusion of the commercial user from the innovation process resulted in the failure of appropriating the value of the generated knowledge. Such exclusion was influenced by the academics' logic of 'openness' in opposition to the user's 'secrecy or data-withholding'. The academics' logic was achieved through the fund prevailing rule (e.g. academics freedom of including/excluding the user from IP ownership). For them, the involvement of the user as a partner appeared to involve the considerable cost of violating the traditional ethos of their science and conflicts with their intrinsic aspect of the reward system, which is based on establishing IP priority through publications

(e.g. publication as an incentive for promotion). The commercial user's inability to appropriate the knowledge generated was also affected by the fund and the non-commercial user's (e.g. ministry) misalignment strategies. Although the implementation of the research outcomes is absent as a goal within the fund, an operational initiative (e.g. implementation negotiation) was taken by its officers to ensure the practical application of the generated outcomes. Yet, such initiative was not in synchronization with the non-commercial user's (ministry) prevailing institutional prerogative. For the user, the practical application of the outcomes appeared to involve the cost of financial liability since it is not assigned as one of its mandates (e.g. lack of R&D strategy). Hence, such misalignment merits exploration. Again and as mentioned in case A, such misalignment can be explored through the lens of institutional fragmentation.

### 4.5 Appendix conclusion:

In conclusion, this appendix has isolated each individual case and examined it thoroughly. This allowed the researcher to develop detailed descriptions of all four cases in this study. As a result, patterns have emerged from within each of the individual cases. Next is the cross-case analysis chapter, which will attempt to examine the data and the emergent patterns across all four cases.

### References:


IIC 2010, *Form-2 Proposal Research Contract*, Industrial Innovation Center, Muscat

IIC 2010, *Form-6 Terms and Conditions*, Industrial Innovation Center, Muscat

IIC 2014, *Annual Evaluation Report, 2014,* Industrial Innovation Center, Muscat

ORG 2014, *ORG Policy Report 2014*, The Research Council, Muscat

SQU 2013, *University Strategic Plan*, Sultan Qaboos University, Muscat

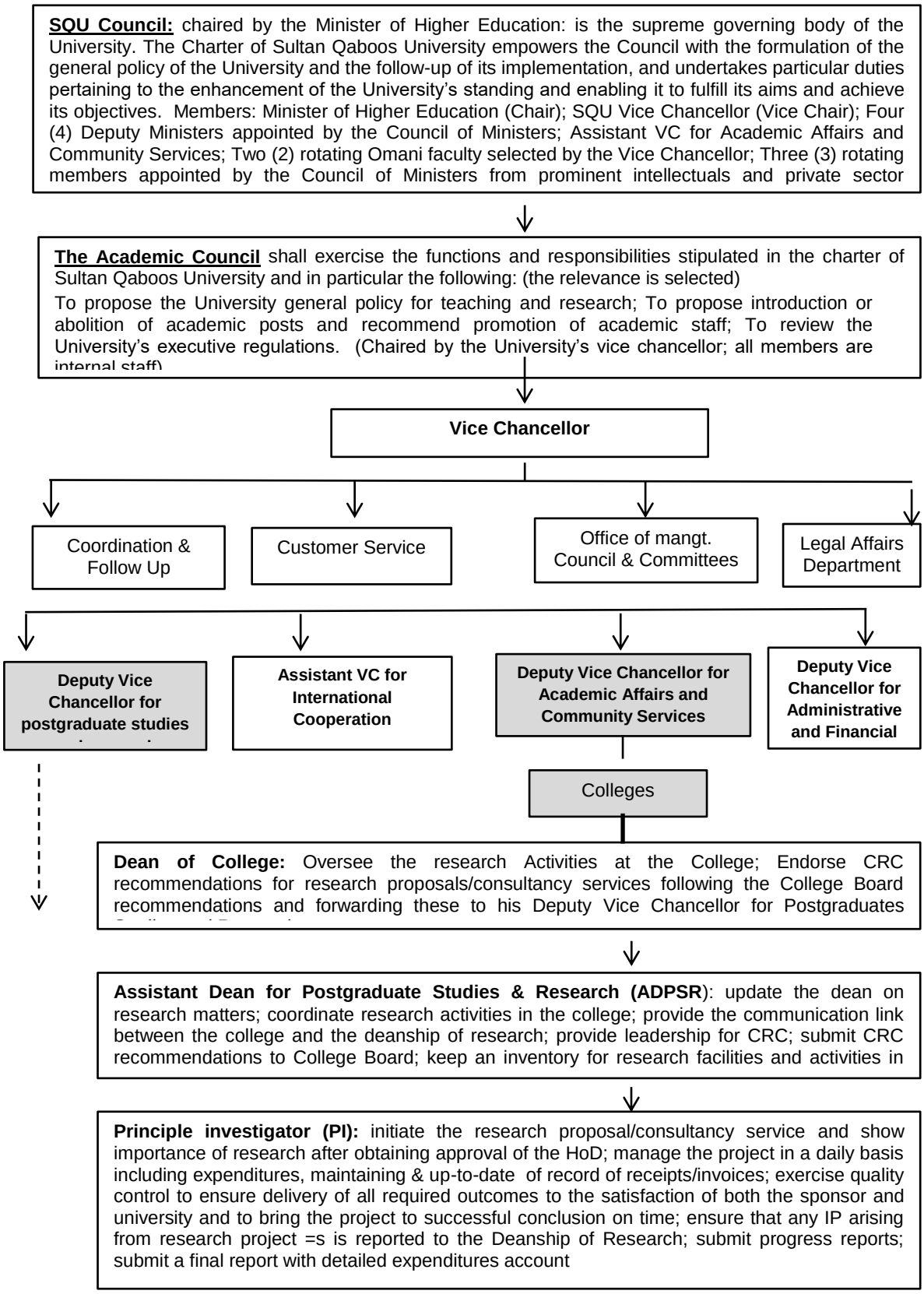
SQU 2014, *B&P IP agreement*, Sultan Qaboos University, Muscat

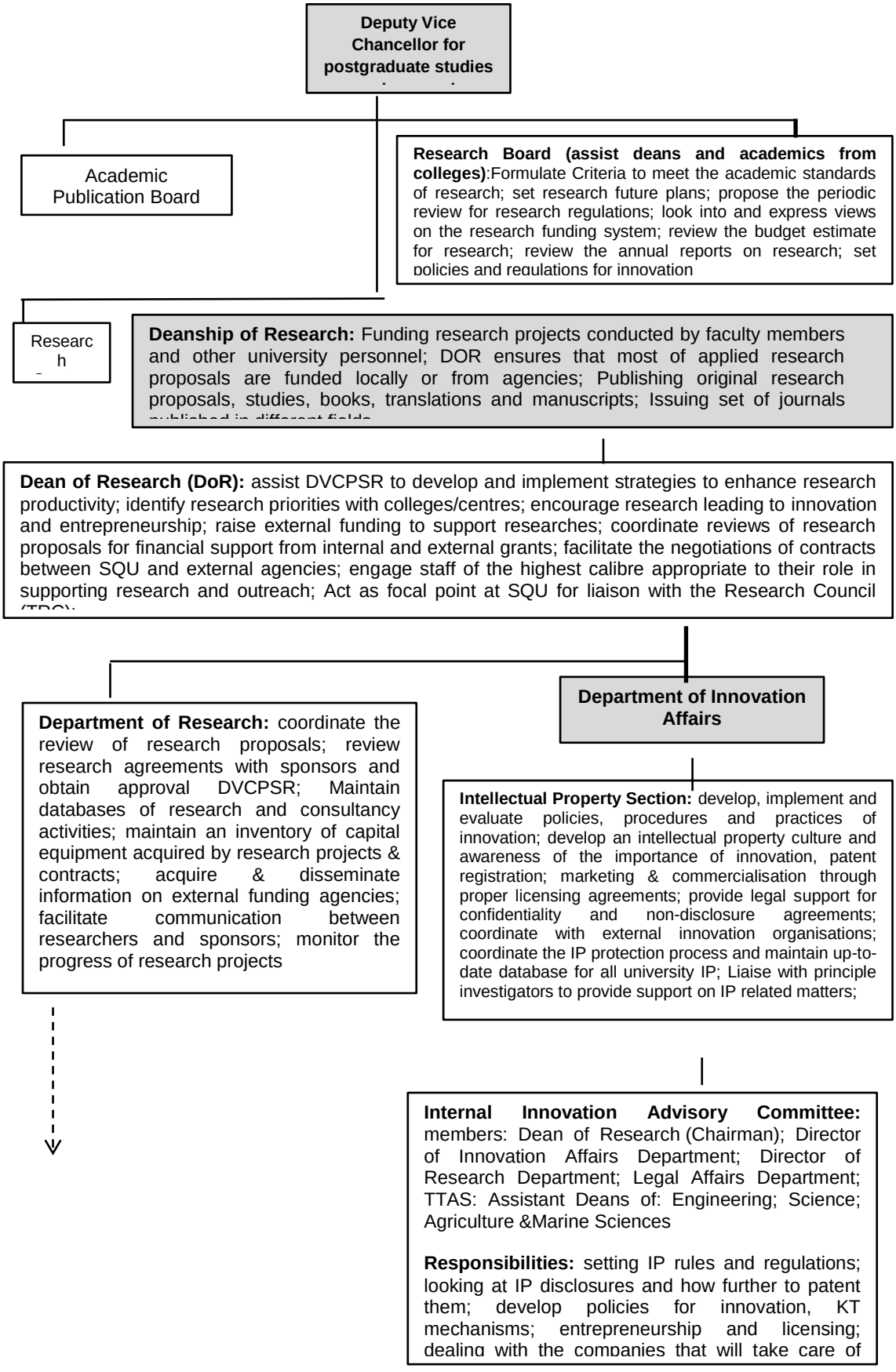
SQU 2014, *Research Regulations Annual Report*, Sultan Qaboos University, Muscat

