TECHNOLOGICAL INNOVATION IN POULTRY SUPPLY CHAIN FROM A HALAL PERSPECTIVE IN IRAN

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Abstract

Technology and innovation pervade all aspects of modern life. In past decades, technological innovations have changed the poultry industry from what was once a small-scale back yard operation to industrialised intensive mass production farming. In Iran, technology transfer has had a varying degree of adoption amongst poultry farms. Technological advances in supply chain management and the increase in global demand for halal products has led to closer integration of halal supply chains globally. This global integration of supply chains inhibits the opportunities for many developing countries to participate in the global supply chains. The aim of this study is to investigate the specific implications and influences that technology can have on the conduct, attitudes and working relationships of individuals working on poultry farms in Iran from a halal perspective.

Previous approaches to the examination of the adoption and diffusion of technology in agribusiness have focused either on systemic change initiatives shaped by technology that lead to the transformation of an entire organisation (macro level theories) or on small-scale and individual adopters in an organisation that may benefit from technological change (micro level theories). There is widely-agreed recognition of the fact that these approaches, by not fully encapsulating the interactions between the structure and individuals, have failed to fully appreciate the complexity of technological adoption within the institutions. Therefore there has been a shift towards an integrative approach that recognises the interactions and interconnections between the structure and the individuals within the social structure, which also consists of traditions, cultures, and moral codes (i.e. the halal concept).

In pursuing the research aim, Giddens' structuration theory, along with Orlikowski's structuration model of technology adoption and Rogers' work on adoption and diffusion of innovations, was followed as a methodological framework in examining the subjective perspectives and perceptions of a number of participants interviewed in five case study farms in Iran.

In order to build an understanding of the causal links influencing the underlying concepts of adoption and diffusion of technology, qualitative analysis of interactions between agency and structure of five case study farms was conducted. This allowed for rich data collection within different contexts. In each case study, a number of respondents who had responsibilities for the adoption or diffusion of technology were interviewed. These case studies included poultry farms with a vertical supply chain, and semi-vertical and horizontal supply chains, across a mix of breeder and layer farms.

In presenting the findings of the study, and to aid the process of analysis, the use of tables summarising the related case evidence in emergent theory proved essential to demonstrate the depth and detail of the findings, rather than providing a summary of the statistics.

This research has contributed to theoretical knowledge, as the first study to outline the potential use of structuration theory as the meta-theory in halal poultry supply chain research, and to ongoing research by exploring some of the fundamental concepts within socially and technologically constructed social systems. Findings from the proposed

technology acceptance model of this study could lead to further studies, generating ideas and recommendations for the effective implementation of technology in halal poultry production in local markets, and their preparation for integration into a global market.

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GMP	Good Manufacturing Practice
HACCP	Hazard analysis and critical control points
ICT	Information Communications Technology
JAKIM	Jabatan Kemanjuan Islam Malasia
TAM	Technology Acceptance Model
SIRIM	Standards and Industrial Research Institute of Malaysia
WPSA	World's Poultry Science Association

CHAPTER ONE: INTRODUCTION

1.1 Introduction

Technological changes are creating modern and capital-intensive production chains for poultry meat and eggs. The development, transfer and adaptation of technologies focus on improving the efficiency of feed utilization and increasing animal productivity. In Iran industrial production of poultry is increasing relative to the reduction in production from grazing and mixed farming systems, but the majority of livestock is still kept by small holders. Increasing demand for halal poultry products, together with globalization of supply chains, is placing pressure on Iran's poultry sector to both adapt and expand.

Halal does not cover only the religious aspects but it adheres to very strict quality and hygiene compliance, which is in line with good practices (Lodhi, 2010). This study investigates the specific implications and influences that technology can have on the conduct, attitudes and working relationships of individuals working on poultry farms in Iran from a halal perspective. This introductory chapter outlines the initial context for the thesis and presents the research rationale, and research question. An overview of research design and methodology used for the investigation is presented. This chapter offers a summary of research contributions and outlines the thesis structure.

1.2 Poultry and The Iranian Perspective

Before the industrial era of modern production poultry in Iran was produced on a small-scale, back yard operation, as in other countries, and only for local consumption (Vali, 2008). However, the introduction of poultry eggs and meat in Iran can be traced back to the Aryans, who introduced chickens when they migrated to Iran (Persia) in about 1500 BC (Shariatmadari, 2000). The domesticated fowl believed to have been descended from the wild Gallus gallus breed.

Prior to the land reform of 1962, the village in Iran was more than an assemblage of peasant households. Rather, the village was a socio-economic complex (Lahsaeizadeh, 1993). Traditionally, native breeds of poultry were reared in villages under extensive and mixed systems. The villagers marketed the poultry alive. It was recorded in 1954 that

there were a total of 8.31 million pieces of chicken being kept by villagers in their homes (Askari, 1978). The size of poultry enterprises ranges from small farm flocks to large commercial operations. Most of the poultry raised in Iran is produced in medium commercial operations (Kamalzadeh, 2009). In general there are three types of chicken enterprises: broiler production, egg production and raising replacement pullets. In egg production operations, laying hens are confined in cages and in a few cases farmers may use a floor-pen system. The poultry industry is private and some services are provided by the cooperatives. Few poultry farms are under government management.

The traditional poultry-farming model of production characterises a rudimentary division of labour (Fami, 2009). Each unit of production is relatively small and does not develop the social forms of labour, which lead to the socialisation of production (Lahsaeizadeh, 1993). The peasant family is the basic unit of production. Modern farming, however, are capital intensive and use a large proportion of skilled labour (Katouzian, 1978).

Lahsaeizadeh (1993) argues, that a particular type of tenancy farming existed prior to the land reform of 1962. This system was modified to short term contracts of one to two years between the landowner and tenants (Ajami, 1976). The increase of this type of tenancy was seen as an unexpected result of the land reform. Azkia (1980) argues that there is evidence that these tenants after renting the land for a few years, have bought the land and expanded their farms. During the 1960s, with the dissolution of feudalism, land reform and its related measures had created a petty commodity mode of production, which established capitalist relations of production in the countryside Lahsaeizadeh (1993).

After the land reform of 1962, a new phenomenon emerged, as peasant capitalist farming: this included the former small landowners, some of the rural elites, former landlords, and the heads of production teams (Abedini, 1977). The capitalist peasant and his family members usually supervise and do not perform any manual labour. The management is more direct compared to commercial farms (Lahsaeizadeh, 1993). The capitalist mode of cultivation in Iran was the introduction of agribusiness in rural areas, by enormous initiative of the state (Bakhash, 1989). The privileged sector of both villages and urban areas, also invested in agriculture based on capitalist relations of production at the expense of the poor stratum of the peasantry (Azkia, 1980). Some agribusinesses involve

the setting up of a large scale mechanised and capital-intensive farming operation, with commodities including industrial crops, red meat and poultry products (Aresvik, 1976).

1.3 The Research Problem: Background Issues and Context

Modern poultry production in Iran is around sixty years old with currently 1.67 million tons of chicken meat and 775 thousand tons of table eggs produced annually. Major turning points occurred in the poultry industry after the Iranian revolution in 1979 and during the eight years of war with Iraq from 1980-1988. The move from small-scale backyard operations to modern industrialised farming systems and methods was initiated, by the late Shah during early 1950s (Ansari, 2001). Commercialisation began by replacing indigenous breeds with new imported breeds for the expansion of animal breeding alongside the related technologies from the United States (Ansari, et.al, 1997). However, the arrival of industrial breeds such as Truman, Plymouth Rocks, Rhode Island Reds and New Hampshire also imported a poultry disease, commonly known as Newcastle Disease to Iran. Recognised as one of the major contagious diseases affecting the poultry population worldwide this disease almost wiped out Iran's indigenous breeding stock (Fazel, et al, 2012). As a consequence of the Shah's modernisation policy there was a gradual increase in the number of poultry farming units throughout the 1960s and with the subsequent increase of the production of day old broiler chicks' imports started to decline as the domestic market grew.

Between 1965-1975 Iran's population grew by 15 million to reach 45 million. At the same time, there was steady migration from rural villages to large cities and urban areas as people looked for work and searched for a better way of life (Arjomand, 1988). The effect of this migration on poultry production was twofold. First, the demographics of rural society changed and this undermined traditional ways of poultry production, which also declined, leading to a reduction in poultry supply (Anon 1995). In addition, the migration from rural villages also resulted in a reduction of agricultural produce and increased the poultry industry's dependency on feed imports (Ansari, 2001). Despite agricultural self-sufficiency of the 1960s, by 1979 Iran was importing 65% of its crops (Shariatmadari, 2000). Declining productivity was blamed on the over use of modern fertilizers by farmers, which was seen to have inadvertently scorched the thin soil (Ansari, 2001). Unresolved land reforms, lack of economic incentives to raise surplus crops, and low profit ratios combined to drive increasingly large segments of the rural population into urban areas (Ansari, 2001). Iranian entrepreneurs followed with the use of new

technological advances in poultry farming, and this contributed to the creation and development of modern and intensive poultry units during the early 1960s.

After the revolution of 1979 and the subsequent change of government higher government subsidies for grain and other staples, with extended short-term credit and tax exemptions for farmers complying with government quotas were used as a way to promote self-sufficiency in the poultry sector. Although the poultry industry continued to grow in the post revolutionary period, it was also directly affected by the Iran–Iraq War (1980-1988) in various ways. The state focus in this period was on maintaining the growth of the domestic market to reduce the volume of imports and save on foreign currency expenditure (Shariatmadari, 2000). Nevertheless, the strategic decision to limit the import of breeding stocks affected Iran's poultry industry over the next decades. Stock diversity was reduced to only one breeding line in order to strengthen the domestic market and to enable greater state control (Mustafavi, 2012). Poultry experts opposed the controversial policy of having only one breeding line and argued that diversity in breeding stock was needed to provide protection from the increased threat of disease (Mustafavi, 2012). Not surprisingly, despite the government's efforts to limit imports by the late 1990s Iran was actually more dependent on agricultural imports than it had been in the 1970s (Shariatmadari, 2000).

By 2012 Iran had become the sixth largest producer of poultry meat globally and the twelfth largest in egg production, producing 1.65 million tons of poultry meat and 775 thousand tons of eggs (Mustafavi, 2012). There are in excess of 22,000 poultry meat farming units and 1,500 egg producing units in Iran and 350 breeder farms (Mustafavi, 2014). In terms of poultry meat and egg prices, the market is monitored and prices are controlled by the government rather than by market rules of supply and demand. There are a few state owned farms with their own vertically integrated supply chains, which provide them with some degree of immunity against the rapid price fluctuations of the poultry feed and other poultry related goods. The rest of the farms are owned privately and rely on supply market stakeholders in the value chain, who compete against each other, with buying and selling prices manipulated and influenced by a large network of well informed opportunistic dealers, known as middlemen (Mustafavi, 2014). The majority of privately owned small poultry enterprises are supervised and managed, by inexperienced, often uneducated owners, who have joined the industry to supplement their

income (Mustafavi, 2012). Many of the farm units that were given licenses to set up poultry units after the revolution fall within this category.

These privately owned farms are responsible for their own technological improvements and they receive some help from the state in the form of affordable low interest financial loan packages. There has, as yet, been no standard national requirement or state sponsored strategy in relation to the adoption of technology, and hence, the case for research in standardisation issues is supported. The liberal policy of issuing licenses for setting up poultry farms, which started in the 1980s and has continued ever since, has resulted in a relatively rapid quantitative growth of poultry farm units. The inefficient supply chain of poultry products has given rise to a network of middlemen that act as dealers between different entities of the supply chain (Shariaatmadari, 2000). For these reasons the poultry supply chain in Iran is unique. Unlike poultry production in industrialised countries, or Iran's neighbouring countries, that enjoy the stability of a sustainable supply chain, the poultry industry in Iran has a supply chain that has been a source of great instability (Mustafavi, 2012).

In recent years there have been attempts by the Iranian Ministry of Agriculture to address Iran's poultry industry problems. In its latest attempt at cooperation with representatives of the private sector, and a supply chain expert from the University of Science and Industry of Iran, an extensive study of poultry supply chain models of five countries was carried out. The outcome of the study proposed a number of models of supply chain configurations under different scenarios of ownership between suppliers and poultry producers. However, the study failed to propose a model without the influence of middlemen (Mustafavi, 2014), as the proposed supply models were complex and the designed included the middlemen. The proposed models were strongly criticised by private sector and industry experts. The representative of World Poultry Science Association (WPSA) branch in Iran criticised the outcome of this study and argued it did not provide the infrastructure needed to eliminate the role of middlemen and hence ensure the stability that is needed to develop a sustainable supply chain (Mustafavi, 2014).

Halal is an Arabic word which means permissibility of actions and consumption as outlined in Islamic practice. The halal market is a fast growing market even in non-Muslim countries such as France (Lever & Miele, 2012) and in some places it has already

overtaken organic and bio-products in market volume (Ahmed, 2011). The global halal market volume is estimated to be US$1 trillion a year and is one of the fastest growing segments of the food industry (ITC, 2015). Halal labelling is being used as a hygiene and quality factor and halal branding is now also being practiced in Muslim countries, yet recent attempts to develop halal logos and implement certification has created both challenges and opportunities (Wilson, 2013). Amongst Muslim populations the overwhelming understanding of halal focuses on the permissibility of consumption (Wilson, 2014) and the significance of the permissibility of actions, a situation in which the treatment of animals has largely been ignored. Prior to the political change of 1979 both halal meat and non-halal meat (not permissible) were widely available for Iranian consumers (Axworthy, 2013) who did not require convincing that the meat they bought from a local butcher was halal. After the creation of the Islamic Republic of Iran non-halal meat was banned and it was not until relatively recently that a halal standard was introduced. One of the objectives of this study is to examine the significance and perception of permissibility of actions from a halal perspective amongst poultry workers in Iran. Technology and innovation are central to this endeavour.

Technology and industry have always had close links. Technical adaptations will attach the production process of supplier and customer. However, these adaptations often focus on the technical content of innovation and do not necessarily consider the significance of culture and its impact on halal production and consumption. The poultry industry is one of the fastest growing sectors of the animal industry and technological innovations need to emerge in coming years to service new demands in the supply chain. Poultry industry innovations need to address social and environmental issues as products have to be consumed by different cultural and religious groups.

Muslims are supposed to live their lives in line with the principles and practices of halal, which is associated with cleanliness, integrity and self-restraint. Consequently halal refers to all aspects of life and is not only linked to food. Halal food should therefore be regarded as an excellent standard of quality comprising respect for animal welfare, environmental sustainability and social responsibility. The industrialisation of food production, the globalisation of the supply chain (raw materials, ingredients) and the use of modern technologies have created a new complex model in Islamic countries. From a halal perspective, the Iranian poultry industry, which has emerged as a result of

modernisation and technology transfers with limited or no adaptation to local context, standards and values, presents a complex problem in adhering to the true spirit of halal in recognising the permissibility of actions. Although the halal market in North America, Europe and some part of Asia has been the subject of a number of studies, research on the production and consumption of halal poultry in Iran is quite rare. This research focuses on and explores the local approaches towards the adoption of new technologies in poultry farming and the poultry supply chain in the northern east region of Iran. The next section briefly explores the models of technological innovations and diffusions in operation.

1.2 Technology Innovations, Diffusion and Current Research Studies

Diffusion models (Rogers, 1995; Rogers and Shumaker, 1971) have been used by a number of researchers for the introduction of innovations (Arumapperuma, 2008; Fisher et. al, 2000; Slain, 1998). However, in the context of the poultry farming system, which is the result of a number of interdependent components within an environmental setting these models can be argued to have several shortcomings, as they are more directed and systematic in nature and are based on the assumption that all innovations are inherently valuable. Technology and human are the two major elements that form the poultry farming system. The type of livestock and physical potential of the farm can be determined by technology and changed or modified by technological development (Chi, 2002). The human element is influenced by exogenous (culture, norms, community structures, external factors) and endogenous factors (farm rules, management), as well as possessing its own social and cultural orientation that requires convincing and compelling evidence of the benefits of proposed change. Furthermore, in relation to diffusion models it can also be argued that diffusion models have a product-centric view of innovation. The environment or system they operate in is regarded to be relatively stable. Poultry farming is a social system and when viewed from the moral values of halal the product centric approach of diffusion models offer too narrow a conception. Studies examining diffusion and adoption of technology in agribusiness can be categorized as having either a macro level or micro level approach. At a macro level, studies are more concerned with changes that encompass the whole institution through organizational and structural change (Yates, 2001). The main argument of this approach is centered on the assumption that technological superiority is the main driver of adoption and will eventually replace inferior technologies. This approach relies on top down strategies through the role of

senior management by identifying the organizational factors but fails to acknowledge the complex nature of technologies and the fact that individuals do not necessarily adopt technologically superior products.

At the micro level, the widespread application and development of technology adoption that would bring about radical transformation and instigate systemic change of the entire institution is not the focus of these research studies. It is presumed that human interaction with social and cultural orientation (e.g. halal) guides the change rather than technology superiority (Lisewski, 2004). This presumption is based on the understanding that individuals can make decisions on their own undeterred by external factors; but individuals within an organizational context do not make decisions in isolation and are affected by the organizational roles and positions that have been imposed upon them (Slappendel, 1996).

The adoption of one approach may fail to fully address the complexity of innovations and therefore the findings would be limited as only part of the innovation process is examined (Lisewski, 2004). The preferred and more complete approach is when both institutional attributes and individual perceptions are taken into account by establishing a link between *macro* level and *micro* level theories, explaining change or stability in terms of the interactions between individual actions and organizational (structural) influences (Hung, 2004). Carr (1999) is of the opinion that adoption theories should concentrate on the potential adopters and contextual characteristics in which they use the technology. In preference a combined approach that considers both institutional and human factors that lead to the adoption or rejection of technology is recommended; Giddens (1984) refers to this balancing of structure and agency as duality of structure.

1.3 Research Rationale

A global economy characterised by rapid change, accelerating scientific and technological breakthroughs, and an unprecedented level of competitiveness creates demands for higher levels of education and training. These developments in the halal poultry production domain generate a requirement for a greater capacity of innovation, management, animal welfare, and ecological consideration.

The poultry industry in Iran has witnessed a dramatic cycle of change over recent decades especially as the political system changed from a more secular form of governance to an

Islamic form. It can be argued that the introduction of new technologies represents radical change within the industry. Whilst there is acceptance that technology needs to be diffused into poultry supply chains and a greater understanding of the best way to introduce innovations is necessary, the level of adoption is not systematic and varies greatly case by case and the gap widens even further when it is viewed from a halal perspective. However, despite this problem – which is not unique to Iran's poultry industry – there has as yet, been no effective and sustainable strategy or solution to the problem found, and hence, the case for more research in this area is strongly supported.

A study of the diffusion of innovation in halal poultry production could lead to the development of a systematic, prescriptive model of adoption and diffusion of technology. The findings of this research could not only benefit Iran, but also other Muslim and non-Muslim countries that produce and supply halal products or form part of the global halal supply chain.

1.4 Research Aims and Objectives

A review of the halal poultry supply chain literature in terms of the adoption of technology shows that there is very little evidence of substantive theoretical accounts, which adequately integrate multiple levels of analysis and explain adoption and diffusion of technology in this context.

Addressing this challenge requires an explanatory framework that accommodates both micro and macro level perspectives. Such a framework will enable the integration of both micro and macro levels of analysis by recognising the equal contributions of both structural processes and human agential powers. Therefore this thesis aims to investigate how does structure enable or constrain the adoption of technology from a halal perspective in the poultry production in Iran? Through this aim, the research seeks to meet the following objectives:

- To explore the role of human agents, technology and the institutional characteristics of poultry production in Iran
- To examine factors that enable or constrain the adoption of technological innovations in the halal poultry supply chain

- To analyse, within the available information, the role of technology in the diffusion of innovations in halal poultry production in Iran
- To propose a model that captures the effectiveness of diffusion strategies that enable and/or constrain the adoption/implementation of new technologies.

1.5 Theoretical Framework

In order to examine the adoption and diffusion of technological innovation in Iran's poultry production Giddens' Theory of Structuration, as adapted by Orlikowski (2000) offers significant analytical advantages. Giddens' Theory of Structuration attempts to bridge the gap between the two differing views that dominate social science theory. On the one hand, views held by Structuralists and Functionalists, and on the other hand, views that focus on the individual. Structuration theory maintains that there is no clear distinction between the two approaches and asserts that both perspectives are interlinked and social life is not just a micro level activity and neither can it be studied purely by macro level approaches. Giddens' "duality of structure" theory views structure and human agency as an inherently dependent duality, within which structure and agency are interlinked by three corresponding modalities: interpretative scheme, facility and norm.

Structuration Theory has been employed to study technology-induced organisational change. However, technology does not feature explicitly in Giddens' structuration model. In this respect, Orliowski has produced a Structurational Model of Technology in which three components can be identified, these being: (i) human agents, (ii) technology-material artifacts that mediate work tasks of the individuals; and (iii) institutional properties of organisations (such as structural and control mechanisms, strategies, culture, expertise, and communication channels). In order to answer the proposed research question, this study uses these principles to reconstruct the adoption of technology in the context of the halal poultry supply network in Iran, and to present a model for investigating the relationship between technology, halal and organizational elements that integrate structural and individual factors. Diffusion and adoption are important considerations in this context (Rofers, 1995).

Diffusion is the process by which an innovation is communicated through certain channels over time among the members of a social system. In this study, diffusion refers

to the structures, systems and processes that are employed to increase the adoption of technology by the human agency, for example; these may be via strategy staff training, infrastructure such as smart buildings, management support (Eynon, 2005), and/or rewards and incentives (Moser, 2007).

Adoption refers to a stage, where a person or group of people selects the technology for use. This includes the period where everyone participates in activities that lead to the adoption or rejection of innovations. In this study, adoption is mainly concerned with factors influencing the take-up of the innovation, for example, personal motivation (Schifter, 2000), previous experience (Conrad, 2004), curiosity (Armstrong, 2000), and pragmatic motivations (Caroll-Barefield et al, 2005). However, the main objective of this research is to investigate the structure of organisations, systems and organisational processes that influence the take up of technology from a halal perspective.

1.6 Overview of Methodology

A qualitative exploratory case study (Guba, 1990) approach is believed to be the most appropriate way to pursue the research question and hence, realise the objectives of the study as the subject under investigation does not have a well developed set of theories regarding the level of knowledge and status of implementation. As such the content itself involves a complex system of producers and suppliers' interdependency. The research explores genuinely open questions and new phenomena, rather than testing theoretically derived ones, since the topic of study is dynamic by nature. Within the case study method, interviews were conducted with personnel connected to the management and running of five Iranian poultry farms involved in meat and egg production.

Semi-structured interviews were used as the main method of data collection, and thematic analysis of data was conducted to categorize the main themes that are connected to the research question. This process of data reduction and drawing of conclusions has been complemented by comparison of data within and across themes and accompanied by continuing simultaneous reading of literature.

1.7 Research Contribution

This thesis seeks to make a direct contribution as the first study to examine the technological innovations in the poultry supply chain from a halal perspective in Iran.

This is important as there is no ready model that encompasses all the organisational components associated with the adoption of technology in poultry production in transition from traditional to modern poultry farming. The thesis presents knowledge on how technology can facilitate the dissemination of poultry innovation, by proposing a theoretical model of innovation-diffusion process that can be critiqued and used by future studies as a frame of reference. Such a model may provide useful guidance for policy makers, industry practitioners and decision makers who are addressing poultry industry issues. This will involve a systemic attempt to identify stakeholders in the poultry innovation system in Iran. The thesis also provides new materials on the poultry halal supply chain that may be of value for researchers outside the field. For example, in ecological public health it may help to close the knowledge gap in developing countries (Nasr, 1997). The results and lessons learned from the interviews undertaken for this study provide useful input to technology strategy planners in understanding adoption issues and hence achieving greater efficiency by developing more realistic plans.

1.8 Thesis Structure

This thesis consists of seven chapters, including the conclusion. The rest of the thesis is organized as follows:

Chapter Two explores and synthesises the literature on the scope of this research. It consists of four sections: the first section presents prominent conceptual models of technology adoption and diffusion that have been mostly used by researchers. Section two outlines the theories related to supply chain, scope of supply chain management, and the poultry supply model in Iran. Section three explores the background and trends of poultry production in Iran before and after the revolution of 1979. Section four discusses halal and Shia understanding of halal and its jurisprudence, animal rights in Islam and animal welfare issues.

Chapter Three presents the theory overview and the theoretical justification for the selected methodology for this research. In this chapter the concepts leading to the development of the conceptual framework based on Giddens' Structuration Theory and Orlikowskis' Structuration Model of Technology are discussed and a conceptual framework is proposed.

Chapter Four presents an overview of philosophical paradigms and discusses the research methodology. The rationale for the selection of single or multiple case studies along with the stages of data collection and data analysis procedures within the research process in relation to the interview questions are discussed in this chapter.
Chapter Five reports the findings of the research. The data collected from the interviews of five case studies is explained under the identified themes and in relation to the theoretical framework, and a cross case study analysis is conducted.

Chapter Six provides a discussion of the themes and sub-themes that emerged from the data analysis in comparison to the reviewed literature. Factors that influence adoption and diffusion of technology in halal poultry production are developed as a means to propose a model through which the research question can be explored.

Chapter Seven is the final chapter and concludes the findings of the research by discussing the contribution made by the study to theoretical knowledge, practice and methodology. The theoretical implications are discussed, and future research is suggested based on the findings of the present study.

1.9 Chapter Summary

This chapter presented the background issues relevant to the research. The transition of Iranian poultry production from a small-scale backyard operation to modern commercial production was presented. This chapter provided an overview of the research rationale, research question, aims and objectives of the research and outlined the theoretical framework. The chapter presented an overview of the methodology that has been used for this investigation. The chapter discussed the research contributions of the investigation and outlined the structure of the thesis. The following chapters will further develop the conceptual framework and methodology to investigate the technological innovation in the poultry supply network from a halal perspective in Iran. The next chapter reviews the literature on the adoption and diffusion of technology from different perspectives. It discusses the issues related to sustainable development and advances in supply chain and supply chain management. A comprehensive definition of halal and halal related standards as well as an account of Iran's poultry production is presented in the next chapter.

CHAPTER TWO: LITERATURE REVIEW

2.1 INTRODUCTION

This chapter starts by examining the literature on the innovation, adoption and diffusion of technology, and their applications in the poultry industry supply chain in Iran. The two differing views on structuralist and individualist perspectives on the adoption of an innovation are presented. Diffusion of technology forms an organisational perspective that includes the role of management, communication and training as well as supporting structures, which are all discussed. Understanding personnel beliefs and values and their moral codes are perceived to be important components in the adoption of technology. The poultry industry in Iran and its transition from a small-scale localised operation to the utilisation of state-of-the-art technologies in mass production is studied in this chapter.

A comprehensive definition of the halal dictum as a guiding principal and cultural norm in an Islamic country is presented in this chapter alongside a discussion of the permissibility of action and consumption that halal refers to from a Shia Islam perspective. Different categories of supply chains and the development of supply chain management in indutrialised countries, as a result of challenges posed by the globalization for supply networks are also examined. Animal welfare and an Islamic perspective on the treatment of animals in general and issues related to treatment of animals in poultry farming are also discussed.

This literature review also examines the changes in government policy that affected Iran's poultry production before and after the revolution of 1979. The role of communication in the diffusion of innovation, and the role of senior and middle management in providing support, resources and motivations, which play an important role in increasing levels of adoption, are discussed in section 2.3.2 and 2.3.3 respectively. The findings of the studies in relation to developmental components of supply chain management are discussed in sections 2.4, while the determinants of a halal supply chain are reviewed in section 2.4.3.

Organisational infrastructure is perceived to be an important factor in enabling or hindering the adoption of technology. In this respect poultry production training and technical support are the key determinants of the adoption of technology. Issues related to the integration of technology into the halal poultry operation systems are investigated. Section 2.5 discusses the development of poultry production in Iran and the challenges it faces from market forces and increasing demands from consumers. Section 2.6 highlights the position of Iran's poultry production in the world and presents a regional comparison with Turkey's poultry production capabilities. Section 2.7 and 2.7.1 discuss Islam and halal by looking into different Islamic beliefs and schools of Islamic jurisprudence. Section 2.7.2 presents animal welfare from an Islamic point of view. In summary, the chapter identifies the literature of all relevant and important contributions in the field with the purpose of focussing on and providing detailed knowledge of the range of issues that influence the adoption of technology in the Iranian poultry supply chain.

2.2 Technological Innovation

Innovation depends on so many factors and causes, and there are many different definitions of innovation as schools of thoughts have developed over time in different disciplines. Classical definitions for innovation, define innovation as a creative idea that is realised (Johansson, 2004) or the successful exploitation of a new idea (DTI, UK). A working definition of innovation is the entire process by which an organization generates creative new technological ideas (invention) and converts them into novel, useful and viable commercial products, services and business practices for potential economic gain. Lopez (2004) describes innovation as a process, which is linked to the learning ability and knowledge of the actors and agents involved. Hall (1986) takes the view that innovation comes in two forms; either product innovations or process innovations. Piana (2003) classifies innovation into three categories: of product innovation, process innovation and behavioural innovation in terms of new organizational routine, and further argues the multidimensional nature of the innovation, which could affect the environmental issues by addressing regulatory requirements, change in patterns of consumption, productivity and cost as well as quality of produced goods.

Edquist (2001) argues that 'the systems of innovation approach' has actually been more focused on technological change and not on innovation, and furthermore that technological innovation has also been more focused on technological process

innovations. The kind of innovation that confirms its determinants as technological process innovations have determinants other than organisational process innovations. Dividing innovations into different categories is therefore necessary. Edquist (2001) describes innovations as new creations of economic significance, which may be new or a new combination of existing elements. The taxonomy of innovations discussed by Edquist (2001) is depicted in figure 2.1 below.

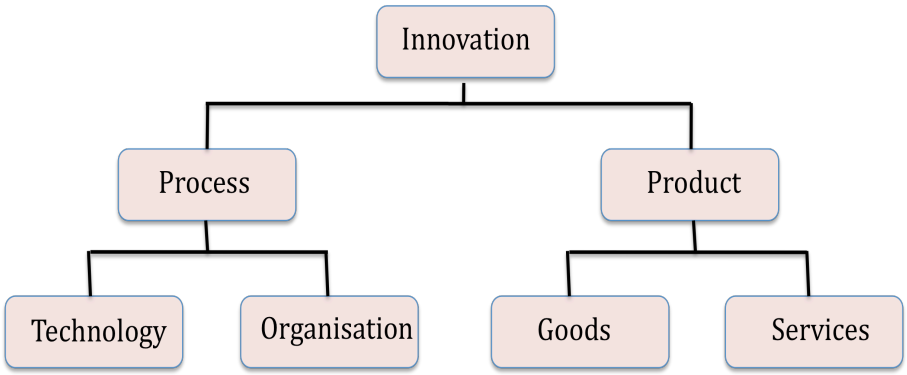


Figure 2.1: Taxonomy of Innovation, Edquist (2001)

In this taxonomy product innovations are identified as goods or services, which are the main mechanisms behind changes in the production structure. Some product innovations that are not for immediate consumption are transformed into process innovations, for instance an industrial robot is a product when it is produced and then a process when it is used in the production process. Process innovations are categorised as either technological or organisation innovations. Product and process innovations are closely related, however, it is important to make distinctions in order to pursue the analysis at different levels. Technological and organisational process innovations are necessary for the competitiveness of all industries.

Rogers (1995) defines innovation as an idea, a practice or an object that is considered to be new or is perceived as new by the potential adopters or an individual. The process that communicates an innovation by certain channels over time to the members of a social group or system is known as diffusion of innovation. Innovation is a pervasive phenomenon and there is no simple pipeline from invention to application. For a single poultry farm, innovation can be defined as introducing new ideas in processes, products,

management or marketing (Bryant, 1998). Rogers (1995) argues that people discover an innovation by accident because they cannot actively seek an innovation until they become aware that it exists.

Rogers (1995: 139) describes technology as being a product of society, which is influenced by the norms and values of the social system. From a technological point of view there are several distinct technologies that are associated with the developments of the poultry industry. These developments have progressed from mechanisation in the last century to information systems technology for processing, handling and improving methods for integration, as well as efficient utilisation of resources in the poultry farming and its supply chain. The major technological developments have occurred within mechanical machinery, veterinary technology such as vaccines, computer technology for information systems, remote sensing, automation, mechatronics, traceability technology such as bar codes and Radio Frequency IDentification (RFID), biotechnology for gene technology and genetic modification, nanotechnology, such as intelligent materials, smart machines for achieving higher timeliness in operations and monitoring impacts of the production in the environment and ecosystem. It is envisaged that in poultry production another area of innovation may arise from unexpected situations, such as the outbreak of diseases, where information sharing and community involvement play an important and direct role by drawing on wider experiences in prevention and containment of the diseases. The existence of halal production compliance with some mandatory regulatory actions may in itself be the source of innovation in poultry husbandry.

Another technological challenge is derived from the emergence of the "Halal Value System" (Wilson, 2013). The recent phenomenon of creating halal branding strategies, with halal certification and logos has created both opportunities and challenges (Wilson, 2013). For the poultry industry these challenges stem from the globalisation of the poultry supply system, which calls for greater traceability and sustainable animal farming practices, which requires vertical integration within and between firms in both industrialised and non-industrialised countries.

2.3 Innovation Diffusion Theories and Models

A considerable amount has been written on the subject of innovation diffusion and innovation in general (Rogers, 1995). This section discusses conceptual models employed by researchers to examine how innovation and change are believed to occur. These

models are selectively examined, and include both micro and macro level theories. Given its importance in the literature a large part of the section focuses on Rogers' (1995) theory of innovation diffusion. The aim of research using these approaches is to develop theories of adoption that will assist larger scale adoption of innovations.

There are various acceptance models and frameworks related to the adoption of technology. The more frequently cited models – Technology Acceptance Model (TAM); different versions and extensions of Technology Acceptance Model such as TAM2 (Ventkatesh, 2000); the Unified Theory of Acceptance and Use of Technology (UTAUT); the Theory of Reasoned Action (TRA); and the Diffusion of Innovation by Rogers (1983) – have been named by Nanayakkara (2006) as acceptance theories.

The Theory of Reasoned Action (TRA) is a scientific theory designed to predict people's behaviour in a real voluntary situation, not in a mandatory context by statistical generalisations, by creating a link between attitudes and behaviour, and by linking behavioural intention to a person's actual behaviour. The Theory was developed by Fishbein and Ajzen in the 1960s and was modified in the 1980s and subsequently called The Theory of Planned Behaviour (TPB) to consider the mandatory situation. In the 1990s Fishbein, in cooperation with Kasprzyk and Montano, developed a further extension of the theory and called it the Integrated Behavioural Model (IBM). In regards to innovation, the theory includes two measures of attitude and social normative as determinants of behavioural intention and argues that the intention to adopt is based only on the adoption behaviour and intention. Criticism that has been raised of this theory is that it does not take into account factors such as personality and personal variables, group and community factors, and that the theory is applicable only when the individuals have full control over their behaviour, hence it cannot explain addictive behaviour.

Davis and Bagozzi (1989), based on the Theory of Reasoned Action, introduced the Technology Acceptance Model (TAM), which aimed to explain and predict the user's acceptance or rejection in the adoption of technology. The theory comprises of two beliefs 1) usefulness, that determines user intention and lead to actual behaviour in adopting or rejecting a technology, and 2) ease of use as 'the degree to which an individual believes using a system would be free of effort', therefore Perceived Ease of Use (PEOU) and Perceived Usefulness (PU) refer to the degree to which a person believes using a

particular system would enhance his or her job performance.

Ventakesh and Davis (2000) criticize the Technology Acceptance Model for failing to consider the environmental factors and they subsequently developed the Technology Acceptance Model 2 (TAM2), which included the role of social influence in user acceptance or rejection in the adoption of technology. TAM2 retained the ease of use perception from TAM as a direct determinant for perceived usefulness. The main criticism directed at the deployment of TAM models concerns the use of the self–reporting measure of data embedded in these models rather than the use of actual data, which may result in unreliable and subjective findings. A qualitative meta-analysis carried out by Legris et al. (2003) found out that TAM produces inconsistent results and fails to predict in many studies.

The Unified Theory of Acceptance and Use of Technology (UTAUT) was formulated by Venkatesh etal (2003), which was based on a review of eight earlier models. The theory proposes four constructs, three of which are direct determinants of user intention and behaviour and determinants of behaviour; these are performance expectancy, effort expectancy, social influence, with the fourth being facilitating conditions. Bagozzi (2007) criticized the model and its subsequent extensions as being too complicated. With 41 independent variables for predicting intentions and at least 8 variables for predicting behaviour he concluded that it contributed to the study of technology adoption reaching a stage of chaos.

Roger (1995:227) defines diffusion as a process, which communicates the innovation to members of a social system over a period of time through communication channels: as "an idea, practice or object that is *perceived* as new." Rogers' approach to innovation diffusion in all his case studies, from bottle feeding babies in the developing world to black music in America, was to identify the factors that affect the adoption of an innovation or otherwise. He argues that social systems and technology are separate and diffusion is the adoption of technology by a social group. In this respect technology transfer therefore is seen as an attempt to bring together the social and technical elements. Innovation Diffusion Theory has been successful in describing how innovations diffuse or move through social groups either to be accepted or rejected. This success lends itself to the fact that anything can be explained, by a reference model of the initial force or

resisting medium (Latour, 1986). What actually needs to be explained is the acceleration or deceleration of the rate of adoption, which is then dependent on people and culture if there is an effective change agent or a backward culture that affects the rate of adoption.
However, in diffusion theory, Berlyne (1962) argues that the existence of an innovation is believed to cause uncertainty amongst the potential adopters and this uncertainty is associated with lack of information and predictability. The potential adopters therefore in considering the adoption are motivated to gather information in relation to the occurrence of probabilities of alternatives taking place to reduce this uncertainty (Rogers, 1995). There are four elements in any theory of innovation diffusion, these are: characteristics of innovation, communications channel, time and the social group through which innovation is diffused. It is the things that are perceived as attributes and characteristics of the innovation by the adopters that are considered to play an important role in the rate of adoption. Rogers (Rogers, 1995: 227) notes five characteristics of an innovation, which are perceived as important and are positively correlated with the rate of its adoption. These five characteristics are:

- *Relative advantage*: this is when an innovation is perceived to have the edge over the existing solution either in financial terms or social standing;
- *Compatibility*: when an innovation is perceived to be in line with the potential adopters' values and past experiences;
- *Complexity*: this is when an innovation is perceived to be complicated and not easy to comprehend;
- *Trialability*: the rate of adoption increases if the potential adopter is able to play with the innovation before making a decision;
- *Observability*: this is when the results of an innovation are more visible.