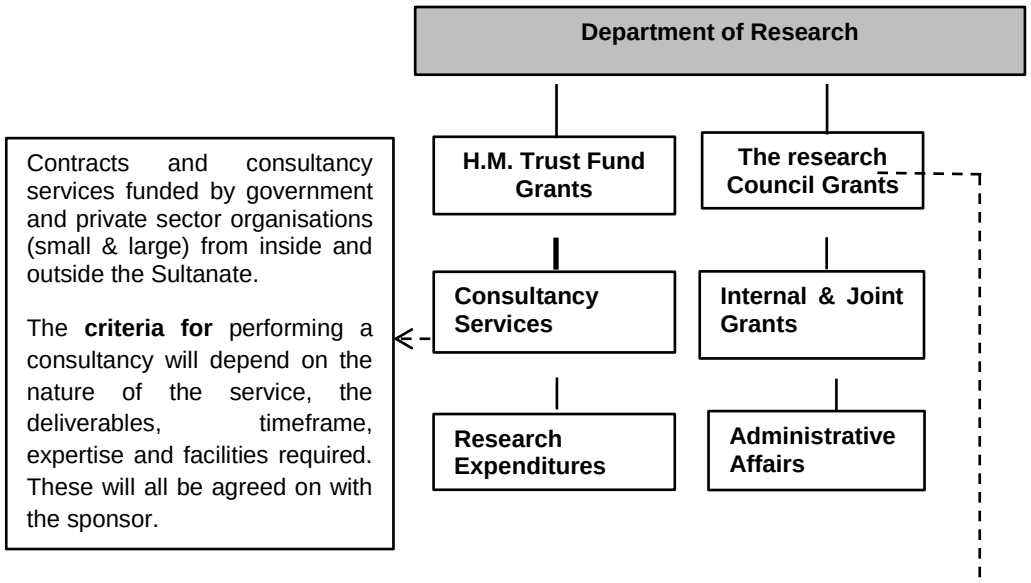
SQU 2015, *Research Contract Agreement Form*, viewed 10 December 2015, <https://www.squ.edu.om./Researh-Department/Application-Forms>

TRC 2014, *TRC Research Annual Report*, The Research Council, Muscat.

## Appendix 2: SQU and TRC Governance and Organisational Structures




Deputy Vice Chancellor for postgraduate studies
Academic Publication Board
Research Board (assist deans and academics from colleges):Formulate Criteria to meet the academic standards of research; set research future plans; propose the periodic review for research regulations; look into and express views on the research funding system; review the budget estimate for research; review the annual reports on research; set policies and regulations for innovation
Researc h
Deanship of Research: Funding research projects conducted by faculty members and other university personnel; DOR ensures that most of applied research proposals are funded locally or from agencies; Publishing original research proposals, studies, books, translations and manuscripts; Issuing set of journals
Dean of Research (DoR): assist DVCPSR to develop and implement strategies to enhance research productivity; identify research priorities with colleges/centres; encourage research leading to innovation and entrepreneurship; raise external funding to support researches; coordinate reviews of research proposals for financial support from internal and external grants; facilitate the negotiations of contracts between SQU and external agencies; engage staff of the highest calibre appropriate to their role in supporting research and outreach; Act as focal point at SQU for liaison with the Research Council
Department of Research: coordinate the review of research proposals; review research agreements with sponsors and obtain approval DVCPSR; Maintain databases of research and consultancy activities; maintain an inventory of capital equipment acquired by research projects & contracts; acquire & disseminate information on external funding agencies; facilitate communication between researchers and sponsors; monitor the progress of research projects
Department of Innovation Affairs
Intellectual Property Section: develop, implement and evaluate policies, procedures and practices of innovation; develop an intellectual property culture and awareness of the importance of innovation, patent registration; marketing & commercialisation through proper licensing agreements; provide legal support for confidentiality and non-disclosure agreements; coordinate with external innovation organisations; coordinate the IP protection process and maintain up-to-date database for all university IP; Liaise with principle investigators to provide support on IP related matters;
Internal Innovation Advisory Committee: members: Dean of Research (Chairman); Director of Innovation Affairs Department; Director of Research Department; Legal Affairs Department; TTAS: Assistant Deans of: Engineering; Science; Agriculture &Marine Sciences
Responsibilities: setting IP rules and regulations; looking at IP disclosures and how further to patent them; develop policies for innovation, KT mechanisms; entrepreneurship and licensing; dealing with the companies that will take care of

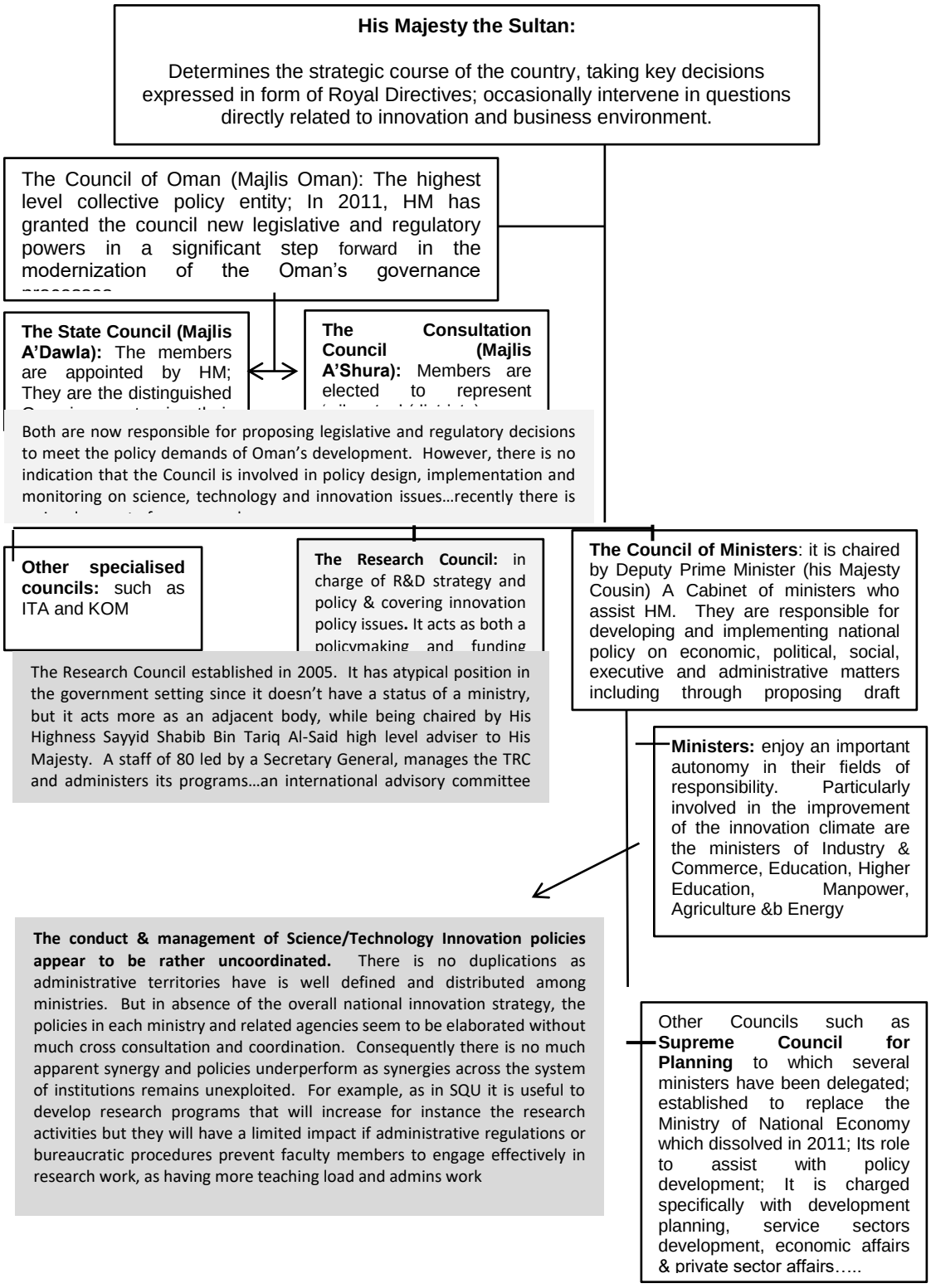



**Open Research Grants & Strategic Research Grants:** funding researches that fit with the economic and social issues in Oman and present the international trends in the concerned proposed field.

**Institutional Focal point:** aim is to facilitate the procedures between researchers and TRC as well as facilitate the delivery all researchers' requirements to TRC

**Responsibilities:** assess the eligibility of proposals to TRC format (check the formats that is required by TRC); send the proposals to the concerned research sector (there are six sectors); link between academics/researchers and TRC; Manage the funded projects by specifying the needs of researchers (financial, materials, time, etc.), create awareness about the TRC procedures and rules, finding new ways to fulfil the researchers needs, participate in TRC meetings to discuss the proposed researches (a way to negotiate the importance and value of the researches, in order to ensure getting the fund), send the researchers needs to TRC electronically, follow up the project expenditures during the project implementation period, matching expenditures of university and TRC, make sure the required fund is paid by TRC and entering the amount in the university's HR system; follow up the progress of those projects….

**TRC Governance and Organisational Structure**



## Appendix 3: TRC Governing Board

**Royal Decree 30/2010**

**TRC Board Members**

**TRC Chairman is the chair of the board**

**Members: First as per their positions in the country:**

1. Minister of Higher Education, the Deputy Chairman (the chairperson of the SQU Council)
2. Minister of Health
3. Minister of Oil & Gas (chairman of the PDO Board of Directors)
4. Minister of Education
5. Minister of Social Development
6. Secretary General of the Ministry of the National Economy
7. Undersecretary of Ministry of Agriculture
8. Undersecretary of Ministry of Fisheries
9. Undersecretary of Ministry Commerce & Industry for Commerce and Industry (the chairman of the PEIE-Public Establishment of Industrial Estates)
10. Secretary General of TRC
11. Chairman of Chamber of Commerce
12. SQU Vice Chancellor
13. Chancellors of three private universities, who will be selected according to their active contribution in Scientific research; they are selected by the chairman after getting approval from the Board members; their membership last for four years up to renewal; no need to get the approval again as they got it in the first selection (Royal Decree 2005/54 these universities were: Sohar University, Nizwa University and Dohfar University)
14. GM of KOM

**Second as per their personal identification:**

1. Two public persons who concerns about scientific research
2. Two persons with high scientific qualification with practical experience in managing financial establishments or international/multinational companies

operating in Oman (they are appointed by the chairman after getting agreement for their organisations; their membership last for four years up to renewal for one time only)

**Responsibilities of the Board:**

Responsible to approve and make amendments to the organisational structure of TRC

It should achieve the duties of the TRC as stated in article (5): TRC Objectives (overwhelming research or overpowering in effect or strength)

1. Draw the TRC policy and strategy that it should follow to achieve its national duty
2. Formulate a complete scientific research[28] strategy with the participation of the concerned units in Oman and follow its developments
3. Develop a national plan/strategy for scientific research (NRS) and specify its priorities with reflect to the requirements of economic and social development plans in coordination with the concerned units in Oman; to make it known to public (publicize) in order to create the motive towards scientific research development; Develop the required programs to implement the identified national research priorities as per the plan and supervise the implementation of these programs
4. Support individual innovation and research programs/projects in accordance with national research priorities
5. Support the publication of valuable outcomes; organize conferences and activities relevant to scientific researches
6. Encourage private sector establishments, companies and others to participate in the arenas of scientific research and fund/support their participation

[28]scientific research in this context, and according to the Royal decree, means the activities that are organized in the different scientific and human aspects, which are aimed at production of new knowledge through following and performing a specific methodical study and it includes academic, applied and development researches including innovation

7. Distribute the allocated budget of the TRC over the different programs according to the priorities of the NRS (see the slides about the national priorities)
8. Ensure achieving the cooperation and coordination between the governmental administrative units and between these units and the private sector in scientific research arenas in a way to ensure the achievement of the expected benefit from the research activities and programs (that's mean achieving the goals of each program)
9. Develop the required parameters to evaluate the and approve projects of the scientific research (the parameters are in each program, read carefully and get them)
10. Ensure the provision of the needs required to establish a strong infrastructure for scientific research
11. Develop and apply/implement programs aimed at creating awareness about the importance of scientific research and innovation
12. Give consultancy services regarding the areas of scientific research
13. Build a national database for scientific research by getting use of the data, statistics and reports submitted by governmental and private units which concerned about scientific research (SMEs is not as they have lack of R&D, therefore they get it form large companies)
14. Declare and approve the policy and programs for building research capacity of national researchers and students in scientific research areas
15. Suggest the regulations and laws of the royal decrees relevant/specific to scientific research in coordination with concerned units; and declare/approve the decisions related to its specifications (special fields)… they are suggesting laws to be declared as a royal decree, they have the authority and freedom
16. Represent Oman in national/regional and international conferences and meetings that relevant to the scientific research
17. Ensure the development of initiatives in supporting and cooperating with international scientific establishments in Scientific research aspects; initiate and sign agreements and MoU that are required in coordination with the concerned units
18. Study the subjects related to Scientific research that raised by the Council of Ministers

19. Perform any tasks relevant to Scientific research appointed by HM

**Decision-making**:

The Board meets at least three times annually via an invitation from the chairman; meet whenever it is necessary; most members should attend including the meeting chair person;

Decisions are made by getting the votes of most members; if these votes are even in this case the side with the meeting chairperson will win;

The Board regulations and work system are placed according to the bylaws decided by the Chairman, these bylaws should be presented to the Board before declaration;

In case of the absence of the chairman his deputy (minister of higher education) takes his place;

The Board can be assisted by a consultation committee, formulated by a decision from the chairman after getting the agreement of the board members as well as the concerned organisations; members should be the GMs of popular international companies, chancellors of well-known universities pioneered in scientific research practices; their rewards are assigned by the chairman of TRC (the advisory committee)

The committee responsible to give advises and solution for issues brought by the Board members or the Chairman; the Chairman can invite the committee members to attend the Board meetings without giving them the right to vote in any decision;

## Appendix 4: Statement of Ethics Approval

Ethics Application: E370

Thank you for submitting the amendments, these have been reviewed now and the Chair of the Humanities, Social and Health Sciences Research Ethics Panel has considered the documentation also. I am pleased to inform you that the Chair of the Research Ethics Panel has confirmed approval of your research study, with no further ethics scrutiny required. Please add a sentence onto any material you share with participants confirming that ethics approval has been granted by the Chair of the Humanities, Social and Health Sciences Research Ethics Panel at the University of Bradford on 16th June 2014.

Best Wishes

**Omar Ali**
Research Funding Coordinator
Research & Knowledge Transfer Support
Room C.21, Richmond Building
University of Bradford
BD7 1DP
Tel: 01274 233112
Email: o.f.ali@bradford.ac.uk

## Appendix 5: Information sheet &Informed Consent Form


**Information Sheet**

Researcher Name: **Faiza Awladthani**

Title of Project: **University Knowledge Commercialisation through Institutional Logics Perspective: the Case of Oman**

You are being invited to take part in a research study. Before you decide, it is important for you to understand why the research is being done and what it will involve. Please take your time to read the following information carefully and discuss it with others if you wish. Ask me if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

The purpose of the research, which is part of my doctoral thesis, is to explore how rules governing knowledge transfer between university and industry are created through the interaction of multiple actors from universities, governmental bodies and enterprises. In order to achieve this it became imperative that I talk to people who are directly involved and have considerable experience of the research phenomena. This is why I am carrying out the interviews.

You have been chosen because you are either a knowledge producer, knowledge user or a knowledge policymaker or an expert in the field, who are involved and interacted in the process of rules creation. It is expected that the interview could well last 1-2 hours. It is up to you to decide whether or not to take part. If you do decide to take part you will be given this information sheet to keep and asked to sign a consent form. If you decide to take part you are still free to withdraw at any time and without giving a reason. As well as you can take a short break or terminate the interview if you wish to do so.

All the information that is collected from you during this research will be kept secure and any identifying material, such as names and addresses will be removed in order to ensure your anonymity. It is important to mention that the data will be retained by the

university for ten years for audit purposes. It is also anticipated that the research will be written up into a report which may be published at a later date. However, your anonymity will be ensured, including the anonymity of your quotes, and all the information I have collected about you will continue to be kept secure and confidential.

Please note that if you decide to withdraw your data from the study after participation you can do this within two weeks as after this period the researcher will have already written up the report.

If you require any further information about the research please contact me by email; fssawlad@student.bradford.ac.uk or contact me at 0096892099876 or 00447843709678.

Thank you for reading this information sheet and for considering taking part in this research.

**CONSENT FORM**

Name of Researcher: **Faiza Awladthani**

Title of Project: **University Knowledge Commercialisation through an Institutional Logics Perspective: The Case of Oman**

Thank you for considering being interviewed as part of this research project. I would be grateful if you would read through the following questions and indicate your response to each of them. The purpose of this is to ensure that you are fully aware of the purpose of this research and that you are willing to take part.

| | | **Yes** | **No** |
|---|---|---|---|
| 1 | I have been informed about the purpose of the study and have had the opportunity to ask questions about it if I wished. | | |
| 2 | I understand that I can withdraw from the study up to two weeks after the interview, without giving a reason and that my data will not be included in the research. | | |
| 3 | I understand that I am free to choose not to answer a question without giving a reason why | | |
| 4 | I have been informed that the interview will be audio-recorded and I give my consent for this recording to be made. | | |
| 5 | understand that extracts from the recording might be used in a publication at a later date | | |
| 6 | I confirm that I have not been involved in a similar study in the past 6 months. | | |
| 7 | I understand that if extracts from the recording are used any identifying information about me will be removed and anonymity will be ensured. | | |
| 8 | I confirm that I require the name of my organisation to remain anonymous. | | |

I give my consent to take part in the research.

**Participant**

Signed ……..

NAME IN BLOCK LETTERS …..……

Date ……..

Date ……..

(*note: if NO then the name of your organisation will be made available in my PhD thesis and any publications at a later date)

## Appendix 6: Interview Guide

### The interview Guide

This document will be used as a frame to guide the interviews. The order and the nature of the questions within each section will be flexible and adapted to the course of the discussion in order to keep the talk flowing. Interviews always started with an introduction explaining the research scope and aims, and the objectives, proposed duration and course of the interview.

**Key Informants from University, Industry and Government**

Does knowledge transfer between universities and enterprises exist?

What are the policies applied to enhance knowledge transfer from universities to industry? Can you please explain?

Do you think both universities and enterprises have a good environment for knowledge transfer?

What do you think motivate academics and enterprises to participate and become partners?

What are the rules that govern knowledge transfer between universities and enterprises? Can you please explain?

Who are involved in making those rules?

How did their participation come about?

What are their responsibilities? Could you draw a diagram of the actors in charge with their role? Which one is most important? Why?

What do you think the limiting factors for implementing these rules? Why?

What do you think the factors that facilitate their implementation? Why?

What do you think as the major challenges of knowledge transfer in Oman? Why?

**Academics:**

Do you have any personal experience with knowledge transfer? What is it? How did it come about?

What do you think motivates you to participate with enterprises?

How did this participation come about? When did it start?

What are your responsibilities? Can you please explain?

Who are the individuals do you network with from industry and government? What type of communication is involved in such networking?

What are the rules you were involved in making in order to transfer your knowledge?

Why do you think these rules are important? Can you please explain?

Could you explain how rules have been implemented? When did they start? Have they been applied?

Who are in charge of monitoring results? To whom are results sent?

What do you think the limiting factors for implementing these rules? Why?

What do you think the factors that facilitate their implementation? Why?

Do you think your university provides you with required knowledge transfer environment? Can you please explain?

What do you think are the main challenges of knowledge transfer in your university?

What do you think are the main challenges in interacting with other actors from industry and government?

Based in your experience, what are the most important factors that make university knowledge transfer successful? Why?

Overall, what are the impediments to successful knowledge/technology transfer in Oman? How do you think could this be improved?

**Enterprises:**

Why do you participate with universities? What motivates/drives you in this participation?

How did this participation come about? When did it start?

What are your responsibilities? Can you please explain?

Who are the individuals do you network with at the university and government levels? What type of communication is involved in such networking?

What are the rules you were involved in making?

Why do you think these rules are important? Can you please explain?

Could you explain how rules have been implemented? When did they start? Have they been applied?

Who are in charge of monitoring results? To whom are results sent?

What do you think the limiting factors for implementing these rules? Why?

What do you think the factors that facilitate their implementation? Why?

Do you think the Omani universities have a good environment for knowledge transfer? Can you please explain? Has it been changed in recent years?

What do you think are the main challenges in interacting with other actors from universities and government?

Overall, what are the impediments to successful knowledge transfer in Oman? How do you think could this be improved?

**Government:**

Why do you participate with universities and industry? What motivates/drives you in this participation?

How did this participation come about? When did it start?

What are your responsibilities? Can you please explain?

Who are the individuals do you network with from the university and industry? What type of communication is involved in such networking?

What are the rules you were involved in making with them?

Why do you think these rules are important? Can you please explain?

Could you explain how rules have been implemented? When did they start? Have they been applied?