There is also the bandwagon effect mentioned by Abrahamson and Rosenkopf (1993). This is when an innovation is adopted by organizations or a social system because of the sheer number of adoptions by others, and this seems comparable with the observability characteristics of an innovation.

2.3.1 Sociological Perspective on Diffusion of Innovation

As discussed above, according to Rogers (1995) there are five attributes of innovations. Wong and Romm (2004) argue that choosing the right time to start the technology rollout,

with the time as a unit of measure for the adoption rate amongst the potential adopters, constitutes the importance of the time effective communications channel. The relationship between time and the extent of diffusion can be visualized by the diffusion S-curve, which is the single most commonly accepted finding in the social sciences (see Figure 2.2).

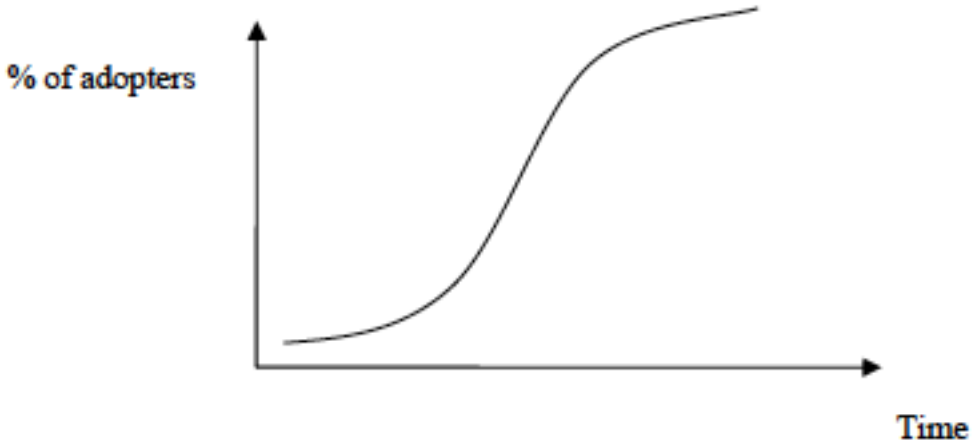


Figure 2.2: Understanding Market Dynamics (Rogers, 1995)

The percentage of adopters who adopt an innovation is usually shown using a Gaussian (normal distribution) distribution function, which is a bell shaped curve and the time element of the diffusion process identifies the different categories of adopters. The S-shaped distribution shows that the adoption rises slowly at the beginning with the number of adopters moving along the time axis and eventually it levels off and starts to decline.

Sheehan (2005) explains that by increasing the number of adopters in any given time it is possible to shift the curve to the left and hence increase the number of adopters, which is made possible by increasing awareness amongst the potential adopters through communication channels. In order to maximize the number of farmers who will adopt a new technology, diffusion theory considers two factors in the diffusion process. The first factor is to make sure that the innovation is in response to the farmers' needs and the second factor is the selection of the most appropriate communication channel. In general there are other factors that influence diffusion, such as word of mouth, supply constraints, process improvement, vintage effects (machine tools), general shifts in the needs of the population (life style), progressive development of skills and finally pricing strategies.

In real terms in poultry production adoption of innovation is a social process as well as a mental and physical one, and occurs in five stages: awareness, interest, evaluation, trial, and acceptance/rejection (Rogers, 1995). The adoption process is accelerated if the time taken in each stage is shortened; for instance Information Communications Technology (ICT) can help to generate awareness and interest and reach more potential adopters by providing rich information content in a relatively short amount of time, although this does not exclude the social link and interaction between the research community and the farming communities which takes place in a much broader social context. The social players have a much greater influence on innovation diffusion as by their attitude they exchange not only ideas but also concerns that could influence the tacit knowledge of traditional farmers.

Different categories of adopters differ by, for example in economic status, resources, affinity for risk and knowledge. Rogers (2003) lists innovators as the first category to adopt an innovation as they are considered to be risk takers with primary motivations to learn about new technologies for their own sake; they are pioneers. The second category includes the early adopters, who are visionaries with great imaginations for strategic applications and motivation to gain competitive advantage through breakthrough innovations; they are pro change and are respected in the social system; they also encourage others to take up the new technology. Members of the early majority group form the third category of adopters. They are pragmatists with a primary motivation to gain sustainable productivity improvements through evolutionary change. The late majority group of adopters are conservatives seeking demonstrated Return On Investment (ROI); they are cost sensitive. The final group classed as laggards, have a low willingness to accept new technology and like to maintain the status quo. The laggards represent the group that resist adoption until they have no choice; in fact they may never take up the new offering at all and on the S-curve they represent a standard deviation of dispersion with early and late majority as the mean value, which has been depicted in figure 2.3.

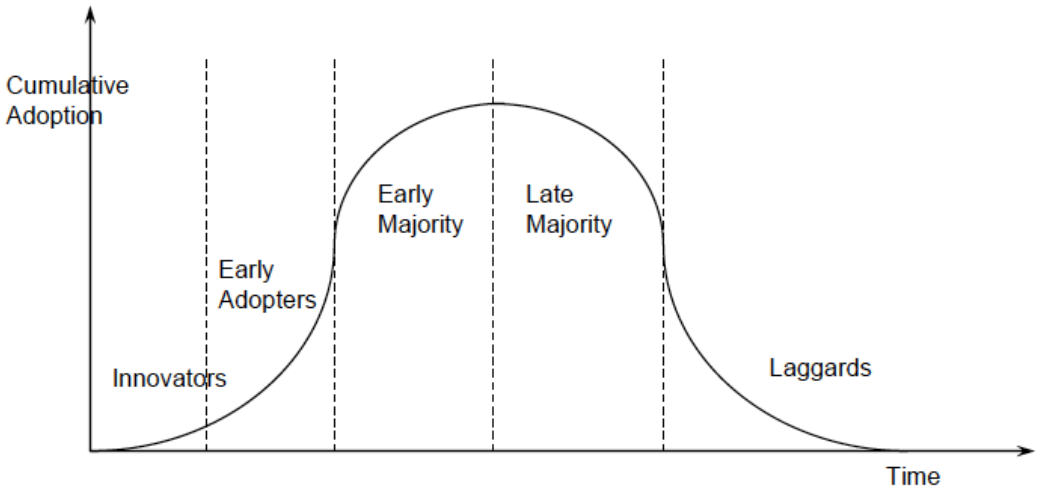


Figure 2.3: Market Dynamics Basic Segmentation (Rogers, 2003)

Rogers (2002) describes the S-curve as an innovation and system specific describing the diffusion amongst members of a particular group that describes the successful innovations. Rogers' diffusion model has been criticized as being focused on individuals rather than on organizations and organizational issues (Lundblad, 2003) and the need to describe the relationship between the innovation, the adopter and the social system and other factors of adoption remains unanswered. Others have questioned the distribution curve as not being representative of the size of the adopter categories, a claim rejected by Rogers as the empirical evidence supports the Gaussian (normal) distribution as the appropriate mathematical model for a large number of products.

2.3.2 Communications Perspective

Rogers and Shumaker's (1971) model of innovation diffusion is the oldest practical model for agriculture that highlights the limitations of the communication channels in the diffusion process and the uncertainty that is associated with innovation. Rogers and Shumaker's model dates back to before the internet and information revolution and therefore takes only two channels of communication into account, mass media and interpersonal channels (opinion leaders, suppliers). This model is valuable in identifying the four stages of the decision-making process depicted in figure 2.4.

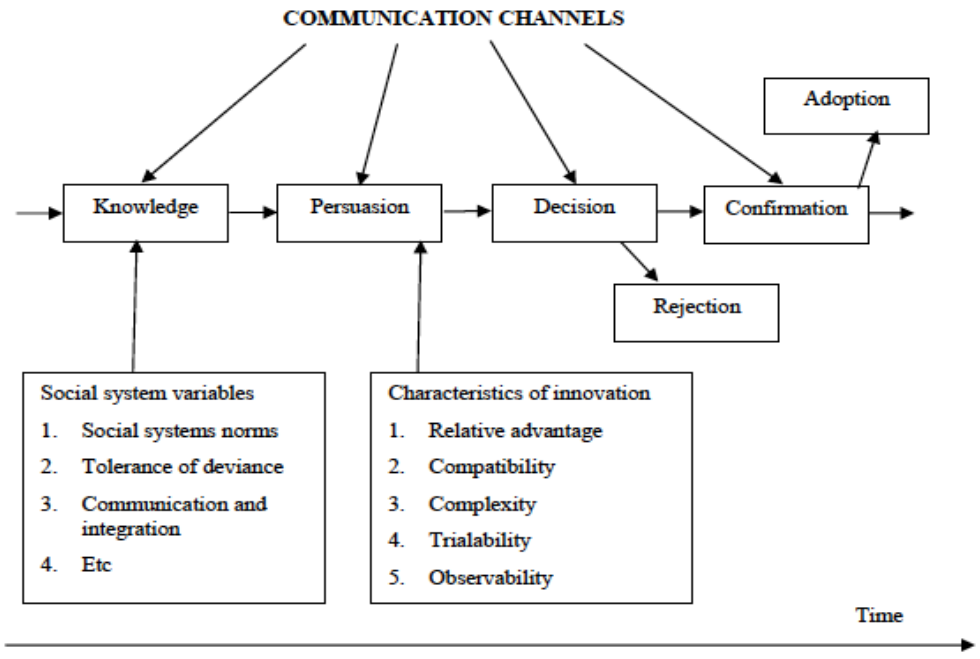


Figure 2.4: Rogers and Shumaker's Communication Model 1971

Although the above model is helpful in understanding the innovation decision making process it was nevertheless criticized for limitations regarding operational issues.

Rogers' (1995) has proved to be one of the most influential models in diffusion of agricultural innovations. In this model the factors such as the nature of innovation decision making and the nature of the social groups and the communication channels that influence the adoption were identified and the concept of perceived attributes introduced. This further highlighted the fact that innovation in the agricultural domain is a systematic process, which takes place in a social context where the rate of adoption of new innovation is a function of the nature of innovation and communication channels. An important consideration in the social system is the degree of homophily between its individual members. Rogers (1995) argues when social system members share the same interests more effective communication can occur.

Rogers (2003) expands on the adoption of the innovation decision making process by elaborating on three types of decision making processes:

1) Optional decision making processes when an innovation is accepted or rejected by an individual independent of the others.

2) A collective decision making process, which refers to a decision-making process that involves other members of the organization to accept or reject.
3) Authority decision-making processes whereby the decision is made by senior management of the organisation without any or insignificant involvement of the potential users.

The innovation decision-making process is depicted in figure 2.5.

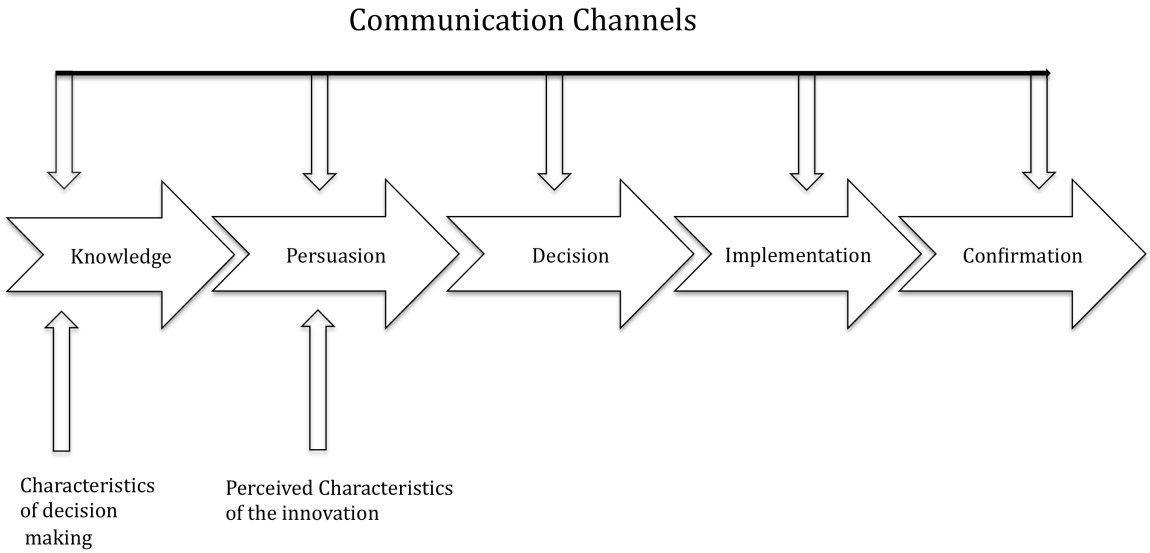


Figure 2.5: Decision making process (Rogers, 2003: 170)

2.3.3 Management Perspective

Top down and bottom up approach models provide a directional perspective to the process of diffusion and adoption in order to satisfy the need to get commitment from members of the organisation. The top down approach aims to materialise the formulation of a vision or a set of visions (Spoelstra and Elzen, 2010). This approach is generally research led and its starting point is to explore the future sustainability possibilities for achieving a sustainable technological development (Hirsch Hadoen et al, 2008). The bottom up approach in poultry production is seen as an ongoing innovation process with a local nature, which does not contain the overall sustainability vision of top down approaches, as the visions of change are limited to the farm level.

This is a process that Roep (2002) calls 'technological institutional' design. The process that has been originated by a top down approach does not encourage the potential

adopters (Carr, 2000). It has long been a common understanding that the main driver behind any organization's attempt for the adoption of innovation is managerial support. The management determination and capability of creating an environment that is based on trust, fluency of organizational hierarchy and creativity are the major factors for a successful adoption of innovation (Jassaawalla & Sashittal, 2001). Other researchers emphasis the role of senior management in creating an organisational culture that supports, encourages and motivates the potential adopters. What managements fail to take into account are the human dimensions related to the management of change (Salmon, 2005). Huang (2004) argues that the role of management is to lead by example and exhibit the willingness to accept the new challenges, as employees would imitate them and therefore create a culture that promotes change. In a Muslim work force involved in poultry production, halal as a guiding principal that provides clear direction in the management of one's actions could provide the senior management with a powerful tool to address the human dimensions associated with the management of change. Rogers (2003) argues the importance of middle management in the adoption of less radical innovations that middle managers also have a role to play, skillfulness and persuasive powers in this respect are as important as powerful individuals.

2.3.4 Organisational Perspective; Micro and Macro Level Theories

As discussed earlier micro level approaches do not develop theories of technology adoption that will have widespread application and radical transformation and systemic change within the entire institution. The essence of micro level approach is that human interaction and social and cultural orientation guides the change rather than technology superiority (Lisewski, 2004), which is based on the assumption that individuals are rational in their decision making and can therefore make decisions on their own without being influenced by external factors. Critics of this approach have argued that individuals within an organizational context do not make decisions in isolation and are affected by the organizational roles and positions that have been imposed upon them (Slappendel, 1996).

On the other hand the macro level approach to diffusion of innovation is concerned with the systemic and radical change that affects the entire organization. Such holistic approaches are about structural change and are less concerned with individuals of an organization. In these approaches the focus is on developing theories within which technology is the main driver. The modern nature of the poultry industry has been

characterized by a series of technology led transformations. Macro level approaches, by not taking into account contextualized factors of local settings and therefore missing some differences of requirements, have limited findings. In terms of contextual influences that link external factors to internal adoption there are five contextual factors: user community characteristics, organisational characteristics, technology characteristics, task characteristics and environmental factors that could have an impact on different stages of implementation identified by Kwon and Zmud (1987). Carr (1999) cites organisational characteristics, such as management and resources, as important influencers to the adoption of technology.

2.3.5 Integrative Theory Model

In overcoming the shortcomings of micro level and macro level theories and to fully realise the complexity, dynamic and multi dimensionality nature of the adoption of innovation a combined approach is recommended (De Freitas; Oliver, 2005). Edwards (2000) indicates a shift from individualist or structuralist approaches to an interactive view that considers interactions between individuals and structure. Giddens (1984) describes positive developments in structuralists' approach by introducing frameworks that explore interplay between structure and individual (agency) that provide more insightful research findings. The integration of micro level and macro level analysis can be used to illustrate the contributions of both approaches in considering structure and individual characteristics (Parker, 2000). Fichman (1992) and Abrami (2006) highlight the difficulties involved in integrating the two perspectives. Some of these difficulties include adopter characteristics vs. organisational analysis, as organisational adoption goes through stages and each stage can potentially bring about its own challenges with the individual characteristics.

2.4 Sustainable Development and Supply Chains

Sustainability provides a methodology for efficient use of resources where effective developments are the result of a process of change; and as Thomas (2011) noted the drive behind sustainability is to preserve and to behave ethically. The food supply chain is undergoing continuous changes in terms of innovation, which are powered by regulations, growing competition between producers and supermarkets as well by as social change. Another development in the growth of food markets has been the effect of the globalisation of food markets and the underlying reduction of trade barriers, which have

led to global competition involving all aspects of the food supply chain. Green et al (2001) describe four dynamics that affect sustainability in food production and consumption: the environmental change in food production and distribution, change in economic development, change in household consumption patterns, and technological changes. Amongst these dynamics, the effects of technology in the food system upon sustainability are the least examined (Weaver et al, 2000). Morgan and Sonnino (2008) discuss the importance of environmental protection, stating that sustainable development is seen as dependent upon successful social and economic development and successful social and economic development is dependent on environmental protection (see also Lever & Evans, 2015).

A radical technological innovation may cause social or cultural change for consumers, communities and organisations in the food system. Therefore, the most appropriate way of investigating the sustainability implications of innovation in relation to poultry production is to understand the value chain in the system. The supply chain describes the interlinked system of all material and services of suppliers that affect the process of delivering a product from concept to the consumer and disposal. Forrester (1958) discussed the theory of distribution management that highlighted the relationships and integrated nature of organizations as the system dynamics are so closely related they can affect the performance of functions such as sales, research and production. Forrester (1958) further predicted that, "there will come a general recognition of the advantage enjoyed by the pioneering management who have been the first to improve their understanding of the interrelationships between separate company functions and between the company and its markets, its industry, and the national economy." In other words, Forrester identified the factors and dynamics of a management phenomenon called Supply Chain Management (SCM). Getting a product on time and of good quality to the market faster than the competition is no longer considered to be the competitive advantage but a requirement, with companies being forced toward a more coordinated flow of materials globally between suppliers and distributors.

There are different interpretations of SCM; some view it as a management philosophy or a management process (Lambert, 2008) while others view it in terms of its operational functionalities (Tyndall et al, 1998). However, in terms of supply chains, definitions are more closely matched. Christopher (1992) defines a supply chain as a network of

independent firms that are linked together through upstream (supply) and downstream (distribution) linkages in producing value in the chain that leads to the consumer. There are different configurations of relationships between the entities that form a supply chain, but what is important is the fact that within these different relationships from simple to complex there exists a supply chain, whether it is managed or not. Another important point to note is that a firm can be part of many supply chains, hence the network nature of supply chains.