Who are in charge of monitoring results? To whom are results sent?

What do you think the limiting factors for implementing these rules? Why?

What do you think the factors that facilitate their implementation? Why?

What do you think are the main challenges in interacting with other actors from universities and industry?

Do you think both universities and enterprises have a good environment for knowledge transfer? Can you please explain? Has it been changed in recent years?

Overall, what are the impediments to successful knowledge transfer in Oman? How do you think could this be improved?

**Closing:**

Thank you for your time. I will email you with a summary of this interview soon, so that you may make any corrections or further comments.

## Appendix 7: Sample of Interview Transcripts

**Interview with an Asst. Professor, Food Science, College of Agriculture and Marine Science, SQU**

**Date: 21/09/2014**
**Time: 12:30 pm- 2.30pm**
**Interviewer: Faiza**

**Interviewee: Ac1**

**Faiza: thank you so much for taking part in this research and the information will be mentioned in this interview will be treated as confidential and anonymous.**

**Faiza: Mr, Ac1, do you have a personal experience in research collaboration with industry? Please explain**

**Ac1:** Yes, I have couple of collaborations with the industry as well as with ministries. For the ministry is like improving dates quality. And developing Omani Halwa with a halwa factory, to see for quality I mean to make low fat low calories halwa

**Faiza: how this participation come about?**

**Ac1:** actually I had a student, he did his master here then he went to Malaysia. From which he got the idea of collaboration. He was very pleased to work on a local product, halwa product. Then he started his research, we started to visit many factories. Then form his thesis we started this project and we contacted one company which was helpful in giving their facilities and the CEO allowed us to use all his piloted plans and we are taking all the ingredients and other thing. But in that work we haven't publish any and the project now it is discontinued. But in the long run maybe we will try to make a patent. But things are still not clear, if we don't have any issues in patenting we could go in different way

**Faiza: can I know the reason why you couldn't publish?**

**Ac1:** no, no they are not against publishing, we can publish. They don't have any problem in publishing the project of Omani Halwa and it comes in the media. Patenting

is not a problem also. The issue is in producing the same name of the product, producing it as an Omani halwa is the issue. We should give a different name such as sweet halwa or totally different name. Many people asked us to change it to go for patenting. But for the time being we discontinued and paths will go in different direction.

**Faiza: so who will do the patenting for you?**

**Ac1:** the patent evaluation is done by the university. We need to submit two pages then the university has its IP office to handle that issue

**Faiza: Why did discontinued the project?**

**Ac1:** the direction has changed. We having the intention that the factory will help us to produce the product and deal with the marketing aspect, but then I thought that's better to think little bit more about it and latter maybe we will decide.

**Faiza: what do you think motivates you to collaborate with the industry?**

**Ac1:** the main motivation is the satisfaction that you feel you are serving the industry. It adds to your profession. Second one is that you learn from them in the real world how they are doing it and also transforming science knowledge through their products and quality.

**Faiza: what do you think motivates the industry?**

**Ac1:** the enterprises are motivated to get some free services that is all. They are still not ready to understand that R&D can give benefits to them. They think government should give everything free. That sort of. They want everything for free.

**Faiza: what were your responsibilities?**

**Ac1:** the main responsibility is to identify ingredients include health aspects and the quality. And then apply, do trial one in the factory and bring it here to do other chemical testing; other research quality and also supervising PhD students.

**Faiza: who usually follow the outcomes of the research?**

**Ac1:** no one actually follow up. We have published two papers, one about what types of Omani halwa do people like? We identify classification of people types. Some like

sweets, some don't like, some like diet, some like yellow colour and from that study we could classify five types of people and their preferences to the industry community and the science, you can market only one generated type, you sell to everyone; we have different branding names and different brands targeting high class or at lease major two or three classes; this is one aspect of the research and we published it in a journal. And second one we again to identify what are the types of available in the market? Okay and we classified how many types, their quality and their characteristics, we found 3,4,5 classes based on sweetness, oiliness, etc. all of these, and that one we also published, only we didn't publish with the new formulation with the name of Omani halwa. We are thinking either to change the name, changing name again another issue might come. By discussing with the people from TRC they said patenting may be less because patent will go only through process and if anything happened they will take care, but until now nothing happened.

**Faiza, so the project is through TRC?**

**Ac1:** it is through IIC which is also a branch of TRC and ministry of commerce

**Faiza: who are the individuals and bodies do you network with from the industry and government?**

**Ac1:** the IIC form the government side. From the industry with Almarai, and with an Omani Halwa company, and we visited some of companies like Oman sweet but we couldn't come up with a research work to develop some items for the school kids, like healthy, good protein food but we didn't do formal project, we discussed a lot of possibilities.

**Faiza: what type of communication channels do you use?**

**Ac1:** mainly through face to face meetings and through phone conversations. But these are not regular, just when they or us fee we/they need something we call and making appointment for a meeting.

**Faiza: I believe you explained the actions that you have been taken within KT, which is publishing?**

**Ac1:** publishing and also news items and media, where there are some issues may occur. You sometimes write something, concern somebody and they make it different

which raise difficulty for researcher. Then it is better to do it in scientific aspect instead. And also different factors involved in different cultures and different country, that's need to take care and it is not easy and simple as in science publications. But sometimes given workshops and presentations through ministry and other organisations.

**Faiza: so in the commercialisation side you have only one case isn't it?**

**Ac1:** yeah but we are working now in some product that we are trying to patent. We don't want to take industry as a partner because of the IP issue. And if we worked with and see there is a patent, they will not give it to the university. We will let the innovation department to do it and handle everything. Then if the industry is interested and feel hmmm local or overseas, it will benefit the university and the researcher. So we give knowledge to propose patent. Another patent we are trying to do in my work of health financial product for magnate scale form Jabal Al-Akhder, they suggested to me to get more specific findings. The university has a lawyer to help in filing the patent; and we worked in another one also, health formulation for preventing diseases like diabetic and others. But these are not completed yet but we are planning to make it as patenting.

**Faiza: do you think you will be able to do that, because the university still doesn't have clear IP rules and regulations?**

**Ac1:** still it is possible because the university has funds to handle legal process. They also give its credentials to the university. I think they are motivated.

**Faiza: so why you didn't approach the industry through and try to commercialise this idea?**

**Ac1:** no even you go to the industry the legal process we can handle it. You have to handle the whole process by yourself. If something happened in between who will take care of you as a researcher, you will be in trouble and we will not be protected. But if we go through the university link, they have legal process and everything they will sort out.

**Faiza: why do you think the commercialisation of the ideas is very important?**

**Ac1:** yes it is important. One thing is to the benefit of the community and the country like one innovation happens actually it didn't benefit the university only like Microsoft Windows, Bill Gate got rich but at the same time the whole world get benefited from his idea. This is a one aspect and for the researchers it is important for credit that they have innovative ideas. Patent is a different way of innovation than publications, it gives more weight for us within the university and industry also. Maybe you will not get project but sometimes you get consultancy. Sometimes you get invitation to participate in changing courses and so on. Sometimes ahhh I will give you one like ahhh video conferencing; one company from USA arranged a video conference and they invited 15 CEO of good industries in USA and they wanted to know what are the new technologies and there were two from USA and I was from Oman, this is one of the things that gives you courage you know**.**

**Faiza: who are in charge of monitoring results? To whom are results sent?**

**Ac1: t**he assistant dean of research in out college though him we do everything and if we need an extension we have an assistant dean for extension services. Actually they communicate with us and we work through them. The same thing for commercialisation side such as patenting and others they also follow them for us.

**Faiza: what do you think the limiting factors for implementing these rules? Why?**

**Ac1: t**he main limiting factor is that the industry is not trained up and dealt up in such a way of understanding the benefits of the R&D. Another factor is the administrative process also which gives a lot of innovation limitations. Other factor is the HR also, you may have enough funds but you may don't have enough skilled people to run the experiments. These are the three factors: industry motivation; the administrative process and the HR

**Faiza: Do you think your university provides you with required knowledge transfer environment? Can you please explain?**

**Ac1: t**he university is encouraging now comparing to earlier days, because there are innovations, industry collaborations, and patenting and IP rights, mentoring the junior people.

**Faiza: what do you think are the main challenges in interacting with other actors from industry and government?**

**Ac1: i**n interacting is materialising at the end a product is very difficult. Reaching final stage is not that simple and easy. When we reached the application stage if the idea we usually face problems. But we are encouraged now to do more patenting to take the credit.

**Faiza: why do you think they dot materialise the outcomes of researches?**

**Ac1: o**ne aspect could be that don't clearly what they will do and they are not clear in their vision and in all aspects they are in their mind are hissy and then if you are clear okay we will support and they also think hundreds of issues which also we don't know. And also they but in such things that if we give this you have to give this which is in research and R&D is very difficult to do. like there is a good shop and you want to buy you pay ten rials to have the product, but in research it is not like that; if you try to negotiate like that then for the researchers it is very difficult to negotiate and reach the final stage.

**Faiza: based in your experience, what are the most important factors that make university knowledge transfer successful? Why?**

**Ac1: n**o in promotion and other career progress is also give credit. If you have many people publish their work and you have patents, I think university and the committee understand that the one with patent has different weight. This is clearly understood by the committee here and the people involved; yes it is not written but it is understood by the management here; but they explored and found that we still don't reach that tangible level.

**Faiza: overall, what are the impediments to successful knowledge/technology transfer in Oman? How do you think could this be improved?**

**Ac1:** many things are not clear. When you want to do no one gives you a clear idea what it is and what to do. I mean the administrative process. For example if I want to buy a pen, so what is the procedure to buy a pen, to whom you will write and how long it will take and then they will say we didn't receive this and that; i have again to go there and get this and that approvals, if IT i have to go to the IT department if not i have to go

to the dean office, innovation department, ahhh different place actually the process is not clear and very slow sometimes

**Faiza: any final word do you want to say**

**Ac1:** no thank you for this interview and hopefully it will help you in your study and it will be beneficial to Oman

**Faiza: Thank you for giving some of your time**

**==========**

**Interview with GM of Expert Software company, Medium Enterprise, Ruwi**

**Date: 07/10/2014**

**Time: 3.15 pm- 4.07pm**

**Interviewer: Faiza**

**Interviewee: CU2**

**Faiza: thank you so much for taking part in this research and the information will be mentioned in this interview will be treated as confidential and anonymous.**

**Faiza: why do you participate with universities? What motivates/drives you in this participation?**

**CU2:** I think during our past operations we wanted actually to come up with something else useful for the market; looking to the market situation today the competition is too high okay it you try to maybe copy and paste and do the normal things as many people are doing you are definitely out of risks. So our way of doing business is trying to think totally different so we thought of areas that not many people can do and willing to do, so that's what we thought like okay we would like to try something else and do it in that way (it is a competitive advantage driver)

**Faiza: what do you think motivate academics and universities to participate and become partners?**

**CU2:** Hmmm for me I think it is a win-win situation, academic can be definitely are very good in thinking, they can think, they can develop and analyse, they have the environment which is requirement for them to analyse things and maybe to come forward with a new technology and so on and we as a solution company as a service provider we are really hunting for those ideas, so I see there is a very good combination between these two entities or organisations if we can call them.

**Faiza: you said you have collaborations with academic, how many collaborations do you have?**

**CU2:** ahh I think we have only one we just started it very recent, the reason that maybe we don't have that much opportunities, we don't have much of exploration in that area but at the moment we are trying with one and the best, and the university that we are dealing with is one of the leading universities in the country.

**Faiza: so can you please give me some explanation about this collaboration?**

**CU2:** the whole was started just when one day I was watching the TV, in one of the programs I saw Dr. Jamail was interviewed and he was talking about his system, okay, I know Dr. Jamail personally so the system he was talking about it is actually very close to what we are doing in our business so I thought that why don't we talk together and understand more so after the interview I called him and told him that I saw you interview in the TV and can we meet and discuss about so there where it has started I spoke to him that the technology and the idea he has I told him very openly, he wants to bring the idea into the market I said I know the difficulties being a businessman and a solution provider and so, so I can help you from that angle okay, I would like to have a very good collaboration with you; you can come up with the idea and we can take it for you into the market. The product and the solution it is more of ahhh you can say a new technology, the concept has been build in a such a way as it is M to M-machine to machine system where he came up with an idea where he can put a device in the vehicle and the device is responsible to transfer the information and you are linking actually the vehicle, linking the information of the road the GIS information, the ROP information; so there are a lot of information which the idea is to bring them together. It

can definitely help many organisations who are maybe involved directly or indirectly with this arrangement.

**Faiza: what are your responsibilities? Can you please explain?**

**CU2:** we tried actually to learn about the strength of each party, so being an academic we cannot play your role and for sure you cannot play or role we are very good when it comes to business orientation, if someone wants to bring a product find a market, to price it to fund a manufacturer or to present it to the market doing the marketing plan, the sales plan and so on we are very good in those areas and you as an academic you are very good in doing research because it is your day to day activity so by understanding the strengths of two parties help us to decide okay fine you will be there and we will be here, so being a company an organisation who is doing business we have to focus more on our strengths, so we said okay you continue in doing the research give us the idea our responsibility is purely bringing that product into an active and actual product which can be utilised and used by the consumer

**Faiza: you said already the person that you are collaborating with is Dr. Jamail as an academic, any other academics?**

**CU2:** Hmmm yeah Dr. Jamail and his colleague Dr. Hafedh both are academics and from our side I have myself and my business partner Mr. Feliger, he is an American citizen so he is working with me; it is like a four people who are actually working closely into this arrangement.

**Faiza: are there any other people involved?**

**CU2:** I think very closely we are working with TRC, because the idea when it has started with Dr. Jamail and then we met together and he informed me that he approached TRC in order to get the funding and move forward, so we went together to TRC and say okay he introduced us as the company whose going to develop and run the business and he will be the person who will do the research and come up with the idea; so there is a very active involvement of TRC in this arrangement that we are doing.

**Faiza: what type of communication is involved in such networking?**

**CU2:** yes I think after we getting in agreement with TRC we will sign a lot of documents of disclosure and confidential agreement and we have filled up the form and even we have short listed with the first group and the second group and third group today I can say we are almost in the final stage of getting the approval even TRC has arranged the patent form US he came and we sat with him, he went through all the documents and we submitted information that we had; I think they asked for information in details about the arrangements and collaboration, our forecast in how are we going to do this, what is the targeted market and so on.. I can say almost more than eight months we had a lot meetings between us hmm maybe the individuals with the academics also together with TRC and in between even they have arranged workshops. They arrange a workshop where they have introduced a gentleman who has more experience in innovation; how innovation happens and what are the strengths and difficulties someone can face and so on; we had a lot of meetings between the three of us.

**Faiza: I think you already have answered the question: What are the rules you were involved in making with academics? With academics and TRC with regards to disclosing and confidentiality and patent, so do you have any other rules?**

**CU2:** hmm maybe because TRC is a local body and for them they really want to ensure that whenever they select any innovation and they want to put it in the market, they want to make sure if it is going to last, it is a very good story and idea, it comes in the parkit of innovative or innovation that can be copied that what I want to say even they invited one of the top IP and patent experts to come and study. Even he has approved our documents. They have also two consultants, one form Russia and the other one from Malaysia. They have also study our documents in details, they asked many questions to understand the technology with the arrangements and so on. So we have signed a lot of documents because they really wanted to make sure that it is going to last and it is active. It is a serious arrangement between the two parties.''

**Faiza: why do you think these rules are important? Can you please explain?**

**CU2:** it is, when we talk about innovation it is really important, because first of all it is not going to be innovation if it is not protected, you need to protect it you need to ensure that in certain extent that this idea is going to last and looking to commercial point of view is it going to really a business or just an idea and it is going to die; because there are many ideas that people thing that they are very good ones and when

you bring it to the market it is too late and so many has already done that, so I really want to say that TRC is really doing a very good job in order to ensure whatever it selected is healthy and can be run for sometimes and also it is very important that it is going to help the society

**Faiza: so the IP who will own the idea?**

**CU2:** ahh it is jointly owned, TRC is not going to be involved in this, they are only funding the idea; they just want to make sure we give the right idea and that idea is going to be materialised in the society. So the ownership is joint between us and the academics; that's why TRC wants to reach a close, there should be an agreement between the two parties, because for them they want to ensure that it is going to last as long as it can. They want to make sure before you start the real work and come forward, have you done your ground work, have you did your investigation, is it clear between both of you before you come to us so we can start giving you the fund, so definitely we have an agreement between us and the SQU.

**Faiza: have these rules been changed? Can you please explain why, how and who are involved in making these changes?**

**CU2:** I think most of changes are like improvements; whenever we see that this point needs to re-discussed again it may to add or to enhance we just add to the existing report.

**Faiza: can you give me some examples?**

**CU2:** ahh it suppose ahh understanding the market, when we say we suppose to have the product being manufactured outside, this was the idea before and when so the opportunities are locally here so we said better to manufacture and assemble the product here so the prospect has changed in that arrangement. The pricing we keep changing because of many elements and so on.

At the moment we are planning to add strong partners and I think you saw the signing of the contract between us and the Belguim company in the news paper; they are the partner that we want to involve because we wanted an experienced partner in this area who can maybe give us a support when it comes from the international point of view; even the idea of this product it is not just be locally viable we want to take this product

globally so we thought maybe they are the best people for us to support, so we have signed an agreement with them.

**Faiza: what is their responsibility? Is it to market the idea outside?**

**CU2:** No, they are going to be the solution provider jointly between us and them we are going to do, because for them they have a very good experience when it comes to the ahhh the world vehicle tracking and monitoring and so on, so they have very good experience in that area.

**Faiza: who are the one who came up with the changes?**

**CU2:** I think from our side we are doing it as a daily activity, understanding the market, learning the changes, and how to market what it is required, so form this area we mostly trying to most of the time brainstorming with all the parties. We say fine why we don't think about this area what if suppose we faced sometime difficulties, what if things don't happen as we move, so I can see everyone is coming up with some points from time to time

**Faiza: are these rules implemented or are still in the implementation stage?**

**CU2:** we are now in the final stage of manufacturing the device, the testing is done, the prototype is also done; the idea and the concept, everything is done. So we are just waiting the green light or the fund from TRC and just go ahead and manufacture the device. So you can see that we are almost in the final stage.

**Faiza: who are in charge of monitoring results? To whom are results sent?**

**CU2:** hmm last meeting we had with TRC we said now with the new arrangement we have new, they have done some new partnership with a small and medium entity which is newly established and Shell company and there is one more, so they said these are their partners. This is because TRC has a limitation of funding so anything above maybe a certain amount so they are not in a position to fund so they have to find other bodies to cover the remaining funds; so the monitoring maybe TRC is not going to do the monitoring because their role end whenever they give you the fund. So may be the new partners ahh if you want to partner someone they will definitely take the role of monitoring, because maybe most of them if they want to invest in some projects they will definitely try to make sure that they will get good results.

**Faiza: who is paying the lion amount of money?**

**CU2:** as I mentioned TRC fund has limit, that's why we will get fund from others, so others are the one who pay more

**Faiza: what do you think the limiting factors for implementing these rules? Why?**

**CU2:** maybe to be very frank, for the country it is typically new; what I found there are some missing factors that we need to consider them out, and according to my understanding we are the first batch in TRC; so there is a lot of learning, try and error and so on; new idea and new concept to the country but it is there in the world people are doing it in daily bases; maybe if someone ask me a question from my point of view of business we don't have any difficulties because we have been doing these and we came from far away as I mentioned to TRC, with you and without we will defiantly be able to do it, we have to do it so we will not go back so but sometimes definitely you keep some projects on hold based on your limitations. Okay I want to start this project I have also other projects in the pipeline so where I divert my investment should I start with this or with the other one, these ones I consider them as limitations in this area maybe the environment is not ready, ahhh to accept such an idea and to make it fast; I hope with our batch because it was taking time but maybe with the new batches things will be faster.

**Faiza: do you mean there is a risk behind applying this idea?**

**CU2:** form business point of view there is no risk. As I said from our side we are doing similar line of business and similar line of products and we have been very fine and we are doing very well. So there is demand, there is market; there is buyer in the market; there is a need for such a solution, so I don't see any risk in investing in such an idea. Because even if we try to say actually the ahhh motivation of this idea is actually saving the life of people, because our system is ahh maybe I will give you an idea, it is a radar; the concept that you are putting a radar instead of having a fixed radar in the road we inviting that radar to be in your car, so you are the judge of your behaviour, shell I speed, I shell not, no outside monitoring you are monitoring yourself so the whole ideas came up with increasing the number of death causality that we having in Oman, it is too scary the number of deaths which we having in daily basis so coming up with such an idea ahh our aim was okay as per the analysis per day we have maybe four deaths

happening in the country, so if we reduce that from two to one then it is a big achievement; what we want to do is to see that how much we can contribute to society; what added value we can bring to the country, then if we are investing I am sure there wont be any risk in bringing this idea into the market.