2.4.1 Supply Chain Management

As discussed earlier, a single definition for the supply chain has not been adopted and the definitions for SCM are not as closely matched as for the supply chain. Table 2.1 below summarises the different definitions of the SCM, which can be classified into three categories of management philosophy, implementation of management philosophy and processes. SCM as management philosophy means taking a system approach that views the supply chain as a single entity (Tyndall et al, 1998). The implications of this view are that the fragmented partnership between different firms is extended to an aggregated effort to manage the flow of goods and services from the supplier to the end customer (Ellram, 1990). In this context Cooper (1997) adds that SCM is a set of beliefs that each player in the chain can influence directly or indirectly the performance and outcome of the chain. In this view each member of the supply chain is therefore encouraged to produce innovative solutions to add value to the chain and this contributes to a strategic approach of becoming customer orientated. This approach of viewing the supply chain from an overall system perspective within a strategic context is called Supply Chain Orientation (SCO), and it is the implementation of this orientation that is more accurately called SCM (Mentzer et al, 2001). Different definitions of SCM from a number of authors are listed in table 2.1 below.

Monczka, Trent, and Handfield (1998)	SCM requires traditionally separate materials functions to report to an executive responsible for coordinating the entire materials process, and also requires joint relationships with suppliers across multiple tiers. SCM is a concept, "whose primary objective is to integrate the sourcing, flow, and control of materials using a total systems perspective across multiple functions and multiple tiers of suppliers."
La Londe and Masters (1994)	Supply chain strategy includes: "… two or more firms in supply chain entering into a long-term agreement; …the development of trust and commitment to the relationship; … the integration of logistics activities involving the sharing of demand and sales data; … the potential for a shift in the locus of control of logistics process."
Stevens (1989)	"The objectives of managing the supply chain is to synchronise the requirements of the customer with the flow of materials from suppliers in order to effect a balance between what are often seen as conflicting goals of high customer service, low inventory management, and low unit cost."
Houlihan (1988)	Differences between SCM and classical materials and manufacturing control: 1) "The supply chain is viewed as a single process. Responsibility for the various segments in the chain is not fragmented and relegated to functional areas such as manufacturing, purchasing, distribution, and sales. 2) SCM calls for, and in the end depends on, strategic decision making. "Supply" is a shared objective of practically every function in the chain and is of particular strategic significance because of its impact on overall costs and market share. 3) SCM calls for a different perspective on inventories, which are used as a balancing mechanism of last, not first, resort. 4) A new approach to systems is required; integration rather than interfacing."
Jones and Riley (1985)	"SCM deals with the total flow of materials from suppliers through end users…"
Cooper et al. (1997)	SCM is "… an integrative philosophy to manage the total flow of a distribution channel from supplier to the ultimate user."

Table 2.1: Definitions of Supply Chain Management (Mentzer, et al, 2001). Adapted from Journal of Business Statistics, Vol.22, No2

Successful implementation of management philosophy requires coordinated effort to adhere to management practices and a set of activities that enable firms to act and behave according to the philosophy. The activities that support this successful implementation are integrated behaviour, sharing of information, cooperation, integration of processes, partnerships with a view to a long lasting relationships and having the same goals and orientation as well as an accepted share of the risks and rewards. Integrated behaviour of the firms must be extended to include that of the suppliers and customers, this inclusion of external integrated behaviours is called SCM (Bowersox & Closs, 1996). Information sharing is particularly important for the planning and monitoring of the processes; information sharing such as forecasts, marketing strategies and inventory stock levels facilitates reduced uncertainty amongst members of the chain and increases efficiency (Andel, 1997). Cooper et al (1997) argue that cross functional coordination between senior managers and operational managers is required for a mutually expected outcome in joint planning and control, which for instance could reduce the size of supply chain wide inventories and therefore lead to a higher cost efficient system. Similarly design of quality control and delivery systems requires joint action (Treleven, 1987). Integration of processes is necessary across the chain for poultry production and this means from farm to fork. Another success factor in SCM is sharing the same goals and working towards a mutually beneficial outcome: for instance being customer orientated, in other word having the same policy (policy integration).

The third category that constitutes SCM is the focus on management processes. These processes are defined as a structured and measured set of coordinated activities aimed at producing a specific output, where a supply chain process is defined as the order of the work activity with a beginning and end and with identified inputs and outputs (Cooper et al, 1997). Therefore, all the functions in the supply chain are identified as processes that are optimised to meet the customer's requirements. Davenport (1993) explains that this process approach aims to encompass the process of managing relationships, information and the flow of materials across the entire chain of production for an enhanced product and better customer value. In relation to halal, Iranmanesh et.al (2015) introduced the notion of the Halal Orientation Strategy (HOS) for food producers in Malaysia to enable firms to retain competitive advantage by enabling firms to genuinely comply with the requirements of halal. This could be useful as a way of providing a strategic operation

strategy for firms that helps them to focus on important resources and capabilities in the present environment (Iranmanesh et. Al, 2015)

2.4.2 Scope of Supply Chain Management

Competitive advantage is the main motivation for forming SCM (Monczka et al, 1998). Customer satisfaction is an important factor in improving the competitive advantage and profitability (Giunipero & Brand, 1996). Therefore it is argued that a successful implementation of SCM results in customer satisfaction that would lead to a competitive advantage, which leads to more profitability for all the members of the supply chain. Innovative solutions play an important role in meeting customer satisfaction, which is one of the main objectives of SCM. The scope of SCM is both functional and organisational, the necessary business functions that are included in the implementation of the SCM form the functional part; the organisational part refers to the inter-firm relationships that are built in the implementation process. Organisational relationship bonding between companies is also reflected to some degree to their success in their supply chain partnerships. Table 2.2 below illustrates the requirements that are needed between a single company to form partnerships with at least three or more companies to form a supply chain orientated towards the implementation of SCM and the subsequent benefits that follow from this partnership.

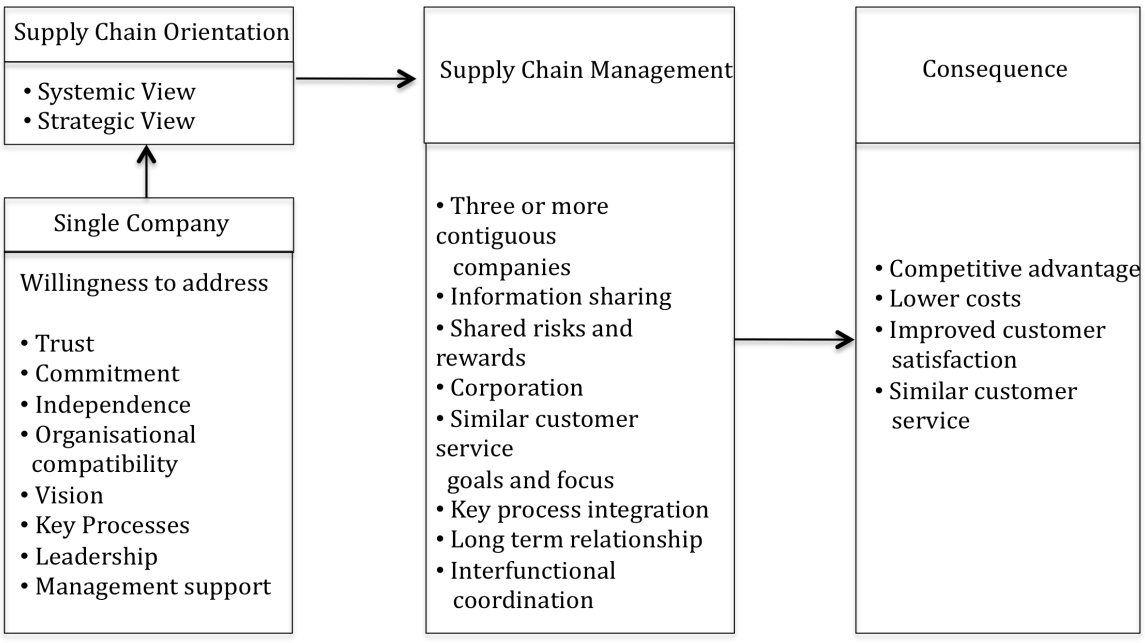


Table 2.2: Supply Chain Progression (Mentzer, 2001). Adapted from Journal of Business Logistics, Vol.22, No.2, 2001

For an ideal SCM to reach its optimum potential the business functions and business flows must be coordinated within each company and across the supply chain. These business functions and flows include inter-functional coordination (trust, risk and commitment), marketing, sales, research and development, production, purchasing, logistics, information systems, finance and customer service. Business flows that are linked to customer satisfaction and profitability, and which lead to competitive advantage include products, services, information, and financial resources.

In industrialised countries supply chains were formed after the 1950s, particularly in USA in line with the development of large supermarkets offering everything under one roof. An example of a mutually configured poultry supply chain of France where there is a one to one agreement between the producer and supplier is depicted in Figure 2.6.

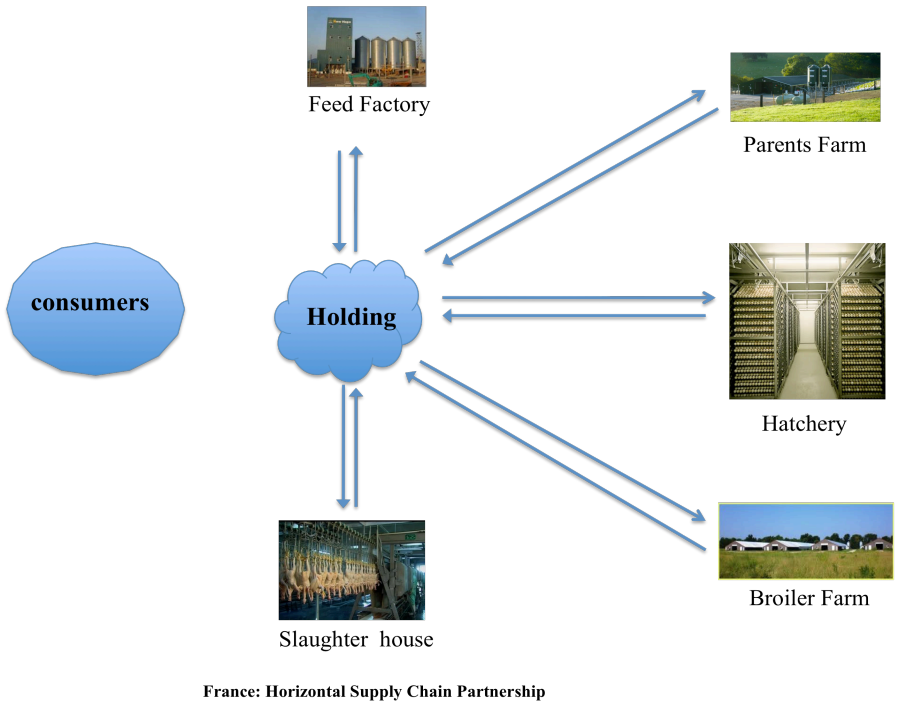


Figure 2.6: Poultry Supply Chain Model - France

However, the rapid quantitative growth of the poultry industry in Iran and the slow transition to a consumer market infrastructure due to a lack of big supermarkets and the gradual take over and manipulation of the supply market by a strong well connected

group of intermediaries, means that Iran has an outdated and unusual poultry supply chain configuration, as depicted in figure 2.7.

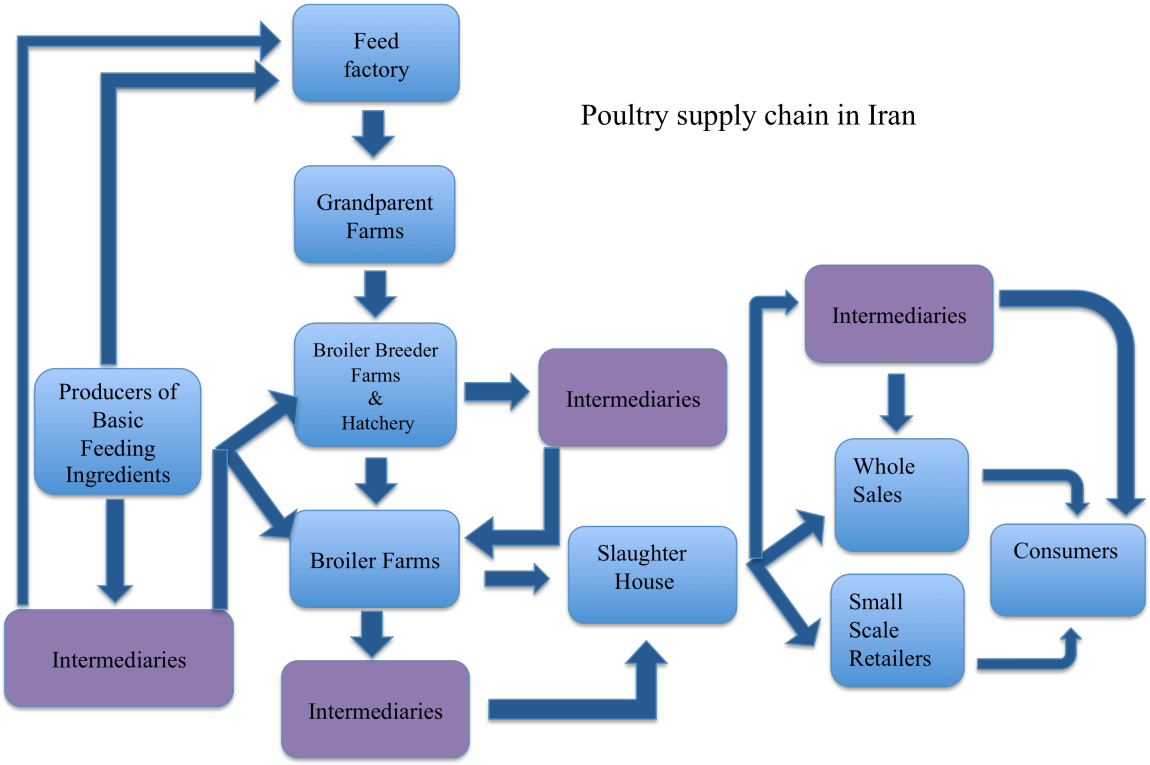


Figure 2.7: Configuration of Poultry Supply Chain - Iran (Source, Author)

The current configuration of the Iranian poultry supply chain is illustrated in Figure 2.7. This configuration is in many ways unique to Iran; it differs structurally from established poultry supply chains in other countries. In the Iranian poultry supply chain there is a network of intermediaries (middlemen), who manipulate, influence and manage the relationship between the suppliers and customers. The intermediaries, also known as dealmakers, exist in every linkage of the supply chain. Intermediaries have privileged and vital information (Mustafavi, 2014) for example; availability and price of imported feedstuffs and vaccines. This is contrary to the definition of SCM suggested by Bowersox and Closs that includes only the integrated behaviour of supplier and customer for the management of the supply chain. According to Bowersox and Closs (1996) the integrated firm behaviour must include all suppliers and customers, as this inclusion of external integrated behaviours is part of the SCM. The model that supports this successful implementation is based on integrated behaviour, the sharing of information, cooperation,

integration of processes, and partnerships with a view to a long lasting relationship, having the same goals and orientation and the acceptance of some shared risks and rewards. As an Islamic country and producer of halal poultry products it is therefore important to evaluate Iran's poultry production in relation to internationally recognized halal standards.

2.4.3 Halal Supply Chain

Supply chains are getting increasingly complex and this complexity increases even further when dealing with halal products and certified halal products, as halal integrity must be preserved throughout the entire value chain (Tieman, 2014). The important factor for the halal supply chain is the integrity of the halal product and assurance of non-contamination with haram ingredients and substances. As Tieman (2014) notes, a system of segregation in the supply chain is needed to protect the integrity of halal products throughout the value chain. Tieman further adds that the requirements of the halal industry are not static and new halal standards are emerging for new products (cosmetics, pharmaceuticals, leather products) and new applications, allowing key supply chain partners such as suppliers, producers, logistics service new providers, distributors and retailers to become halal certified.

Segregation in the supply chain may be implemented at different stages of the chain such as transportation and storage, which may prove costly. In line with the policy of physical segregation between halal and haram and the extension of halal towards supply chain management the aim of the International Halal Logistics Standard (IHIAS 0100:2010) is to address the issue of non-contamination by proposing the marking of "halal supply chain" on freight documentations and on cargo labels for the easy identification of halal consignments.

Lodhi (2010) argues that there is limited research published on the halal food supply chain. While there is an emerging volume of research examining the halal consumer's behaviour and attitude there is a knowledge gap regarding the issues pertaining to the halal food supply chain from farm to fork. Lodhi (2010) identifies the integral elements of current halal supply chains as halal control, halal certification and halal monitoring systems. Tieman (2005) argues that there is a need for a transparent practical model to effectively describe and optimise the existing halal supply chain, as halal is moving from

a product approach where halal is mainly addressed in slaughtering and production towards a supply chain approach where halal is addressed from source up to the point of consumer purchase, whether that in the supermarket or restaurant.

Research has shown that perception of the Muslim consumer is an important determinant for the design of the halal supply chain (Tieman, 2011). The matter becomes more complex as this perception can vary according to the different Islamic school of thought/ jurisprudence. A true halal supply chain for the poultry market would have a focus on the maintenance of the halal status of the products throughout the value chain. This can be achieved by not only safe guarding the common perception of non-cross contamination with haram and halal slaughtering, but also by applying the permissibility of action which includes looking beyond the ingredients and method of slaughtering to include the treatment and welfare of the animal as well as the actions of the workforce involved in the supply chain.

2.5 Poultry Production in Iran

In order to provide an accurate account of Iran's poultry production it is important to give a brief explanation of the global rise of the poultry industry. The first American Poultry Association (APA) was registered officially in 1870. However, the History of American Poultry (Lacey, 2010) makes reference to local and regional associations as far back as 1823. In order to improve the economics of chicken production in Western countries in the years after 1900 a series of heuristic processes were implemented, which resulted in the introduction of new breeds such as New Hampshire, Rhode Island Red and Plymouth Rock. Combined with the genetic technology techniques of recent decades this trend continued and was the precursor of today's hybrid breeds such Ross and Cobb, Arbor Acres, Lohmann, Hubbard and Hybro (Jasper, 1974). In 1912, the Poultry Science Association with participation from 14 countries was established and they subsequently organized "The World Poultry Confederation", which took place every three years after the Second World War. Meetings were held under the name of the World Poultry Science Association (WPSA) and all the latest developments and advances in the poultry industry were presented to more than 4,000 participants from 80 member countries at these events.

In 1996, Iran joined the WPSA and established the Iranian branch and from this point onwards Iran participated in educational activities in accordance with WPSA policies to

encourage and to promote knowledge awareness amongst farmers by organizing knowledge transfer programmes with leading researchers and experts. The turning point in the commercialisation of poultry production in Iran began in the early 1950s when the first hatchery unit was offered to an Iranian entrepreneur by the US Embassy in Tehran, who then also travelled to the US to learn about modern farming. Before the modern industrial era, poultry production in Iran was similar to many other countries in the region: production was on small-scale using indigenous breeds for consumption by the local population (Shariatmadari, 2000). However, during the following years a steady flow of poultry equipment and different breeds was imported to Iran. The first batch of breeding type stock entered Iran in 1964 and in 1974 this was followed by the introduction of grandparent breeding stocks (Darmankohi, 1996). However, changes in policy after the revolution of 1979 affected all aspects of Iran's poultry industry (see 2.5.1).

Progress in the poultry industry in developed countries after the Second World War continued through the construction of buildings with better ventilation and lighting and improvements in disease control and technological advances in animal feed sciences (Narrod & Fugile, 2000). At this time, researchers formulated an indicator to evaluate the effect of applied sciences called the European Production Efficiency Factor (EPEF). The EPEF not only takes the daily growth and feed conversion of the broilers into account, but also includes mortality percentage in its calculations.

$$\frac{\text{Viability (\%) x BW (kg)}}{\text{Age (d) x FCR (kg feed/ kg gain)}} \text{ X 100 = EPEF}$$

Viability = Mortality rate BW = Body weight
Age = Age at slaughter FCR = Feed conversion factor

Source: (Jahnke, 1982)

The value of EPEF is an indication of flock performance, so the higher the value the

better the performance.