**Faiza: is ROP involved?**

**CU2:** yes, we really thought about all angles, like what are the difficulties, the objections we will get from the market, so to drill that down and make it more simple we said okay let us start focus until the idea for the society become acceptable; Dr. jamail has a lot of interviews in the media in the TV, even ROP has interviewed him. We are really surprised by receiving call form people and say when this device will be ready because we really need it. we don't want it to be like ahhh going in larger scale at the beginning so let us focus maybe the objections will come from individuals so we wont touch individual vehicles we may start with school buses and I think no one will have any objection to but a system which will secure my kids and your kids so it is an area of no questioning why and how! That is the focus area that we said to have then gradually we will go to transpiration vehicles, go to taxis and so on we try to implement it by ahh we can say domain we can start in one domain and move to another domain for sure as a system there are too many to learn to see how effective it is

**Faiza: after manufacturing the device it should go to ROP to place it in every car?**

**CU2:** maybe the involvement of ROP they are going the principle because our system actually it has to have a direct link with ROP because the concept here is the rise will generate an automated fine whenever you speed the idea is that for a road where the speed limit is 60 okay and you have the device inside your car and you have over speed say 65 or 70 the device will warn you and tell you that you are over speeding now and you have 15 seconds or 10 seconds to reduce your speed; if didn't reduce your speed our device will connected directly with ROP so the automated fine will be generated.. so in this line ROP will act as a principle we need their server in order to generate the fine.

**Faiza:** but people will play with it, if the warning last for 10 second they will reduce and again they will increase the speed, you the mentality?

**CU2:** we didn't think it as a black box we just put it inside the car and just monitoring the speed; the idea is actually beyond that even the ahhh the idea of Dr, Jamail is to have more information for analysis so imagine this device wont record just the speed even the behaviour of the driver, the harsh breaking, the harsh accelerating, the turning all these information will be recorded in order to come up with future (interruption from me) yes it is in the same device, as I said it isn't just a dummy box that ,… a dummy black box it is an intelligent box we just call it smart or intelligent black box which has a lot of elements not just helping the individual, because today we are not just talking about may be the results of having a lot of accidents; there are so many reason for that we cannot just say because if the road or because of the speed, speed is one of the reasons for that so monitoring the behaviour of the drivers maybe understanding even the new concept or ideas is to have information between machine and machine so that you can really post information and receive information so that there is two way of communication and we are opening a gateway between you and the individuals or between you and the vehicles so today ROP has access to these vehicles the can post information and receive information. when we discussed we ROP they asked can this device helps in analysing accidents we said yes because this device can store second by second information so for you as ROP easily you can go back to the server download the information and then you can know what has happen before the accident, so it is not only a speed device is more as monitoring and analysis device.

**Faiza: do you think ROP is convinced now, because they were not at the beginning?**

**CU2:** I think it is a debate subject to say that ROP is convinced or not convinced; I am 100% confident that ROP will definitely be convinced if you show them the results, you don't tell ROP that you want to test because they have a lot of things in their pipeline to be solved we are trying also to see it with them by telling them okay with very less involvement and very less effort from your side there is no problem anyway TRC is going to fund this prototype so let us implemented in certain number of vehicles and let us see the results, if you fine and want to improve this device we are coming to you as an association with you to help you; we see okay there is a problem today ROP has invested huge money in building and improving a lot of things, radar system they put, increase the fines from time to time but did we reduce the amount of causality we have not to the expectations so we are saying this is good, just try to use it; it is going to help

you and you are not going to lose anything at the end; it is not going to break or to kill or to do any bad thing, it is not going to harm anyone, let us try it if you are convinced and the society is convinced, it is fine we are successful otherwise no side effects of the solution, so they are I think many times we talked to them and discussed with them and they are accepting the idea.

**Faiza: what do you think the factors that facilitate their implementation? Why?**

**CU2:** yeah the difficulties are there, I want to see it more from the advantage way; today for anyone who want to go for business the only fashion is I will do what my father has done and he wont survive in the market, today it is completely different way of doing business, the old fashion of saying okay fine I have the product if you want it or don't want it, it is fine; today is a very fast market, very small village and you feel you have the product and you can get it within one second, I can just send an e-mail and thanks to Google I can find any information from anywhere, anytime and I can be expert in any area I just need information and today everybody is smart because world is open, this really required from people to come up with new ideas from time to time so what I want to say this arrangement what we are trying to do from research point of view is like we want to open new area of market. By saying that we are not a company who just trying to push a product but we want to pull people like involving everyone; because his idea wont work if he is doing it alone and cannot be successful if we do it alone, today everyone needs each other it is a network where people need to set together and the missing part is just an idea, how did you get the idea, how do you utilise it, how materialise it and implement it in the right way and time, with whom are speaking to, and for sure anyone can succeed in this one, so we are saying the positive side of it whatever the difficulties are we are just moving forward..

**Faiza: do you think the Omani universities have a good environment for knowledge transfer? Can you please explain? Has it been changed in recent years?**

**CU2:** unfortunately it is not been materialised. There are many very good ideas I think when you set with the individuals you surprised that they are amazing, ahhh even in the workshop that TRC has arranged I think they shortlisted 10 to 12 innovators, if you sent with the individual and discuss and see and hear from him it is amazing ideas what they have, so with my interactions with friends and relatives I see that there are a lot of ideas

but may difficulties maybe or the missing part is that creating those opportunities and allow them t have the opportunities of ahh taking the initiative of doing, very few universities are actually supporting it. maybe some universities depend on the top person who put their money and invest on these talents, but we have universities with these talents but they don't have the required facilities to do it and they feel ahh I hope universities give attention to that because that is the only way where you can keep people thinking otherwise all of our ideas will die within our campus and nothing will come out; there is no harm is someone fails, failure is a beginning of any success story, so let people try, let them come out and do it my themselves even if you attend ahh because time form time I keep updating my knowledge in technology, if you attend the CMMEX or IT exhibition there are a lot of good ideas are happening but unfortunately we don't see them materialised, we don't see them in the market, I really see that there is very good talented ideas but for sure it requires me better arrangements

**Faiza: what do you think are the main challenges in interacting with other actors from universities and government?**

**CU2:** I think unfortunately as I faced it myself the amount of chances that people are providing or choices I can say unfortunately there is not matter of choices you have one and only one; if you don't choose then you don't have any other options and unfortunately whenever there is an announcement for an opening there is thousands and thousands will go there, so it will be very crowded and it will lose reputation, lost it aim and the motivation wont be there; so the choices within the region are very very limited, like for example if there is funding entity there are very few funding entities which take initiatives and if it is there then the queue will be very long you have to wait and if you wait they will kill you with the questions and you need to submit this and approve this and so on even I remember in one of the occasions they asked me to give a lecture for new business comers like to tell them our real story, I started and my first sentence was 'if you depend on x,y,z then you will do nothing, so you forget about someone will support you, someone will invest, you forget you need just to depend on yourself, prove, stand and let people come to you' but if you wait for people to come and help you it will not happen, so we have many limitations in terms of opportunities and funding is one of them, second it providing the individuals and talented people tools and facilities, form they will get if they want to start even Dr. Jamail when he came with the prototype it was bits and pieces and it wasn't very well organized, and so and so,

he didn't have ahh there is no workshop where someone can go and try. We have explore and many of us have travelled and explored and see how they are actually getting chances and chances and opportunities okay if don't know well no problem you can come and give it a try I wont ask you about the results at the moment, so that is missing in this area I belive.

**Faiza: overall, what are the impediments to successful knowledge transfer in Oman? How do you think could this be improved?**

**CU2:** I mentioned some above. In addition, I think we need to be more practical on what we are proposing or what we are doing, if we just keep things in papers and it will not be implemented, we should try to implement things and see the difficulties; otherwise things wont happen. So the practical part that what I don't see it happening very ahh because for sure if we need to learn from others so mine is the first idea, there are many possibilities to fail because it is my first idea, but I don't learn from anyone else who was before me so I need a place where I am not the first one who has done it or the only one who is doing but I need place where 50 people are doing the same, so we can learn from each other and ,, as I said practically even you need to implement it without putting thousands of questions, like one of the question that I post everyone has posted like will ROP agree or not? Hahah sometimes I set with myself and ask myself why should ROP disagree it doesn't really harm them they are not going to pay a penny, they don't do anything we don't need anything from except ok is just can you please generate a fine if the speed is high? That what you are doing so why you should say no. killing an idea and an innovator who wants to become with an idea, killing a talented people, if they say no then believe me a motivation of not me the generation of that age will be unmotivated, okay my friend tried and didn't happen!

**Faiza: Okay thank you Mr. Yousuf, is there any final word you want to say?**

**CU2:** no nothing I am hoping and I am a person who actually believes more in moving forward and not looking back. I really hope that whatever we are doing today is going to be materialised and many people will learn from their mistakes and to see success happening within the society and everyone learn from what they did on the past. Thank you

**Faiza: Okay thank you very much**

**Interview with the IIC's CEO**

**Date: 20/08/2014**

**Time: 1.25 pm- 3.26pm**

**Interviewer: Faiza**

**Interviewee: PFO2**

**Faiza: thank you so much for taking part in this research and the information will be mentioned in this interview will be treated as confidential and anonymous.**

**Faiza: Why do you participate with universities, industry or governmental bodies**?

**PFO2:** personally, it is my passion to actually look at how the two contrasting organisations are come together to make things normally to be possible to look to institutions' needs; coming up with innovation; industry have the capacity to for innovation but that capacity low and very very intangible; university may be better in terms of capacity in coming up with innovation; so most of time it is a blue-sky innovation; they come up with new ideas. Really impossible; I think if we put these two together, I think we will come up with an innovation that is really able to be commercialised so that we reach balance I can say. This is a personal reason.
Professionally, we don't have this especially a country like Oman, if you don't have this particular model where academic and industrial get and work together in innovation it will never happen! Never happened because what we having, the industry here isn't technical, is experience based, it isn't educational based; it is in a very very low level; they buy the machines and get the instructions in how to operate the machine and that what they do; so they cannot go beyond that; and the academics in Oman they don't have the law of their ways in getting doing research out to the market; there is kind of disagreement in doing research; the only way to encourage innovation in Oman is to make sure that these two parties come together.