The poultry industry has enjoyed significant growth in many countries but some countries have a more prominent position in the global trade than others. America is the largest producer of poultry meat globally with a total production of 16.5 million tons and with a supply of 3.8 million to the world market. Brazil is second with 9 million tons of total production and a supply of 3.5 million tons to the global market. Studies of over 13 poultry meat producing countries over the past forty years bear interesting results and demonstrate the improved position of Iran from being ranked 27th in the world in 1969 to the position of 6th in 2009 9 (Mustafavi, 2012).

Table 2.3 below illustrates this comparison. It demonstrates that from 1969 to 2001 and then to 2009 there has been little change in the position of most producing countries, with countries like the US, China, Russia, the UK and Japan retaining their prominent positions and status. In the case of Iran, however, there has been a significant change in quantitative production, which resulted in Iran moving from 27th position in 1969 to 15th in 2001; a further doubling of production within eight years moved Iran up to 6th position by 2009. The comparison within egg producing countries over the same period of time also demonstrates a similar significant shift from being the 56th highest ranked egg producing country to 12th. Changes among the egg producing countries over the last 40 years are outlined in Table 2.4.

Name of	Year 1969	Year 2001	Year 2009

Country	Production	Rating	Production	Rating	Production	Rating
USA	5979	1	16747	1	16334	1
China	2382	2	13286	2	11425	2
Russia	1040	3	---	---	2313	5
France	6304	4	2077	4	1039	14
Italy	619	5	1156	9	---	----
UK	574	6	1561	6	1463	7
Canada	542	7	1092	10	1037	15
Japan	494	8	1180	8	1394	9
Spain	454	9	1024	11	1179	11
Brazil	360	10	6394	3	9933	3
Mexico	325	14	1945	5	2600	4
Germany	340	11	886	13	802	18
Iran	53	27	859	15	1610	6

Table 2.3: Comparison of poultry meat production in 13 countries over the last 40 years
Source: USDA

A comparison of the rate of poultry meat produced between 1997 and 2009 shows a yearly growth rate of 5% year-on-year which has increased the production capacity of Iran from 50 million tonnes to 80 million tonnes. In the case of egg production the growth rate is 2.7% per year, which is an increase of 12 million tonnes between 2000 and 2009. In Iran per capita consumption of poultry meat increased from 8.6 kilogrammes to 11.5 kilogrammes from 1997 to 2009 and for egg consumption there was an increase of 1.8 kilogrammes from 8 kilogrammes to 9.8 kilogrammes within the same period. For poultry meat, Iran consumes 10 kilogrammes more than the global average per capita, and egg consumption is slightly higher than the world average per capita consumption too.

Name of	Year 1969	Year 2001	Year 2009

Country	Production	Rating	Production	Rating	Production	Rating
USA	4045	1	5080	2	5340	2
China	3039	2	19884	1	23871	1
Russia	2250	3	1945	4	2195	6
Japan	1735	4	2526	3		4
Germany	1142	5	890	9		13
UK	677	6	629	13		16
France	644	7	1142	8		8
Italia	549	8	70	11		---
Spain	460	9	560	15		11
Poland	387	10	408	20		15
Brazil	337	11	1538	7		25
Mexico	334	12	1881	6		5
Canada	327	13	363	22		31
Netherland	267	14	658	12		14
India	78	29	1926	5		3
Iran	56	31	600	14		12

Table 2.4: Comparison of egg production in past 40 years, Source: USDA.

Egg exports are usually traded between neighbouring countries rather than through global trade. The European Union has the highest levels of activity with 800 thousand tons with Spain, France and Netherlands being the major exporting countries. Following the European Union is Asia with 250 thousand tons of exports taking place, most notably through India and the Gulf States; followed by the Americas with 100 thousand tons of exports.

Technological advances in the poultry industry have led to significant increases in labour productivity most notable when it moved from free ranging to confined operations that have enabled the management of much larger number of birds. The benefits of technological change can also be detected in the positive impact of management techniques for segregating animals of different ages. The innovative technique of the

evaporation shed cooling, for example, has enabled large scale industrialised operations in countries with a hot climate (Poapongsakorn et al., 2003).

There have also been structural changes in both developed and developing countries (Delgado et al, 2008). This has been evident in the move towards the ownership of vertically integrated poultry operations as depicted in Figure 2.6. This has resulted in a higher level of control (Narrod, 1997). However, there are different degrees of integration in different countries and also firms that are based on the levels of cooperation amongst suppliers for production inputs. Figure 2.6 illustrates the links of typical integration between different processing operations for broiler production and layer production. Different segments of the industry, which form part of the supply value chain in production, are also depicted in Figure 2.8.

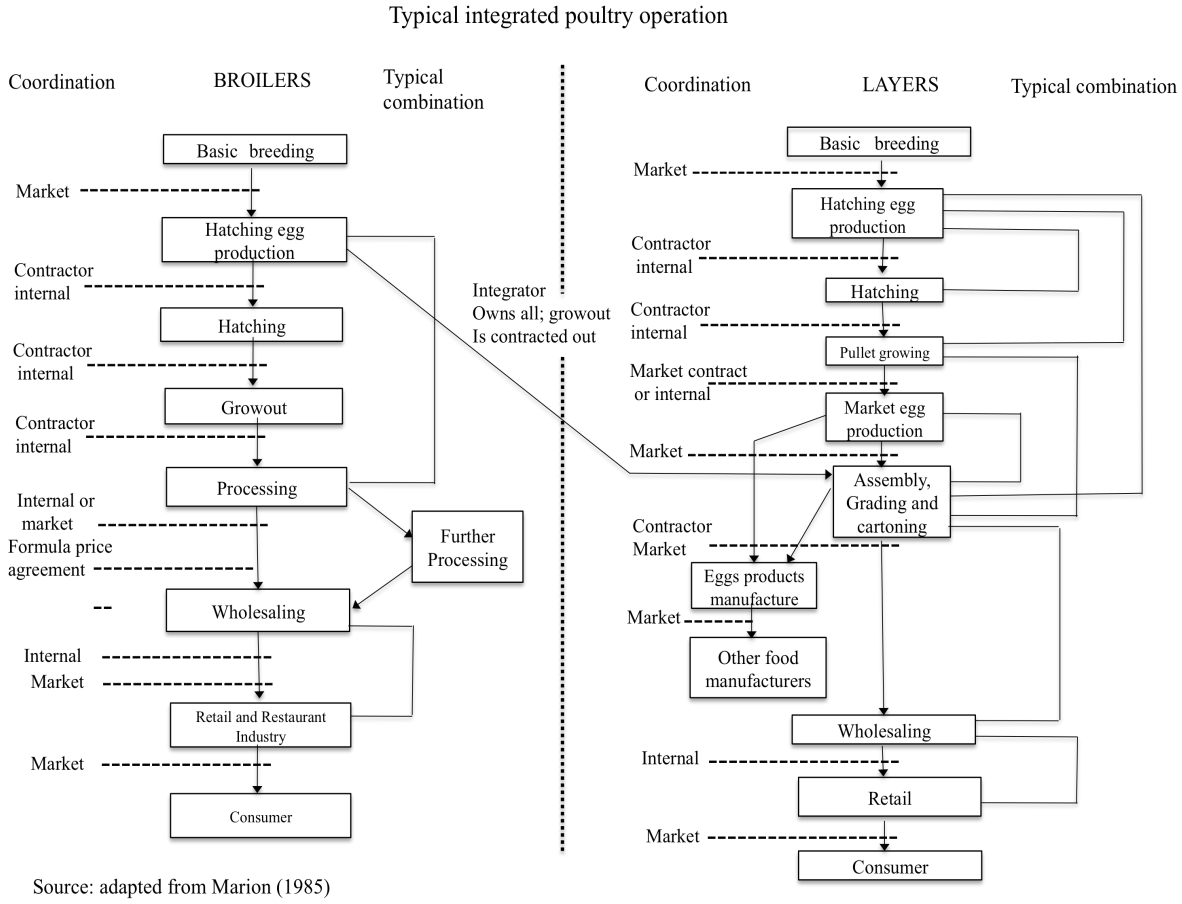


Figure 2.8: Integrated Model of Poultry Operation

Source: Adapted from Marion (1985)

The move towards vertical integration in industrialised countries stemmed from a stabilised economy and the growth of urban markets. Undeniably developing or existing urban markets have contributed greatly to the expansion of integrated poultry operations (Narrod, et.al, 2007). The extent of integration of the configuration of poultry operation and its supply chain in Iran has been discussed in sections 2.2 and 2.2.2.

2.5.1 Post 1979 Revolution Policies

As highlighted in section 2.4.2, Iran has a unique poultry supply network the like of which is not seen in any other non-industrialised country. This section examines the policies that were adopted after 1979 that contributed to the creation of Iran's present poultry supply chain. The consequences and effects of state policies on the poultry industry in the post-revolutionary era are important not only because of how they affected and shaped the poultry supply network, but also in terms of producer supplier relationships and the subsequent quality of production and animal welfare. It is also important to assess the effects of these policies from a halal perspective as an Islamic guiding principle.

Primarily a decision was made early in the post-revolutionary period in the early 1980s to limit the import of breeders to one breed line. The Liberalisation Act of 1988 was implemented in two phases (mustafavi, 2012). The aim of the first phase was to free the distribution of chicks from the government's monopoly by allowing the implementation of the supply and demand principle with the exception of price regulation, which was to remain under the government's control. The second phase was to start seven years later, with the aim to provide the poultry industry with total economic freedom. The objectives of the second phase of the industry's Liberalisation Act were also to address the following:

- To improve management, reduce waste and increase productivity
- To promote the efficient use of resources and efficient use of credit and foreign currency
- To improve the quality of poultry meat and eggs to the same quality of imported products

- To enable export of poultry meat and eggs, in line with the development of non-oil products exports policy
- To provide a secure environment for investment and to reduce the role of government

Some of the objectives of phase two development – such as facilitating and allocating resources for poultry export – could have provided poultry farmers with the economic freedoms that they enjoyed before the revolution (Mustafavi, 2012). Reducing government control and export provisions did not take place and they were subsequently included in the next government's development plan, which was named the fourth development programme. Nor was the supply and demand principle fully offered to poultry producers, despite being part of the Liberalisation Act of 1988. The earlier decision to limit the import of breeder lines was reversed in 1998. The current poultry market is mainly dominated by breeds such as Ross and Cobb and a domestic pure line of broilers called Aryan, although there exist other breeds such as Lohmann and Arbor Acre too (Shariatmadari, 2000).

Another policy that affected the poultry industry in a damaging way was the response to unemployment in the years after the war with Iraq. Faced with growing unemployment, the government started issuing poultry production licenses to a large number of applicants without consultation with the industry. The poultry industry that functioned in a free market before the revolution of 1979 came under the tight control of the government in the 1980s (Shariatmadari, 2000). By the mid 1990s the government started to reduce its subsidies on the feedstuffs and its tight grip on the production system. However, the government continued to exert its authority by controlling prices and flooding the market with imported frozen chickens, policies that allowed it to control prices to suit its political objectives (Shariatmadari, 2000).

In the fourth development programme the trend of progress for the poultry industry was outlined in two dimensions, macro socio-economic and agriculture: The objectives were defined as follows:

- **Macro socio-economic dimension**

- Efforts to improve public health and food supply

- Efforts to promote better income for farmers
- Efforts to protect essential resources
- Efforts to encourage the consumption of poultry products

- **Agriculture**
- Efforts to achieve self sufficiency
- Efforts to improve productivity
- Efforts to increase efficiency and reduce wastage
- Efforts to improve production infrastructure
- Efforts to improve informative product pricing

The fourth development programme was received with enthusiasm by poultry producers, as it proposed favourable terms for exporting their excess products without paying export tax and the programme also aimed for the industry to become self sufficient in productivity (Mustafavi, 2012). The fourth development programme required poultry producers to meet certain production targets. The producers not only met these targets but also in some cases even exceeded the set quotas in anticipation that they would be able to export their excess. However, contrary to the aims and objectives of the fourth development programme the provisions for poultry exports did not take place (Mustafavi, 2012).

The rapid rise in the number of poultry units in 1990s combined with unparalleled growth of other agricultural sectors to support the increased demand has made the poultry industry more reliant on imported feedstuffs. This has been the main inefficiency of the supply market, which has caused instability and has introduced complex levels of dependency for the poultry producers on a black market in which dealers control the availability and therefore the price of feedstuffs. The effects and consequences of price fluctuations of corn and soybean on the industry in the last two decades are presented in the section 2.6.1.

2.6 Challenges Facing the Poultry Industry in Iran

The phenomenal quantitative growth in numbers of poultry units and subsequent increase in production that earned Iran a high ranking position amongst the poultry producing countries in the world also created numerous challenges that are threatening the very

survival of the industry. Section 2.6.1 examines the nature and source of the challenges that Iran's poultry producers are experiencing.

2.6.1. Poultry Feeds, Corn and Soybean

Corn: corn is the most important energy source in poultry feed and constitutes approximately 60% of the feed ration. Feed cost is one of the most serious challenges for the poultry industry. Iran imports around 4.5 million tonnes of corn annually, a cost, which has also been increasing year on year since early 1990s; the price rise from $100.00 per tonne to $220.00 per tonne in 2012 had a dramatic effect on the poultry farmers, as they had to absorb the price rise.

On the issue of sustainability the absence of a unified coordinating body within the supply chain, and the uncertainty caused by the sharp and sudden price change puts the survival of the whole industry into question. As the current state of affairs disables any future planning the majority of farm owners rely on short term purchasing and this creates an ideal environment for intermediaries to flourish and manipulate the market by exerting their influence on the price of each entity in the value chain. Industry dependence on imported feedstuffs is one of the major sources for price escalation. As a result Iran has a dealer managed supply chain where the producer is the last entity in the chain to make a profit. A closer examination of the price fluctuations in 2013-2014 (Figure 2.9) and steady rise in the price of corn from 2002 to 2014 (Figure 2.10) presents an insight into the roots of this industry's inability to rely on the supply market for its long term cost benefit plans.

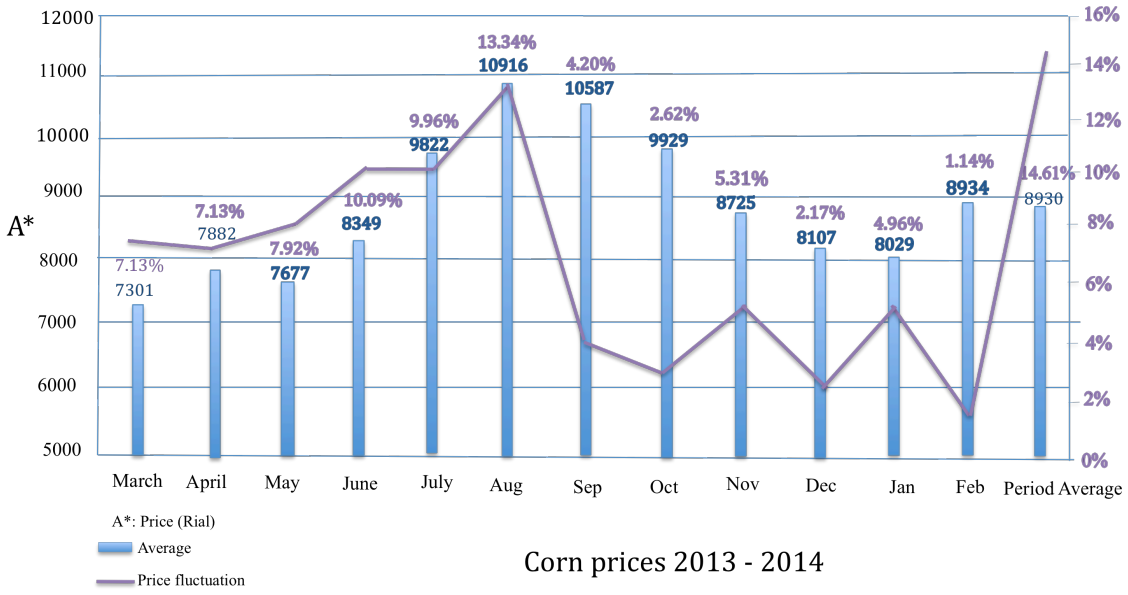


Figure 2.9: Monthly price of Corn in 2013 -2014 (Mustafavi, 2012)

As demonstrated in Figure 2.9, between, March 2013 and February 2014 the price of corn changed every month and the rate of these price changes varied from 1.14% to 13.34% in any given month. One of the factors that continues to lead to the sharp rise in feedstuffs prices is the delay in getting the feed ingredients to the farmers. A network of connected dealers, often with links to the country's few importers has thus exploited this agricultural production weakness (Mustafavi, 2012).

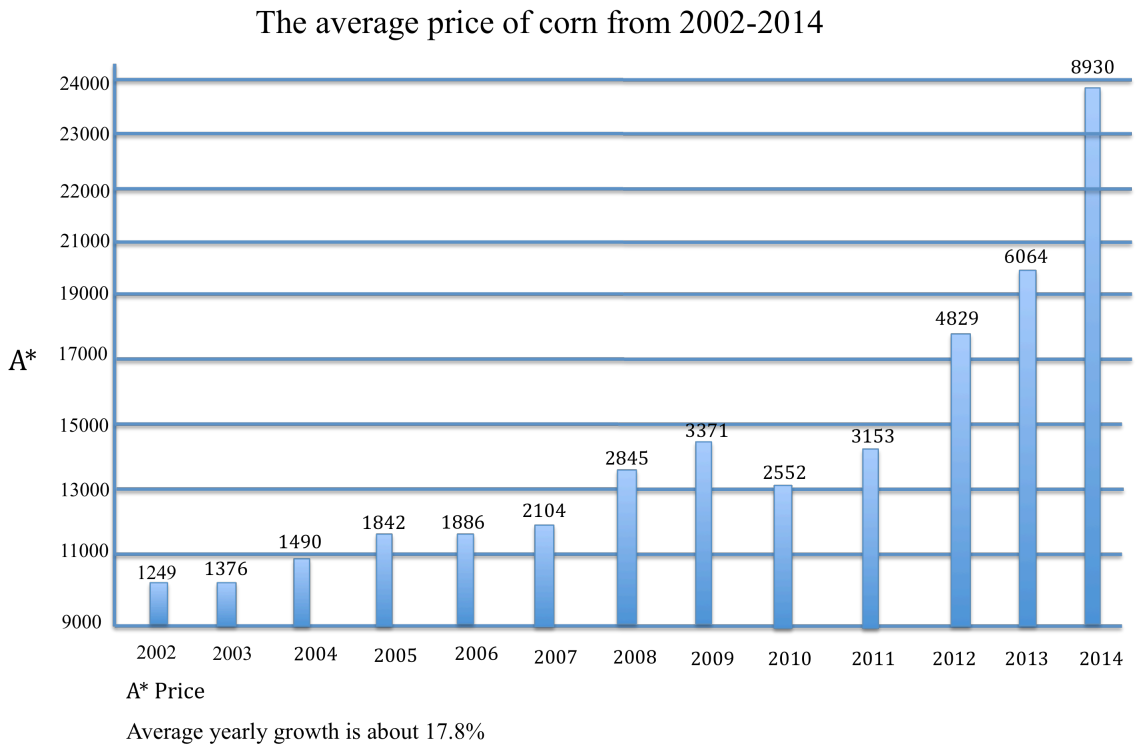


Figure 2.10: Price of Corn from 2002 to 2014 (Mustafavi, 2012)

Figure 2.10 demonstrates the steady year on year price rise for corn where as the poultry meat price for the producers has changed very little.

Soymeal: Soymeal is another important protein source that constitutes 30% of the feed ration. The increased demand for soymeal has also increased the price of this item to almost double its usual price. Iran needs 2.3 million tons of this vital protein feed per year. Since 2007 the import of soymeal has increased from 1 million tons to 2 million tons per year.

Average price of soybean meal and it's monthly price fluctuation in 2014

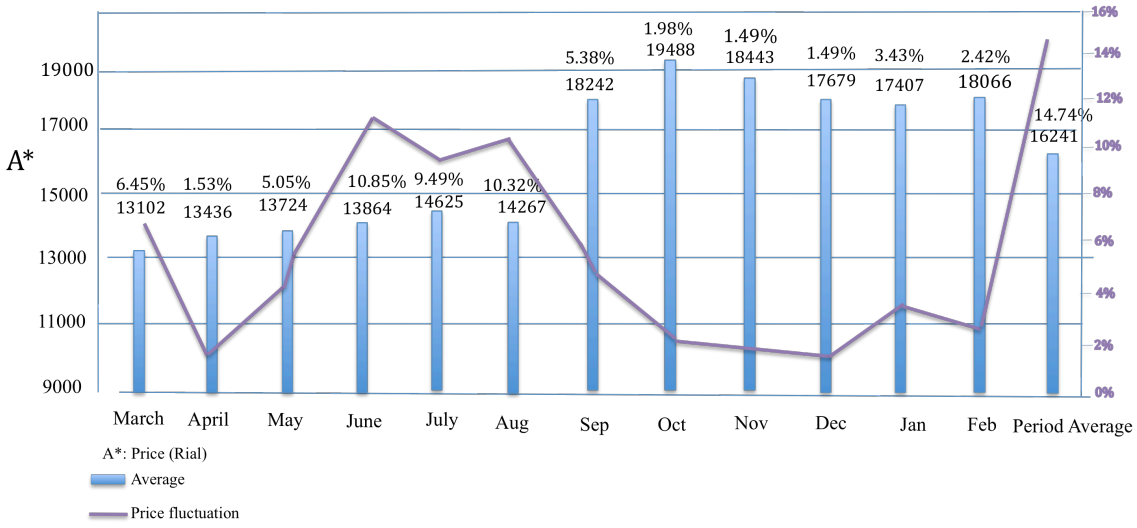


Figure 2.11: Monthly price fluctuation of Soybean (Mustafavi, 2012)

As shown in Figure 2.11, the unpredictability of the soybean price and its sharp fluctuation in any given month is similar to that of corn. This cycle of price escalation has been repeating for the last two decades (WPSA-Iran, 2014).

The average price of soy meal from 2002-2104

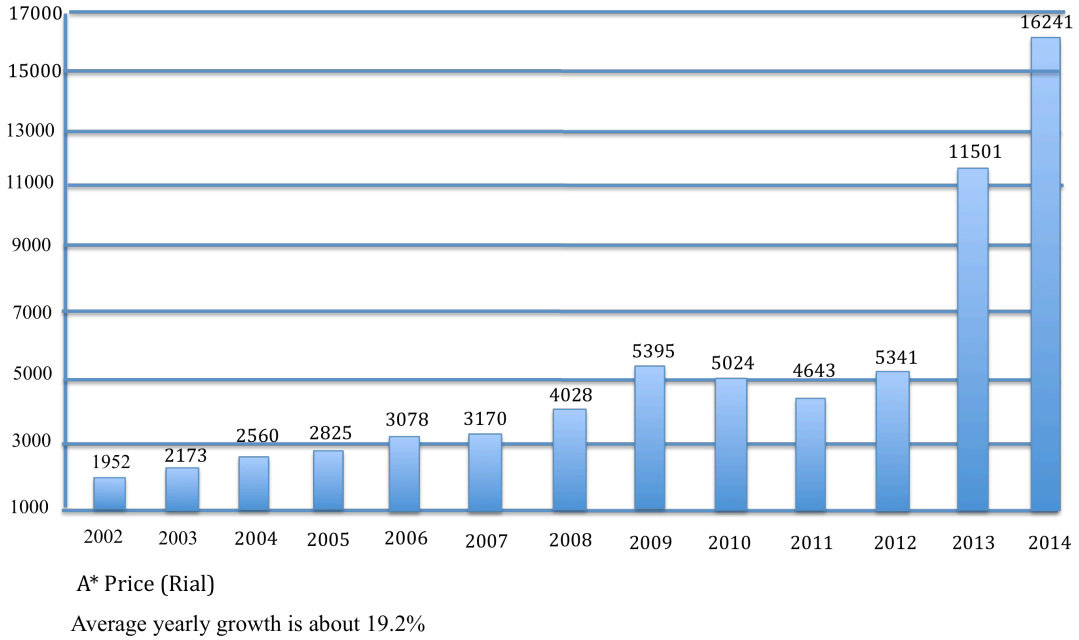


Figure 2.12: Price of Soybean from 2002 to 2014 (Mustafavi, 2012)

The steady price increase in poultry feeds and the inability of the poultry producers to reflect the increased cost of production in the price of their products, which is against the state's policy of maintaining relatively low poultry prices, has resulted in many smaller poultry units going out of business.

Meeting these challenges requires radical change and innovation throughout the poultry supply chain. Supporting research in both academia and laboratories such as Razi Centre for Vaccine Research and closer collaboration between decision-making bodies is needed, as is a scientific approach to the collection and analysis of data for educational purposes. Although the poultry industry is not yet under pressure from consumers concerns regarding the use of antimicrobial growth promoters, animal protein, genetically modified materials in feeds and animal welfare issues, for example, may come to the fore. In time the industry will be confronted with these additional challenges as well with its own significant consequences.

2.6.2 Procurement and Supply of Poultry Vaccine

The dramatic expansion of in poultry farms in the 1990s has led to an increase in demand for different types of vaccines to comply with the Veterinary Ministry's policies for the prevention of disease outbreaks. As domestic production could not meet the increased demand and supply, millions of vaccine doses were sought from abroad. However, the economic sanctions imposed on Iran have restricted the import of these vaccines. As a result the industry suffered a heavy number of fatalities in both broiler chickens as well as in layer birds, both of which had serious financial implications for the poultry producers.

2.6.3 Risk of Disease

The lack of suitable vaccines and the inability of domestic laboratories to identify new strains of Newcastle Disease created many problems as Iran's poultry industry experienced many outbreaks of the disease. In 1998 the severe respiratory disease took its toll on a large number of farms all over the country and caused the loss of 20 million layer chickens and 1 million broiler chickens, which cost the industry over 11 million dollars (Omidi, 1999). The effect of this tragedy first became apparent in broiler breeder farms with reduced production and then finally the loss of whole flocks. The main contributory causes were identified as concentration of intensively housed birds with close proximity of poultry farms to each other, and unhygienic conditions of transportation.

2.6.4 Biosecurity Programme

Another challenge facing Iran's poultry industry is a lack of adequate farm biosecurity to reduce cross contamination and disease transmission between farms and in poultry processing plants. This is an area where progress has been slow. The outbreaks of H9N2 in Iran and H7N9 virus in China and H7N3 in Mexico have all heightened the awareness and need for effective biosecurity programmes in Iran (VAG, 2008).

2.6.5 Foreign Exchange Rate and Credit Risks

The poultry industry Liberalisation Act of 1988 also changed the foreign exchange rate (by six fold) for poultry farmers by replacing the special lower government exchange rate with open market rates. In order to finance this sudden rise in expenditure the bigger farms that were debt free until this time had to resort to heavy borrowing from state banks and financial houses. Raw materials, vaccines and technology related items had to be imported by the producers and paid for in foreign currencies. Exchange rate fluctuations thus continue to play an important role in this equation that can add to the cost of production, especially when this increase in cost cannot be reflected in the market value of the products through price increases. Iranian currency, which once had international recognition and stood at 75 rials to a US dollar in 1979, has been devalued repeatedly. By 1982 it had reached 500 rials per US dollar (Bahmani, 2005) and since then it has depreciated to as low as 33,000 per US dollar in 2014.

2.6.6 Assets liquidity

Another challenging factor facing the poultry community is the ease of obtaining a license to set up and operate a poultry farm with little or no prior knowledge or experience required. The permitted license to set up a farm would also facilitate a favourable bank loan and credit facilities, but problems arise when the new farm owner can no longer stay in business: debt accumulated by poultry farmers to the banking system are substantial and on the increase.

2.6.7 Market risks

The poultry industry in Iran mainly consists of privately owned farms. There are local and regional services provided by cooperatives but there are few poultry farms owned and managed by the government. There are more than 22,000 poultry units rearing broiler breeders overall, more than 350 parent stock (broiler, layer) units and 1500 units of laying

breeder farms. The market is regulated and controlled by the government: if there is a surplus of poultry products that result in a price drop the government mainly intervenes to stock up and sooner or later the products will re-enter the market and become the cause of another price crash (Mustafavi, 2012). In the absence of a professionally tailored export strategy surplus production will continue to disturb the market balance. It is estimated that there is a surplus of 20 thousand tonnes of poultry production every month. (Mustafavi, 2012). Manipulation of the poultry supply chain by middlemen has been the subject of complaints by representatives of different poultry organisations but despite strong promises by the authorities they remain one of the main sources of instability in Iran's poultry industry.

One of the objectives of the fourth development program was not to impose any export duties on exports of poultry meat and eggs. However, contrary to this policy duties were introduced. At the same time in Turkey (Iran's northern neighbour and potential competitor) the authorities started offering 25% export incentives to poultry exporters (WPSA-Iran, 2012). Another change of policy that added to increased costs for poultry producers was the government's decision to impose a 40% import duty on the already expensive corn imports. This caused the price of corn to reach unprecedented levels and cost the industry dearly. In the same year (2011) the government decided to reduce the import duties on poultry meat from 10% to 4% (CSR report, 2011).

When the price of poultry meat is reduced in the market it has a domino effect on the price of day old broiler chicks; then the parent stock; and finally the grandparents have to be taken out of the production cycle. In such circumstances it is the private sector that has to bear the brunt of the government's mismanagements.

2.6.9 Other challenging factors

Other challenging factors facing Iran's poultry industry can also be identified:

- Lack of full and transparent information packages: there is a need for a nationwide centralised education programme
- Multiplicity in the number of decision-making bodies
- Increasing global competition
- Issues over product quality

- Animal welfare
- Environmental issues associated with industrialised poultry production system
- Consumer concern over food safety
- Cost of production

2.7 Performance of Iran's Poultry Production

In this section the performance of Iran's poultry production is compared with its Turkish counterpart and against the reference table of the world's leading countries of poultry producers from 1925 to 2005. This is done in twenty-year intervals – the table 2.6 is known as Aho's table (Aho, 2001) – to realize Iran's poultry producers' level of efficiency with available data for the year 2013 in relation to this data, which is depicted in figure 2.6. The comparison in a more regional and comparable context between Iranian poultry meat producers and their Turkish counterparts is striking and the latter fare 35% better (Table 2.5). This is not the result of the poor performance or lack of enthusiasm of the Iranian poultry producer; instead it is the result of a combination of factors, including poor planning strategies and the government's biased policies in relation to both the domestic sphere and exports, which have had a significant impact on the industry's performance. As Table 2.5 demonstrates, Iranian poultry meat producers feed their flocks between 8 to 15 days longer than their Turkish counterparts to achieve the same slaughter weight, and a loss rate of more than double of the Turkish producer.

	Turkey	Iran
Normal mortality	3-5%	9-11%
Age at slaughter	40-42 days	50-55 days
The average slaughtering weight	2.2 kg	2.3 kg
Feed conversion rate	1.7	2.1
Manufacturer index	292.71	197.17

Table 2.5: Performance Comparison of Chicken Meat Production (Mustafavi, 2012)

Although the poultry industry in Iran has had a significant quantitative expansion in the last three decades the qualitative growth of Iran's poultry production position can only be

discovered once the rate of its production parameters are compared against that of the industrialised countries.

Records	Year	Loss %	Growth coefficient	Weight	Age at Slaughter
1	1925	18	4.7	1	112
2	1945	10	4	1.4	84
3	1965	6	2.4	1.6	63
4	1985	5	2	1.9	49
5	2005	4	1.7	2.4	42
Iran	2013	9.5	2.12	2.5	51

Table 2.6: Adapted from World's Poultry Production Table (Aho, 2001)

Table 2.6 illustrates the industrialised countries' poultry progression in terms of mortality rate, growth coefficient, weight achieved, and age at slaughter by intervals of 20 years since 1925 (Aho, 2001). Comparing the average loss percentage of poultry in Iran in Table 2.6 indicates that in this category Iran's production in the year 2013 fares closely to the industrialised countries' production of year 1945. As for the age of slaughter it can be seen that Iran's achievment in 2013 is similar to that of 1985 of the industrialised countries, and its growth coefficient is between the production standards of 1965 and 1985. The above-mentioned facts demonstrate production efficiency and cost of poultry production in Iran.

2.8 Islam and Halal as a Guiding Principle

There are a number of divisions within Islam, primarily between Sunnis, Shias and Sufis. Sunnis are the largest group, which includes 85% of all Muslims. They have four schools of thought that are still in force in some Muslim countries, while in other countries secular

law has replaced them. Iran is one of the few non-Arab Muslim countries (with a population of 76 million) with a Shia majority the second main branch of Islam. Shi'ites form 15 to 20 % of the global Muslim population. Iran officially converted from Sunni to Shia in the 16th century. Henry Corbin introduced some of the metaphysical and theosophical richness of Shia Islam to the world in a series of books written in the 1960s (Corbin, 1991).

Shi'ism is an affirmation of a particular dimension of Islam led by Ali ibn Abi Taleb. Taylor (1991) states that human beings live by assessing the qualitative dimensions of things in their world, including ourselves. Taylor goes on to say that this constant sifting and measuring is a component of every action that provides the rationale behind every decision to act. Based on Ali's explanations in relation to the definition of halal as a guiding principal in various sermons gathered in the book of Nahjul Balaghe (Peak of Eloquence), the concept of halal is about the seed of change that exists in every action and permissibility of action: it could be argued that this adds direction to Taylor's assessment of the constant sifting and measuring of every action, as actions have consequences and "the seed of change is there in every act which contributes towards the reproduction of any 'ordered' form of social life" (Giddens, 1993: 108).

Ali explains (Jordac, 2010) that the guidelines of halal (inherently good/permissible) and haram (forbidden/not permissible) explained in the Quran are acts that are liked (permissible/allowed) and disliked (not permissible) by God. The implication is that right acts may be followed and that wrong ones should be avoided, as human beings have to act and cannot remain idle. Therefore linking one's actions to the purpose of life, halal is about permissibility of actions and consumption, as humans have to eat to survive and therefore there is halal food and haram food. From this, it is clear that the Quran covers all aspects of life in describing what is halal and what is haram; it is a guide to acting correctly and thus creates a society built upon a social structure with inherently good interactions (Jordac, 2010).

On this account, from a Shia perspective based on Ali's teachings, the empowering dynamic of halal and haram is to generate an intention to do good (halal), and being intentional allows one to focus on how to be in the moment. For instance when playing a game the intention is to enjoy the game regardless of losing or winning. In this sense the

food that we eat has a profound impact on our spiritual as well as our physical health. The Quran explicitly allows for the consumption of meat from certain animals under the condition that they are slaughtered in a specified way. The term halal has become known for its reference to the method of slaughter. However, from the previous discussion it is clear that halal should govern the whole life cycle of the animal and not only relate to how the animal was killed.

The Quran places great emphasis on the humane treatment of animals in over two hundred verses. In verse 6:38, for example, it is stated that: "There is not an animal (that lives) on earth, nor a being that flies on its wings, but (forms part of) communities like you." Akhtar (2012) makes a similar point today when she argues that there is mounting evidence of a very real and often very direct relationship between animal and human welfare, most specifically in relation to human and environmental health. Food production companies, on this account, have a direct responsibility to produce food in ways that are good for animal, human and environmental health. Parallels can therefore be drawn, in this sense, between the understanding of halal and organic methods of food production, for example. (Friedlander, 2014).

2.8.1 Shia Jurisprudence and Halal Standards of Iran

Much like the Hanafi, Hanbali, Maliki and Shafie schools of jurisprudence in Sunni Islam, the divisions within Shia Islam – between Zaydism, Ismailism, Batinis, Nizaris, Mustalis, Druzes and Muqannaah – could be categorized in line with their legal orientation (Nasr, 2004). However, Nasr (2004) suggests a better understanding of Shia jurisprudence can be gained by looking at the different positions each school takes on the Imams. In general, Islamic (Shrai'ah) law is based on a hierarchy of Quran, Sunnah and Hadith. It was from these three sources that an elaborate methodology was developed to create a body of Islamic laws, with the science underpinning the decision making process facilitating the rise of legal principles and Islamic schools of jurisprudence. The intellectual process of deriving laws from the three sources is called ijtihad (independent thinking), which is conducted by mujtahids (men of learning) (Tabatabai 1979; Nasr 2004).

In line with consensus of opinion of Sunnis religious leaders, Sunnis decided a millennia ago that submission to one of the four schools was allowed and that ijtihad or imitation to

any other school was not permissible; it is only recently that the Sunni world has turned away from consensus and started to enable ijtihad in line with wider global concerns (Tabatabai 1979; Nasr, 2004). In Shi'ism, however, mujtahids have taken part in ijtihad throughout history, thus embodying in every generation what Ahmed (2002) calls the seeds of 'renewal and revolution.' Nasr (2004) confirms the historical difference between Sunni and Shia on this matter in the following way:

> 'In the Sunni world, "the gate of ijtihad" closed after the tenth and eleventh centuries, when the major schools were established, whereas in the Shi'ite world it has remained open to this day and in each generation the mujtahids have derived the laws from the established principles and sources' (Nasr 2004, 123).

Arguably it is this difference that has kept Shi'ite jurisprudence dynamic and fresh throughout the ages. Indeed, for the Shia, the act of seeking guidance by following a living mujtahid is central to everyday practice – anything more is forbidden. Although the rise of Islamic and un-Islamic food can to be traced back to the Iranian Revolution and the origins of political Islam, it is only recently – in line with a rise in demand for halal products in Muslim and non-Muslim countries (Lever and Miele 2012) – that halal has emerged as an internally and externally linked issue in Iran. In addition to national standards governing animal slaughter, principals of hygiene, food safety, food labelling and packaging, the authorities have introduced a national Iranian halal standard in line with the development of global halal discourses. In September 2009, the Institute of Standards and Industrial Research of Iran (ISIRI) passed a proposal for the standardization of halal by launching the Halal Food: General Guidelines ISIR 12000. The existing fifteen national food standards are also considered to form part of this new halal standard, which covers a wide variety of items and provides a detailed and in-depth account of what is considered to be halal or haram.