**Faiza: so this participation comes as you are the CEO of the IIC?**

**PFO2:** Correct, you are right

**Faiza: do, when did it start?**

**PFO2:** I am the one who formed the IIC with two other professors from outside, who are expert in the field; I got team from Canada; Omani origin but ….. the built the framework of this center or the selection how should be. Then I brought myself with another colleague to kind fine tone this and we built the structure where we actually can to run something, because they were something theoretical; so we actually came …?... the theory-practically and do the required changes, make it viable and run it as an experimental; the results I believe anybody can see today.

**Faiza: what are your responsibilities? Can you please explain?**

**PFO2:** my responsibility first to make sure the model is working correctly; the model is viable so that the researches that happen have to be viable as well and industrialised, because our form of commercialisation is related to the west; so my responsibility is to try to bridge the gap; the research I had done in Oman and the industry that having/doing the research have the capacity to realisation; this is very important and challengeable; if you looked hmmm what you call this hmmmm in Europe even the industry will collaborate with the researchers to do innovation; they may not willing, wanting or even aiming to do it internally in the industry; the aim is that there is a big fish out there; so they are gona to buy this…spend money in the research as a product, people don't do that, so we need very very tiny incremental …?... very increment on the changes in the factor that they will start to observe those; actually deliver that they …?... and this is the innovation that is was tasked to, so I was fine tuning the model; so I never set in the office and say okay this is fine and let us do it, none, I look at what the research they are doing, what is the next stage, step to this research, what we are doing, what we did wrong, discuss with people to find out what is get more of them; it is an everyday evaluated process; very new for the region; for the country, and for us in Oman

**Faiza: who are the individuals do you network with from the university, industry and government? What type of communication is involved in such networking?**

**PFO2:** in the universities we have the Technology Transfer Agents (TTAs); TTA is a members recruited by the center to support us, his job is to understand his environment, who is there and who is doing research; the way our model works is; we take research according to the requirements of the factories and then connect universities and TTAs in particular system; so he is the one who can say look researcher x can do the research so let us talk to him; we have the model one to one, but we didn't target specific people; TTAs are elected by universities.

**Faiza: But you didn't put any criteria from your side?**

**PFO2:** no, there is a criteria; the criteria is at the end of the day this is a competitive process, the university wants to participate and automatically they will put a person in the job, but we have put criteria and one of the criteria is the member should be old enough in the university; has to have a good portfolio, so we know, has to have collaborative research in fact, so we know people attitude towards research, know the university system, so this is a criteria, so that he knows the costs, is this way the university will observe the cost; if the university get the money they will come back to us in a certain way; if they have various way; so this is a competitive process, so set these criteria, but we don't actually monitor them; I am afraid of wasting my time in monitoring them, because it is up to the university to put the right candidate; it is a bottom line; we concern about the strength of proposal that they put forward.

We can call any university to do the job; if they didn't provide proposals and didn't put a TTA then the only loser is the university itself.

In terms of industry, we are networking with SMEs in all industrial estates, even the industries outside the industrial estates, not large only small and medium in all over Oman; the main aim is to help Omani SMEs; our focus yes is on industrial estates but we don't shy away from industries outside when they approach us.

**Faiza: What are the responsibilities of the industry? Do they got the problem and discuss with you?**

**PFO2:** no, not really; if they give the problem it will be bonus for us! normally we have a strong team who goes out and tell them how they can improve, because when it comes to innovation you …?.. you could yourself operating fine, perfect in everything; making profit 10% more that is good; do you to spend little and your profit will increase by 10%;

sometimes we would walk to a factory, the key point is the team in the factory has to be willing and wanting to do innovation and to do R&D; we approach different industries, we interview, set down and see where the idea coming from and then we go to the factory that we think more willing to take research seriously…Our idea is we are the expert, we do the big think-tank, we do the thinking; we walk and tell the factory that product x should move to this location, you are far behind, what if we change x,y,z what do you think? If yes then we do it; it is not a problem not at all!

**Faiza: what are the rules you were involved in making with them?**

**PFO2:** a lot of rules and regulations, I mean the most important thing is the process itself; I have to involve the industry and the academia and ask how do we approach the problem? For example, form the point that my consultants decide, no, not the innovation consultants, but the client manager, okay, I think this week we should focus on factory x and process of determining why is based on a structure which is agreed by the factories themselves; the next step is, how do we approach them? How do we ask them questions? Those all go down to the aspect of commercialisation, process, all of this we discuss with factories

**Faiza:** so you have forms to be filled?

**PFO2:** yes, we have, we involve forms tremendously; they are quite rigid to be honest, because they are formed by a third-party which is TRC, go to form 5 supplied; they agree many areas to be left empty, for example, due to experience, no need to ask the question twice, because the industry regulated/reheated by those forms.

**Faiza: is there any changes done on those forms?**

**PFO2:** no, I just want to refer to form x, is the question about finance, there is a repetition, so we asked them to refer to the debt form rather than filling that again.

**Faiza: Why you didn't remove the repetitive points?**

**PFO2:** We don't have the authority to make any changes, we are not TRC and it is their money and we have to use their forms.

**Faiza: why you didn't approach TRC, as far as I know there is a member from TRC in you board?**

**PFO2:** yes there is one, but we are the one who is operating; I was in TRC but now I am not a member of TRC so I cannot physically manipulate TRC documents. the bottom line is the forms, I have them and require a lot of thinking from us to operate research work and this is one of the reasons why the job that we have is very timely to put things go smooth; we worked now for 5 years, but things are still very very heavy; so we need changes

**Faiza: how were the rules developed?**

**PFO2:** I set with my innovation consultants, this is one, another one is that I know the system in the world. They actually know what is happening in the academia and industry; so I set with them and try to tackle out which area that we think bad or there is no regulations at all or they are not working; or the regulations are good, so we set and take notes and when it comes to benchmarking with international laws; and what I know about the country then I take them to the board and we have a very board system, very active, so we set down and see what we think we should do; the chairman I have no chance competing with him; those guys working in the industry and innovation for the last 40-50 years, so I am a grandchild to them, as per his knowledge and experience; I often I got told by him, look it is good but I will tell problem x and y will occur and it like magic it all happens; recently, I asked him to give me advice in the future when I have my own company; he knows the culture, the system, what is the difference and others.

**Faiza: for changes of rules, can you please give me examples?**

**PFO2:** for example, we suppose to give maximum of the funds that 50% should come from factory we manage to change it and get 75%, that's one; but the biggest one we had originally the word in-kind was not understood, people thought in-kind is nothing; so they are saying ahhh the factory has to contribute and I said they can contribute either in-cash or in-kind where they don't have to contribute in cash; in cash they want them to give money and ask them to spend; automatically they don't want to do it; even if they have; as a factory manager if I took 20.000 OMR and gave it to you, I need to explain to the board why I gave 20,000 OMR, where did I spend the money; I am a manager is not my company, but I can spend the same 20,000 OMR in if we ask, the IIC ask the manager can spend 20,000, therefore, we consider it as in-kind so they will not question him about the money; it makes no difference to us, say this is the cost of the project 100,000 OMR you have to pay 50,000, 30,000 then you can put it in cash or

you can bought the component x,y,z for the project; it makes no difference. There was a big problem because they wanted to be in cash, actually we managed to change the policy and make people understand, that doesn't mean zero, if I gave you a time, and I paid… I am a consultant and I am rated of 200 OMR per hour, if you gave a time and gave 4-5 hours that will be 1000 OMR; so either I gave you 1000 and then you repay me later or I turn up and I talk to you to build something, so instead of asking you to do that twice, you don't pay me for the project and I will pay you for the consultancy, so this is the case

**Faiza: so only it is in the financial side you made the changes?**

**PFO2:** a lot of, even the research process itself, I don't remember everything now, the process itself, the policy of who can get fund and who cannot get fund, for example, we change the word from SMEs to SMIs because we discovered small and medium industries rather than small and medium enterprises; see when it comes to factories, companies there is the size of response literally directly related number of waiters you have; we don't have like this place with 100 waiters, then you will have to serve almost 10,000 people; unfortunately for a factory isn't the case, a factory that makes very low profit and have very little money; they are labour intensive; some factories are very very rich, but there are few labour; and the example that I always give people has 10,000 workers, worth 400 billion dollars; Ford has more than 100,000 workers and it worth only about 40 million dollars; it worth a hundred times more, but when it is 10% of the people the way it works. If I have an IT company and work in a computer only by me and you we can came up with a million rials; but if we bought 50 bicycles we cannot make one rial, we need more and more people to come and fix bicycles, it is not the competition, it is just the structure of work, if you have manual work and you make people work manually using their hands, okay I will give you an example, Barka, people who make fish cages, these cages are sewing by hand, each Bangaly makes one cage, if you want to make q 1000 cages per month you need 500 people to do the job. A cage is for 10 OMR or 20 OMR the most, there is no much profit in the business; they are not big; because even if you sell cages a month you hardly selling 200 a month; after you paid salaries and do everything you may get 2000 or 3000 OMR even small enterprise…

**Faiza: what about the used KT mechanisms, commercialisation and non-commercialisation, patenting, licensing and others..**

**PFO2:** we are very simple in mechanism; look our job per se is only to do R&D with the biggest short comes about, is only to do R&D; what happened after doing R&D, successfully done of our business, the original idea is to open a commercialisation office; everything is …?.... out there, we have telling time and time, time again guys commercialisation has to be in different areas; written papers on this…?... area number one is to identify the product; area number two is building facilities to produce the product itself; taken part is what TRC is trying to build, the only neglecting is the first part, while is the most important part; in example I came up with a new kind of telephone or let me give you a real example, we came up with a new socket boards in house, very advanced once; before doing marketing for this, before doing commercialisation for everyone to know it, is it competitive in the market, even if it is not better that the ones exist there is cost benefit make sense? Would people buy it by 10 rials more? maybe the benefit are more, so how do I know that?