The jurisprudence of the standard, including the provisions of food, beverages, animal slaughter (Zebh) and fishing is aligned with Jafari (shi'ite) jurisprudence. Everything that Jafari jurisprudence considers halal is also considered halal by the four Sunni schools (with one exception), whereas the reverse is not true. In the introduction to the guidelines it is stated that steps have been taken to ensure that there should be coordination between the Iranian national standard and those of other Islamic countries whenever this is

possible. Although halal certification is not yet obligatory in Iran, in 2012 Iranian companies participated in the Malaysian International Halal Showcase (MIHAS) for the first time (Islam Telegraph 2012). In 2014, a number of major Iranian food products were also recognized by the Halal World Institute, which is linked directly to the Organisation of Islamic Cooperation (OIC) (Halal Focus, 2014).

2.8.2 Animal Welfare

There are different definitions of animal welfare in the literature. One view defines animal welfare as the animal's attempt to cope with the environment (Broom 1996); feather pecking in chickens is thus a sign of non-coping with the environment. Another definition defines animal welfare as being dependent on the animal's feelings (Duncan, 1996). Fraser et al. (1997) described three concepts of animal welfare: natural living environment, affective state, and biological function. Fraser (2008) further states that different understandings of animal welfare could provide different results in welfare assessment and a good welfare assessment of one area of welfare, feed, for example, does not necessarily mean good welfare when another area is examined, for example health.

In 1979 the Farm Animal Welfare Council (FAWC) introduced five freedoms as its definition for animal welfare:

- Freedom from fear and distress
- Freedom from discomfort
- Freedom from pain and injury
- Freedom from hunger and thirst
- Freedom to express natural behaviour

Freedom from fear and distress and freedom from discomfort are included in the concept of affective state, which is about feeling and emotions. Freedom from thirst, hunger and pain are included in the concept of biological function and affective state. Freedom to express natural behaviour is covered in the concepts of natural living and affective state. Fraser (2008) states that welfare indicators used in measuring animal welfare could be related to different concepts since animal welfare is multidimensional (Vannier et al., 2014). Fraser (2008) goes on to suggest that it is important to be aware that choice of

welfare indicators are value based. Welfare indicators are classified into three sets of indicators: resource based indicators, management based indicators, and animal based indicators (Vannier et al., 2014). Keeling (2005) refers to resource based indicators as indirect measures of the welfare assessment: the resource based indicators are about the physical environment, such as cage type in poultry production.

In Iran there are guidelines and legislation regarding the physical environment for poultry production units that all the farms are required to follow, however, the level of compliance varies greatly from farm to farm. Management based indicators refer to the way animals are treated, for example in relation to housing density, while animal based resource indicators are concerned with the health and behaviour of the animal by assessing the animal's responses to the housing system and management (Main et al., 2003), which are often measured at the individual levels. Blokhuis et al (2003) discuss the need and provide criteria for a standardised European integrated welfare assessment platform for on-farm and in-transit monitoring systems to validate practical strategies for improving welfare. The animal based indicators for poultry producers are discussed in more details in section 2.7.4.

Animal welfare is of increasing significance for consumers, as they expect their animal related products to be produced with respect for the welfare of the animals (Blokhuis et al., 2003). This is in accordance with the consumers' perception that food quality is determined by the nature and safety of the end product and by the welfare status of the animals involved in its production (Blokhuis et al., 2003). Miele and Lever (2013) state that the growing public anxiety about food safety in animal farming caused by epidemics, such as Foot and Mouth Disease and BSE/CJD can be aligned with the growth of corporate social responsibility (CSR) in food industry, as it has become an integral part of the strategic management of global food companies, large supermarkets and retailers to convince their consumers of their responsible practices with animal welfare as the central feature (Lever & Evans, 2015). The following section examines animal welfare from an Islamic perspective through what is considered to be a halal treatment of animals.

2.8.3 Islam and Animal Welfare

Almost all religions allow the use of animals for necessary human needs. Humans have always used animals and their labour just as they take each other in service. There seems

to be nothing wrong with this arrangement, except that the animals are not capable of protecting their own rights as human do, and to a large extent are dependent for their quality of life on their caretakers, social censure and government legislation, which is formed and shaped by public opinion.

There is an understanding that the term animal welfare refers to both the scientific aspect describing the mental or physical status of the animal, and values in terms of moral considerations regarding the animal's quality of life (Tannenbaum, 1991; Staflen et al., 1996). Across Europe, consumers interpret the concept of animal welfare in different ways, but there are some common elements associated with local, small-scale and alternative production systems (Evans and Miele, 2012). Miele and Lever (2014) state that the experiences and expectations of European consumers about "animal friendly" animal products available on the market vary and are shaped by the markets to which they have access and what these markets offer. The authors conclude that the farming and retailing sector's investment in innovations to fulfil the perception of animal welfare as a competitive issue is the key determinant to the emergence of these markets and a condition for shaping the orientation of the future farming and retailing industries.

All religions have tried to regulate the use of animals humanely and with equity and justice and there are many laws in the scripture, which cover specific cases. Nevertheless, human needs and social conditions have been the overriding factors, as our moral and social values change in line with modern scientific and technological advances there is greater demand and global pressure on producers to incorporate these new lifestyle demands. In Iran the first law protecting animals was passed in 1967, which prohibited hunting and fishing or causing a health hazard to animals in protected and public areas. The first society of prevention of cruelty to animals was formed in 1998, as inspired by Islamic teachings, with the aim of protecting animal rights by actively participating in public debates and by conducting educational programmes. In Islam it is believed that all animals, together with all creation praise Allah, even if this praise is not expressed in human language. But the Quran has a tendency towards anthropocentrism and gives humans a higher status than animals while strongly encouraging Muslims to treat animals with respect and not to abuse or neglect them (Al-masari, 2007).

The Quran (6:35) explicitly allows the eating of the meat of animals. Certain animals can be eaten under the condition that they are slaughtered in a specific way. Prohibitions include swine, carrion, and animals zebh (ritual slaughter) in the name of someone other than Allah. The Quran also states "eat of that over which the name of Allah has been mentioned" (zebh e halal), so prohibition includes that over which Allah's name has not been mentioned. Carnivorous land animals and birds with talons are forbidden. This prohibition does not extend towards marine animals, though Shia Muslims are only allowed fish with scales, in addition to shrimp and prawn.

There are over two hundred verses in the Quran that deal with animals and six suras (chapters) of the Quran that are named after animals. In Quran the word Muslim has been used for humans as well as animals, for example, a bee is a Muslim precisely because it lives and dies obeying the way of being that God has determined for the community of bees, in the same way a person is a Muslim by virtue of the fact that he or she submits to the revealed dictums in the Quran. Each species of animal is a "community" like the human community therefore it stands to reason that each and every creature on earth has, as its birth-right, a share in all the natural resources. In other words, each animal is a tenant-in-common on this planet with the human species. However, 'Man has always been in competition with animals for food, and the problem has been aggravated in the current world situation, especially because of modern agrarian mismanagement' (Al-masari, 2007).

The issue of animal rights has been mentioned in different verses of the Quran (7:73, 11:64, 26:155, 156; 54:27-31) and the seriousness of depriving animals of their fair share in the resources of nature is considered a sin and is punishable. The story of the people of Thamud (7:3) is a prime example of this fact. The tribe was experiencing a shortage of food and water and was, therefore, neglecting its livestock. It was revealed to their Prophet (Prophet Saleh) to advise them to single out a she-camel as a symbol and to give her a fair share of water and food. The people of Thamud contrary to their promise killed the animal and as retribution the tribe was destroyed.

In all religions suicide is considered to be the ultimate sin as life is trust from God. The animals, however, do not possess the freedom of choice to wilfully terminate their own life and have to go on living their natural lives. When man subjects an animal to

unnecessary pain and suffering and thus cuts short its natural life in a way he commits a suicide on behalf of that animal. For instance, normally chickens kept for egg production are packed tightly into wire cages and kept there all their productive lives crouching on a sloping wire floor. The sole purpose of their existence is supposed to be to lay eggs and they are denied any other inherited behaviour. Animals reared under unnatural and inhumane conditions become frustrated and stressed. Such characteristics are then passed on to those who eat their meat, though it may take many generations to show, we now know that what happens on the farm does not always stay on the farm.

The biological laws of nature are the same for the human species as for other animals. Their diet, environment and general living conditions affect all of them alike. Recent research studies have highlighted the fact that like human beings, animals too have a sense of individuality. The Quran repeatedly confirms this fact. Chickens are individuals and, if given the chance, will demonstrate their own characters peculiar to each individual. Recent research carried out by Bristol University argues chickens show empathic responses, as they possess the ability to show empathy when affected by the emotional state of another. Chickens were chosen for this research because under commercial conditions they witness signs of pain from other chickens (Edgar et al, 2011).

In the recent decades Iran, in line with other developing and Islamic countries, has been importing technologically advanced intensive farming systems from developed countries, a trend, which has been growing in the developing countries. In Islamic countries most are not aware of how meat chickens are reared and how they have been bred to gain weight excessively fast, and whether the love and compassion to oppose cruelty and neglect that is mentioned in Islam and is part of halal behaviour has been offered to them. The Prophet Mohammad has placed the killing of animals without a justifiable reason as a major sin, “Avoid the obnoxious seven things [deadly sins]: polytheism, magic, and the killing of breathing being! Which God has forbidden except for rightful reason.” (Al-Masari, 2007).

2.8.4 Welfare Issues on the Poultry Farm

Cruelty and neglect are the two types of welfare issues that affect all farm animals (Grandin, 2014). Cruelty or abuse is caused by the direct action of humans and the solution is either a change in the process or equipment. Abusive treatment or neglect can

occur on the farm and at slaughterhouses and is usually as a result of poor management supervision of employees or abusive methods that have become the norm (Grandin, 2014). There is mounting evidence by undercover videos both from developed and developing countries that show abusive handling such as the beating, throwing and kicking of animals. Another area of concern relates to painful practices such as the beak trimming of laying hens and air quality standards in intensively raised animals in enclosed buildings. Poor air quality contributes to a variety of health problems such as lung pathology, eye problems and lower weight gain (Kristensen & Wathes, 2000). The biggest welfare issues for laying hens are forced moulting (food restriction), beak trimming, small battery cages and fractured bones caused by osteoporosis. Appleby et.al (2002) recommend two alternatives for replacing battery cages; cage free housing or enriched colony cages. These two alternatives have advantages and disadvantages. One advantage of colony cages is that they help to maintain the bone strength because of partitioned nest boxes and higher ceilings. The disadvantages of the cage free option when stocked at high densities are the dust and egg contamination (de Ren et al., 2005). Sherwin, Richards and Nicol (2010) argue that osteoporosis, loss of plumage and weight loss are major problems in laying hens regardless of their housing type.

Researchers have discovered that there may be a relationship between high productivity and feather pecking, a problem created by the loss of foraging behaviour (Dixon, Duncan, & Mason, 2008). Although trimming beaks reduces the damage from feather pecking the procedure is painful. Forced moulting has been banned in US and Europe but it is a practice that some poultry farms adopt in Iran because of market fluctuations and the inability to plan ahead; it is often carried out up to four times a year. Another area of concern relates to breeder hens that produce broilers, as their weight is controlled by a highly restricted diet and they suffer constant hunger since they are fed below half of their *ad libitum* intake. There are also welfare issues that occur during transportation and long distance transportation (Appleby et al, 2008). The chickens' arrival at the slaughterhouse is a good place to assess their condition as it is their last location before slaughter. Table 2.7 summarises welfare and loss issues that can be monitored at slaughterhouses.

Measurements	Health
Body condition	Foot pad lesions
Lameness	Broken wings on broilers
Cleanliness of hide or feathers	Twisted legs in broilers
Dead%	Breast blisters (dirty litter)
	Feather condition
	Fractures in laying hens
	Osteoporosis
	Hock burn

Table 2.7: Welfare issues that can be monitored at slaughter plant (Source, Author)

2.9 Tracking and Traceability

Smith and Brower (2012) argue that the young consumers of today have a desire to connect with the origin of their food. Traceability is the ability to trace the history, application or location of an entity, by means of recorded identification as defined in ISO 1995 and European Union regulation No 178 of 2002. From a halal perspective the integrity of the supply chain relies on its non-contamination with haram and therefore traceability plays an important role in safeguarding halal integrity. The fear of livestock related diseases and their potential transferability to humans are issues that have used to push for a reliable system to trace an individual meat product back to its animal origin. Recent studies have highlighted the fact that consumers in Europe, Japan and the US are concerned about their food supply chain, questioning its origin and method of production (Nortje, 2002).

Development and integration of a fully operational system that ensures complete traceability requires a comprehensive analysis of current methods and practices in place. The main objective of a tracking system is to find the most suitable technology to provide accurate information on the movement of material to reduce the risk of tampering. The objectives in traceability systems are the verification of the origins, animal welfare and supply chain identification (Golan, Krissoff and Kuchler, 2005). Traceability systems are developed to improve supply chain management and to reduce distribution costs; just

having knowledge of where the product is in the supply chain does not improve supply management unless the traceability system is integrated in a real delivery system or some inventory control system (Golan et al., 2004).

Wide scale adaptation of RFID (Radio Frequency Identification) technology as the tracking technology chosen by major western food retailers has improved the management of supply chains. Halal is an assurance quality attribute, which cannot be evaluated or ascertained by the individual consumer, even upon or after consumption of the good (Darby and Karni, 1973; Grunert, 2005). As a product attribute, halal is about authenticity, origin and the processing method of the product, which entails similarities with organic products and foods produced taking animal welfare and sustainability issues into account.

Azah et al, (2008) identified a few problems with halal tracking such as non-availability of real time halal tracking systems. Currently, there are few countries providing halal certificates such as JAKIM, GMP, HACCP and SIRIM in Malaysia to evaluate cleanliness, safety, efficiency and effectiveness of the system but producer's traceability practices are unclear. There is clearly a need for more global applications and databases to provide more information about all halal products that are available to the consumers. Furthermore, the correct use of halal certification logos is not enforced as logos can be copied and reproduced and used for non-halal products. In the absence of reliable traceability and tracking systems the acceptable level of risk of a recall for a halal product becomes an important issue in terms of safety standards.

2.9 Halal Certification Attributes

Whether a product is halal or not is a critical factor in Muslims' consumption decisions. Therefore, halal regulation and certification have been developed to help consumers identify products, which comply with the Islamic principles. The first efforts were made in the 1970s to set up a system declaring and certifying food products as halal. At this time, western fast food chains started entering the upcoming Muslim countries and naturally, those restaurants were not always applying Islamic standards in their food production. In addition, more and more international food brands appeared in the markets of Muslim countries further highlighting the need for halal certification (Chaudry and Riaz, 2004).

While in former times, the mechanisms were built more on trust and common values among halal food producers and customers, this system does not work in today's business environment. The Muslim customers demanded more transparency for product ingredients not trusting the simple halal labels, even less so when products were imported from non-Muslim countries. Therefore, there has developed a demand for trustworthy halal certificates. Governments in Malaysia, Indonesia, Middle East and other Muslim countries have responded by establishing governmental bodies to supervise and regulate the food markets. As early as 1975, bills were passed in Malaysia to prohibit the erroneous use of the word halal (Chaudry and Riaz, 2004).

Institutes, such as the Malaysian Jabatan Kemajuan Islam Malaysia (JAKIM), one of today's leading institutes in halal matters, were formed. Also in Singapore and Indonesia official bodies were established to supervise and develop the national halal market. The Singaporean counterpart to JAKIM is the Majlis Ulama Islam Singapura' (MUIS) and the Indonesian institute is called "Majelis Ulama Indonesia" (MUI) (Chaudry and Riaz, 2004). Today, halal compliant products are already common in food and financial industries, but the concept is constantly expanding to new industries (i.e. cosmetics, pharmaceuticals, tourism, entertainment, etc.). The most topical example is a halal social network called "Salamworld", which has been accessible since July 2012. It was established in order to provide a Shari'a compliant communication platform for Muslims – just like Facebook – but without critical content like pornographic advertisements, etc.

2.10 Storage, Hygiene

Tieman (2014) notes that a system of segregation is needed to protect the integrity of halal produce throughout the value chain. The adoption of liberalisation in trade and services has forced companies to consider the global market demand in their competitive strategic planning. Hence, firms need to be continuously responsive to the market demand in order to stay competitive. Various research findings have shown that innovation can be the source of generating additional revenues and lead to cost savings (Calantone, 2002; Dilk et al, 2008; Grawe et al, 2009; Kandampully, 2002) or improve the quality of existing processes (Khazanchi et al, 2007) as well as driving forward the potential for gaining competitive advantage (McGrath, 1996).

Technological superiority empowers and provides a considerable advantage over competitors and ensures the future existence of a company, as indicated by Cinicioglu et al. (2012). Supply chains have always been viewed as the most important areas to be innovated as they offer an effective means to gain efficiencies and eliminate accumulating competitive pressures. However, extant studies have focused only on a particular aspect of innovation, such as technological innovation (Busse and Wallenburg, 2011; Shen et al, 2009; Lin, 2008) reflecting the lack of research into service innovations. International Halal Integrity Alliance Standard (IHI) is the first international guideline for logistics (Bruil, 2010).

2.11 Chapter Summary

This chapter reported the investigation of a range of theories that are used to describe and gain an understanding of the attitudes towards the adoption of technological innovations. The key factors that lead to an early adoption were identified and discussed. The strengths and limitations of the research models that focus either on individual or organisational perspectives were discussed and it became evident that neither of the theories provided a solution that integrated an analytical framework to include analysis from both approaches. The need for an integrative approach that could link the two concepts of micro level and macro level analysis of diffusion of innovation was discussed as examining the two concepts independently will not make any significant contribution to the existing knowledge base.

This chapter then provided a comprehensive definition of halal and its relation to the halal supply chain as well as reviewing the current state of technology in the domain of supply chain in general and poultry industry in particular. The animal welfare from an Islamic perspective was discussed and a brief overview of the decision making process from the two major Islamic traditions was presented. The reviews of a range of theories that have emerged to describe and understand attitudes towards the adoption of technological innovations were studied. As a result a number of key factors in a framework for early adopters have been identified. The chapter discussed the strengths and limitations of current conceptual models and from this discussion it is evident that there is no one theory or model that can provide an adequate solution or a generic framework to the adoption and diffusion of innovation. Giddens (1984) describes positive developments in structuralists' approach by introducing frameworks that explore interplay between

structure and individual (agency) that provide more insightful research findings. The Giddens' Structuration Theory and the broadening of its scope by applying it to the research question is discussed in detail in the next chapter.

CHAPTER THREE: THEORY OVERVIEW

3.1 Introduction

The literature review of diffusion innovation highlighted the strengths and limitations of the current conceptual models and the lack of a generic analytical framework that would take into account individual perspectives and organizational perspectives. The coupling and linking of the organizational diffusion of an innovation to the micro level is quite complex and examining the two levels of macro level and micro level separately is unlikely to add to the current knowledge base. Therefore in realising the aim of the research question of 'how does structure enable or constrain the adoption of technology within the construct of halal concept in poultry industry in Iran', Giddens theory of structuration in organizational innovation and change seems to provide the answers. Integration of micro level and macro level of analysis realizes the contributions of both approaches in considering structure and individual characteristics (Parker, 2000).

3.2 Giddens Structuration Theory

Giddens structuration theory merges two different studies of structuralists and studies that focus on individual (macro and micro level). He argues that although the two studies are interlinked and there is no clear cut distinction between the two but no laws in terms of future predictability of their actions (adoption/rejection) can be identified unless the meanings understood by the individual actors are looked into as human agency and social structure are in a relationship. Giddens structuration theory draws on the fact that social life is not a mass of micro level activity and also can not be studied only by macro level analysis and introduces the theory of duality of structure. Giddens duality of structure breaks down the social structure and human interactions into three columns as depicted in figure 3.1 each structure and interactions are interlinked through modalities. Three dimensions of signification, domination, and legitimation are associated with structure and are interlinked by modalities of interpretative scheme, facility and norm to agency interaction of communication, power and sanction.