Does these changes will hold up compares to the future….people are moving forward, using new socket boards now, the future is looking for requirement of new socket boards…second line science behind the actual board itself, who are my clients; can I reach the market directly or get license from the government; these license based on partnership, many questions to be answered for the actual commercialisation to take place; commercialisation is the most expensive part in R&D; before the R&D prototyping is that this can be done, we can make new cup, we can make a new product this is very costly to produce, it costs 100,000 OMR; let us say million rials, but the commercialisation of that board will cost 100 million rials, as an example, you as an investor you will not put 100 million rials if you are not 100% sure… this what we call it small commercialisation will service two years and one to be fixed in the center, so the center will be confident that it is not there; it doesn't exist and I have to do this manually by myself

**Faiza: as far as I know one of your consultants try to patent some ideas through the ministry of commerce and industry, but still things not completed yet, it takes long time to process.**

**PFO2:** absolutely, literally, the consultants set with them say; I need to build this, go patent, this is not patentable forget about it; they need to do trademark or not, they have to see that physically apart from their management duties do this work; because our consultants are equipped to do that; and they don't bother about it; this is nor their

job, they come to me and say after this what would we do, we set down and say okay, you need to communicate with the ministry of agriculture as they have bigger clients; the technology; need this factory to do this component; this by the time we build that, it is a work from which we get paid for about 5,000 OMR, which obviously means work in that particular month,… becomes a big problem, so they should come…

**Faiza: regarding the individuals and bodies that you are networking with usually, whom do you think have the big influence or power over the process?**

**PFO2:** I think it should be the industry, but unfortunately that it is that the university, because it knows the actual R&D; I think the power id quite balance because the factories spent, they are the one who are contributing the fees..?... about technology; so they know what supposed to be done, if we come to the research, university has the full power, if the outcome of the research goes fully to the industry 199% ownership goes to the industry..

**Faiza: you have an issue with some of the academic institution regarding the IP, who owns it?**

**PFO2:** actually, we have a lot of issues, we don't mind the factory to share the patent, we don't interfere, what we work as an innovation center, maybe it is an elected model I cannot say it is complete; but the model that we are elected is based model, where the money we give to the researcher and industry,,, at the end it is their money… because the consultancy work, is my work, all consultancy work is even we discovered new world. Otherwise everybody Microsoft, Google, will own the world; because the thinking doesn't come from the university, it comes from us and the factory; the university according to contract is to do the job; they do the job; they are getting paid to do the job; and this is the only way to encourage companies to do research at the moment.. Actually, we have a lot of issues, we don't mind the factory to share the patent, and we don't interfere. Our elected model is a consultancy based model, where the money we are giving to the researchers at the end is the enterprises money. Because consultancy according to my experience in the entire consultancy works, even if you discovered new thing you don't own that discovery….Because the thinking doesn't come from the university, it comes from us and the factory. The university according to contract is to do the job and they are getting paid for doing the job. And this is the only way to encourage companies to do research at the moment..

**Faiza: okay where there any disagreement when you tried to create rules and regulations? Any disagreement did you face?**

**PFO2:** always, form both universities and industries; because we are always getting disagreements about patent with universities, we are getting disagreement of what we do and how much we spend; the whole beauty is that industry is contributing; we say look guys why you pay this much; maybe you can get this material from here, cheaper, we have these; I cannot call them disagreements, but discussions, so we always discuss and negotiate with and try to convince them and they are always convinced! We never been rejected, except from one, a research is cancelled due to old process, because I told you we have to change it, our old process was very scary to the industry; they were thinking…hhh with regards to legality, the industry backed out; we showed our capability, we gave then good ideas, said we don't want your funds, we want your support, and they actually do the research funded by themselves

Faiza: form universities, what type of disagreements?

**PFO2:** patents mainly, payment process and amount of money we paid; the number of hours we make them work; disagreement between for example smaller university and SQU; they don't consider those hours; they take the money, because is an income, money researcher getting from doing research; but yet they didn't give them extra hours; they don't five hours from their lectures; because they need to do research; because normally things are back dated; it should come from them. But we discussed it and resolved that.. I don't say that they completely solved; we still have some disagreements and it will take time. SQU for instance wants to change the process; SQU wants the process to be fexible with them; if everybody wants it to be according to their process we gona be…So they should work with our process, agree do this; individually every time we try to do this we allowed to come and get these issues to be resolved; what SQU wants is impossible; I don't really want to comment on, but I built a policy where we should be as much aid to anybody; I refused, originally we used to turn down innovators when they bring their projects; I told them no no go away; then we gave them the chance, to see what type of ideas they have; to see what they can do for the factories, unless we get benefit from them, so our policy, but issues don't finish with academia, especially SQU…

**Faiza: why do you think these rules are important? Can you please explain?**

**PFO2:** we are a very young country; we zero in terms of this; R&D and innovation started fresh; we can copy every model; the best model in the world and match with it; we can take Singaporian, Malaysian, Canadian, take whatever we want; the bottom line is that we also have our own cultural issues; we need to keep adopting policies to the point we the world and the people feel comfortable when the outcomes come out; the bottom line is commercialisation; what we really want; what we really want; is to see new innovative products/services come out, we should improve the system as much as we can to get out of these results, then discuss how governmental rules in how getting money; but this is not the point; the point is we want innovation, and this is the reason why I do 4 times almost more than what I required to be doing; not twice, not three times, almost four times,, end up of 36, my aim is that if there any problem that occur in the project; I will resolve it; that's the aim… Every time we have a problem we study it and work what particular policy that can overcome this problem; whatever we can resolve we resolve; whatever we have a third policy like MoCI or SQU or whatever we turn to see if we can do it, that project bases.

**Faiza: could you explain how rules have been implemented? When did they start? Have they been applied?**

**PFO2:** benchmarking! Based on benchmarking, originally and all the used rules are from benchmarking, but eventually the rules were twinkled and customized according to the culture around.. so they are implemented by the IIC, the original work done by me and others, in fact I did very little;  most of the work is done by two very high ent. people from Canada, one from Canada he is an expert and two from here

**Faiza: who are in charge of monitoring results? To whom are results sent?**

**PFO2:** the TRC and the MoCI because they are the one who established this, so every year we send an evaluation report, what are the results coming out

**Faiza: How about the center itself?**

**PFO2:** we want to make sure that we get funded for the next year to ..?.. from day to day basis, we monitor by ourselves, we document them, we evaluate them, send evaluation to the funding bodies; so we monitor them and evaluated by TRC and MoCI….

**Faiza: what do you think the limiting factors for implementing these rules? Why?**

**PFO2:** disparity!! Too many different entities and regulations; for example, until now we cannot commercialise. I am not scared to say anything except the truth! when it comes to commercialisation things are in hold, because TRC 5 years age said they will do this; we told them what about this, you allowed us to do commercialisation, until you open your commercialisation office, we will shift our experience but we cannot; for 5 years without commercialisation; we do research then when we finish we look what to do next; because we are waiting for TRC, when they are ready to do commercialisation… Actually there are few factors, all the limiting factors are already resolved; all in the same level; what they didn't like is that the financing is slow, but this is basic structure in most international systems, we are infant actually we are 5 years old in innovation policy you are talking about a 3 years old child, still not in school, we have 10-20 years to change in the line, if we couldn't change then there is a problem; we built a good foundation where we should be able to build a good system

**Faiza: what do you think the factors that facilitate their implementation? Why?**

**PFO2:** communication! Good communication and good cooperation, we need to get together and determine how to solve issues and think haaa but this doesn't exist, so it is a limiting factor then, if you look to the good factors, we have people who listen, nice people to talk, Hilal is really a fantastic you can talk to him at any time; Dr, Aldhab is a superman I can call him, he just good in what he does; so we are looking for people who supporting the system; but there is a little bit of hesitation from everybody for a reason that I don't want to mention.

**Faiza: you said one of the obstacles you are facing is regarding the communication**

**PFO2:** we having this at the moment but originally we need effective communication and corporation between innovation entities. And we also need this what we already started this not to the level we like to be but we started; to have inter-governmental relations; we have a relation now with the MoCI, minitsyr of agriculture, PIPAID, PDO, these are the governmental entities that we are collaborating with, the innovation entities don't collaborate; these entities are the IIC, first they have their own innovation program, academic innovation program, there is a commercialisation program,

everybody is getting his way in doing the work,, so they are doing the work separately! They need to be one, we need a process that says okay, this is where you start and this is where you end as an innovation; this is the way you go. There is 'Raffed', many entities they are all over the place; but there is no see you as an innovator you will be lost in the sea! You will be drawn! And this is a major limiting factor; this has to be resolved, efforts are there we are spending thousands of millions, but ….. I cannot comment in the outcome.. there are plenty things everywhere in Oman.. we approached for instance TRC but what I want to say is that we need to build new system for innovators; it will go according to my capability, according to my level of education, according to what I need or I want; which is not there.

**Faiza: what do you think are the main challenges in interacting with other actors from universities, industry and government?**

**PFO2:** Policy! Policy! Policy doesn't allow us to be flexible within it mandated; this is innovation, innovation isn't an exclusive science, a scientist will not do it! Isn't an exact/exist science, I was given somebody an example yesterday of a single phase bump used, sorry, there is a three phase used for generation; if you have a single phase generator you have a single phase bump and vice versa. This is the same story; have a flexible system that has no structure and you establish policy, you put your regulation your bottom lines and you tell managers you should be experienced you come up with something; what I do I tell them instead that I want 5 commercialisation in work; I want 20 researches; I don't care about, I am going to give you one million rials, I want to see 5 products, you know what you are doing , you use my money; just let me work.. Because the system is rigid; I can only work in my salary, I cannot go out of the box; too much regulations, no too much restrictions, not regulations; so we need to have more flexible system; a system where we know exactly how innovation and limitations and could those limitations be covered; innovational center, educational center, community innovation center, can cover it! We build a new mini structure, manages on those clasps so the place where ahhh… see we know this is a gap, this is what the IIC and educational innovation program what supposed to meet; you put a person okay you telling him this is your job and works on it, but hopefully it will change..

**Faiza: do you think universities, enterprises and governmental bodies have a good environment for knowledge transfer? Can you please explain? Has it been changed in recent years?**

**PFO2:** no, not yet; I think it relies on the country, especially in the academic side; we have teaching universities, they are trying their best at the moment and some young universities are getting into research; you cannot compare it for instance to UK, I will give you an example, there are universities which age 50 thousand more older than SQU, but they are not research universities, they are not Cambridge, not Imperial College, you see what I mean; you have to understand, so we are developing as far as my concern. The industry guys they are working in trading business to produce sales, machine broke up, put a new one, bring their scale up to continue; nobody will look at new ways to work effectively, but this is changing…

**Faiza: overall, what are the impediments to successful knowledge transfer in Oman? How do you think could this be improved?**

**PFO2:** a better eco-system is required, that's the short answer that I can give

**Faiza: okay thank you very much for giving me some of your time**