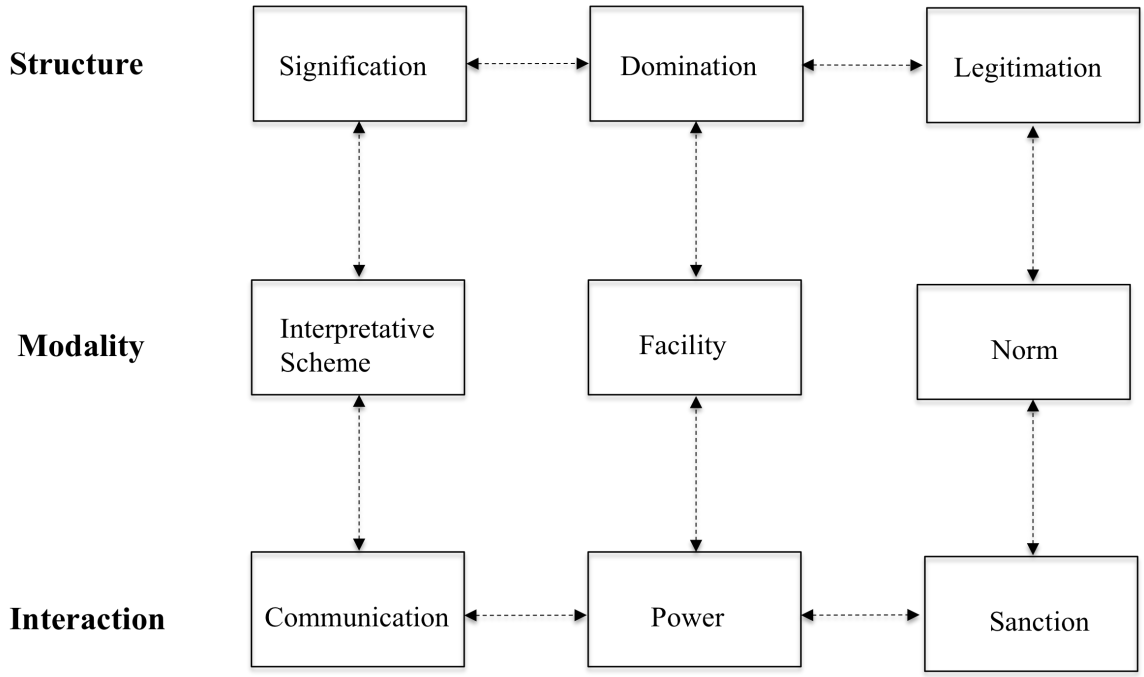


Figure 3.1: Giddens Duality of Structure (1984)

Individuals (agency) draw on these structures and corresponding modalities in forming their actions and transform the structure by doing so, these structural bonding modalities facilitate the interaction between individual and others (Brooks, 2008).

Signification: is when individuals produce meaning of the structure by communicating through interpretative schemes that are embedded in the social structure.

Domination: refers to the use of power by controlling allocative resources (control over material goods) it enables things to get done or authoritative resources (status, education, knowledge), which is capacity to generate command over individuals or actors by issuing policy requirements through modality of facility.

Legitimation: refers to the theory of normative legitimation, conditions governing the continuation of structure.

Table 3.1 summarises the structural dimensions of social systems.

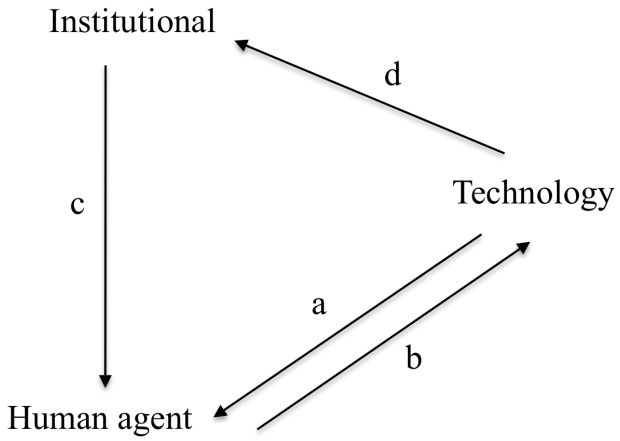
Structures	Theoretical Domain	Institutional order
Signification	Theory of coding	Symbolic orders/modes of discourse
Domination	Theories of resource allocation/authorization	Political institutions Economic institutions
Legitimation	Theory of normative legitimation	Legal institutions

Table 3.1: Structural dimensions of social systems Adopted from Giddens (1984)

The issue of technology adoption is not addressed by Giddens explicitly, however structuration theory has been used to examine technology related organizational change (Barley, 1996). Orlikowski's adaptation and conceptualization of Giddens structuration theory in information technology has been followed in a number of studies (Rose, 1998).

Rose (1998) explains that Orlikowski's (1992) model of the duality of technology is 'social product of subjective human action, within a structural and cultural context as well as an objective set of rules and resources mediating human action' in other words technology is created as a result of human action and also used by humans to do some action. From a structurational point of view potential adopters can either adopt, not adopt or decide their degree of involvement with the technology. However, this is dependent on their role, and in most organizations roles are conferred on people representing a set of behaviours that others expect a person to exhibit. In conforming to roles, individuals are not entirely free and autonomous; their engagement with the technology is subject to a degree of constraint, which is influenced by the structures of signification, legitimation, and domination in another word by their organizational context and based on their varing levels of knowledge and skills.

Structuration model of technology developed by Orlikowski from Giddens structuration theory of 1984 examines the interaction of social action and social structure. Structurational model of technology developed by Orlikowski consists of four components: (1) Institutional characteristics, (2) External factors, (3) Human technology designers, decision makers and users, (4) Technology related work tasks of individuals. Orlikowski stracturation model is depicted in figure 3.2.
In the structuration model of technology a link (a) is developed between technology and human agent as technology is a product of human action and is maintained through its continuous adaptation.



a: Technology as a product of human agency

b: Technology as a medium of human action

c: Institutional conditions of interaction with technology

d: Institutional consequence of interaction with technology

Figure 3.2 A Structuration Model of Technology Adopted from Orlikowski (1991)

The second part (b) views the technology as the medium of human action in both its enabling and constraining roles (conditioning). In the third part (c) a link is established between institution and human agent and two important influences are recognized, first human action is influenced by organizational context in adopting or rejecting technology, second, the adoption of technology is dependent on social and cultural factors. The fourth part (d) institutional consequence of interaction with technology is examined in terms of adoption/rejection may strengthen or result in transforming the institutional properties.

3.2 Development of Conceptual Framework

Although Giddens (1984) mentions the importance of Information Technology (IT) in modern organizations but has merely provided any details of how the structuration model could be applied to the adoption of technology. Orlikowski (1999) however, argues that a deeper understanding of technological agency gives a deeper insight of the relationship between humans and technology. The focus of this study is not on any specific technology but rather on the specific implications that they can have on the conduct, and attitudes of the individuals working under the social rule of halal in poultry industry (farms, supply chain) and the affect they can have on the structure and processes.

The adoption and diffusion of technology is studied using Giddens duality of structure model. Structure refers to the institutional systems as a “virtual order of transformative

relations", for instance, management commitment, allocation of resources. These features of structure could have enabling or constraining affects on the adoption of technology. Figure 3.3 details adapted Giddens (1984) theoretical framework for halal poultry operation, which has been used to propose the research conceptual model.

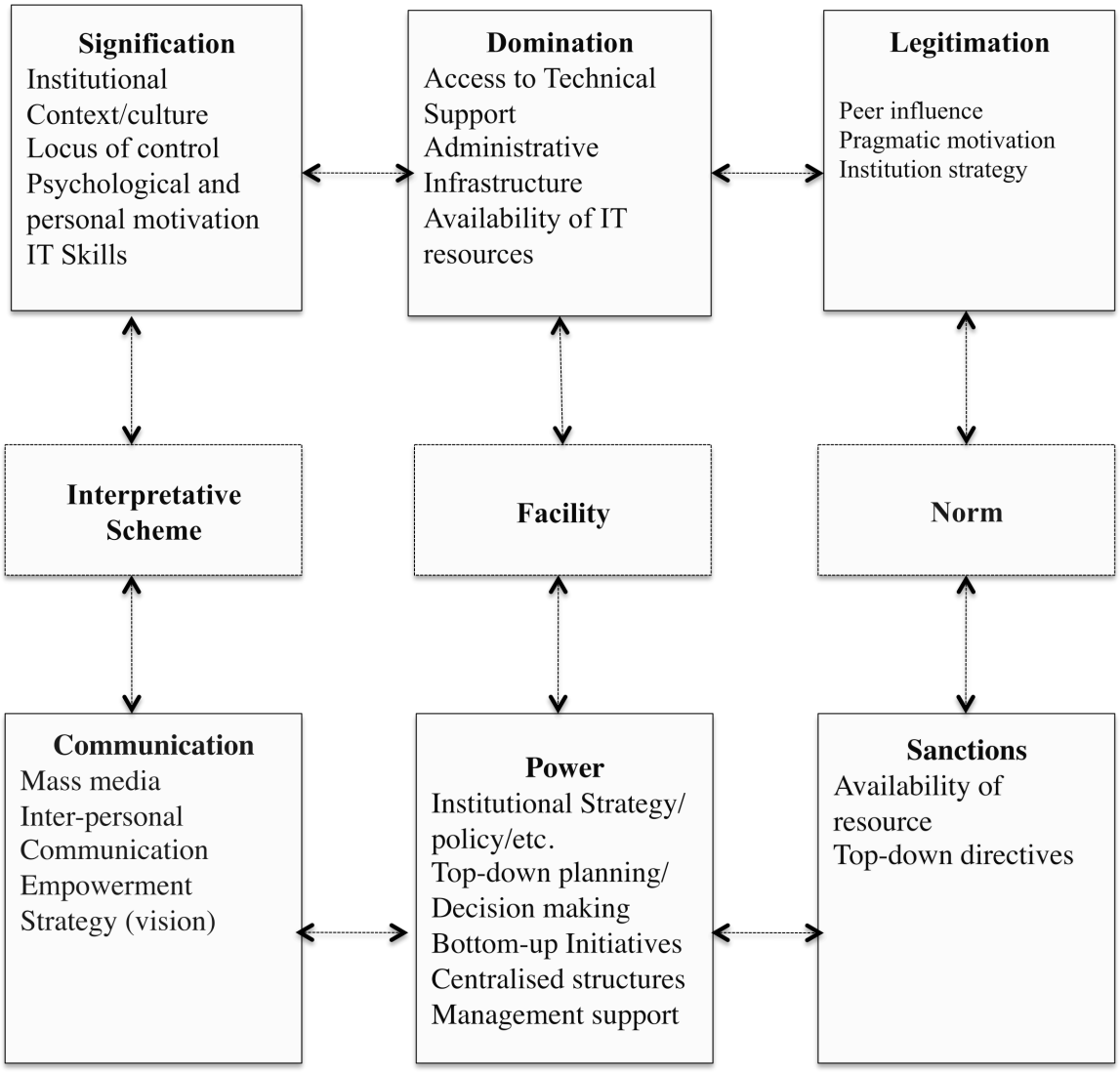


Figure 3.3: Adapted from Giddens (1984) A Theoretical Framework for Halal Poultry

The main features of Giddens structuration theory and its implications, such as duality of structure and virtual existence of structure are summarized in table 3.2. The three modalities that form the bases for Giddens structuration theory modalities of Interpretive scheme, Facility and Norm are looked at in more details in the next section.

Feature of structuration theory	Implication
Duality of structure	Structure and action are inseparable and co-existent
Structure is "virtual order of transformative relations"	Rules and resources exist only in their instantiation and as memory traces orienting conduct
Essential recursiveness of social life	Structure is produced in every instance of action
Agents always have the possibility to do otherwise	Structural constraint simply places limits upon the feasible range of options open to an actor in a given circumstance
Agents are knowledgeable about their actions and continuously reflect on their conduct	Agents are aware of their condition and reflect on it
Unacknowledged conditions and unintended consequences	Production and reproduction of society is not wholly intended or comprehended by social actors
Routine is integral to the continuity of the personality of the agent...and to the institutions of society	Individual identity and social institutions are sustained through routine
Time space distanciation	Societies "stretch" over spans of time and space
Double interpretation	Concepts that sociological observers describe are already constituted as meaningful by social actors and can themselves become elements of the actors understanding of their own condition

Table 3.2: Main features of Giddens Structuration Theory (Giddens, 1984)

3.2.1 Interpretive Scheme

This modality refers to the signification of communication of meanings, individuals in order to make sense of their own actions and that of the others draw on interpretative scheme and produce meanings of the structure through language and communication of meaning. Introduction of technology is perceived to be an economical move for higher financial gain and to some degree a political one. The senior management develops the

different stages of the technology roll out plan and communicates it through a top down approach to the rest of the organization. How the potential adopters interpret the communicated information from the senior management for the diffusion of the technology will have an impact on the adoption or rejection of the technology. In the structuration theory the production and reproduction of culture is the result of aggregated effect of a group of people working or living in a social framework. The interpretative schemes are drawn upon to help make sense of the interactions in communication, at the same time these interactions reproduce or change these interpretative schemes as signification, underlining Giddens description of continuity of social production and reproduction (Giddens, 1984). Several studies have reported that a clear, well-explained and communicated strategy at section level would aid the diffusion process (Maguire, 2005).

3.2.2 Facility

This modality refers to the basis of allocation of resources within the social group. This is manifested through interactions of power, which as a social structure is in a constant state of change (evolution), the interactions of power reproduces the facilities leading to structures of domination in the social group or community, the structure of domination is about power. Facility deals with the levers of control of resources, allocative resources and authoritative resources, these are the resources that enable individuals to exercise control and to influence and guide the conduct of others. Authority, however does not hold a form of total power, rather it is involved in ”dialectic of control”. The implications are that all the members of a social group have a role in developing power structures. In the balance of power the importance is placed on the transformative capabilities of allocative resources or authoritative resources.

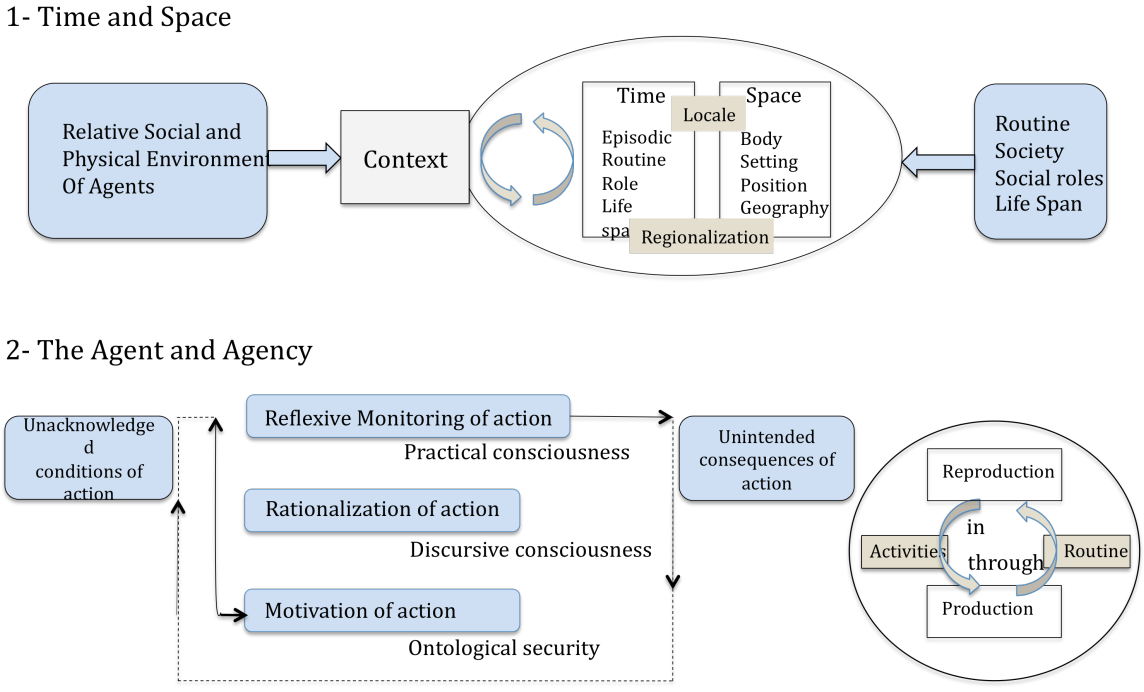
3.2.3 Norm

This is the application of sanctions, when people draw upon norms and they eventually become normative rules, the methodological procedures for governing their behaviour of being encouraged or discouraged through the application of reward and penalty. Ellis and Mayer (2001) describe that norms are “suitable for articulating and sustaining what they [actors], in a particular context, consider right or wrong. The spirit of social interactions can also be represented by norms and for instance products of a poultry unit in an Islamic country is taken for granted that it is halal or the normal way of doing things maybe

socially influenced by the norms of behaviour set by others such as peer groups or religion (Sheth & Paravatiyar, 1995). Katz and Shapiro (1986) note that adoption decision of individuals or organizations could hugely be influenced by community reaction to adoption. The social rules may only exist in our heads but it is noticed when it is not carried out and therefore generates a reaction. Understandings as well as sanctions for these interactions, would reproduce the norms to give rise to structures of legitimation for the social group

3.3 Proposed Conceptual Model

Giddens (1984) regards technology as an augmentation device and not a real artifact. However, Orlikowski (1999) has argued that a more developed understanding of technological agency allows for a deeper insight into the relationship between individuals and technologies, as technology is a product of human action that is maintained by the continuous adaptation of technology (Orlikowski, 1991). Through its use by individuals, technology can enable any form of influence. Therefore, the focus of this study is on the fact that technology can have specific implications for the conduct, attitudes and workings of the individuals in the poultry production domain and that they can affect the structure and processes as well as changes in the organizational structures (Grant and Danziger, 2005). The core elements of Giddens Structuration Theory in relation to their relevance for the examination of the research question are depicted in figure 3.4.



3- Duality of Structure

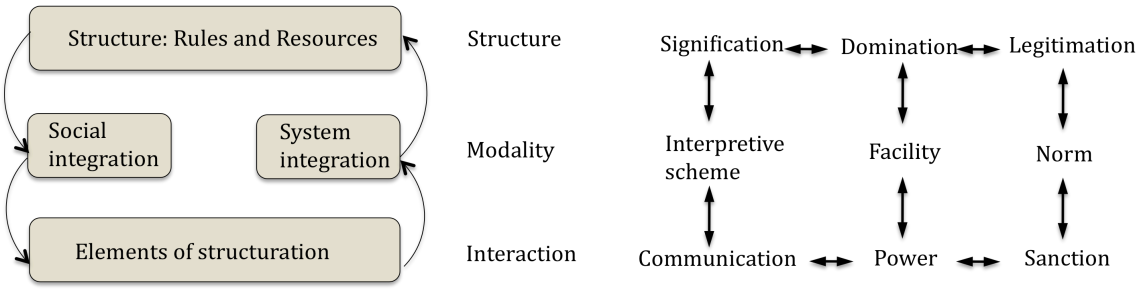


Figure 3.4: Relationship Between Core Elements of Gidden's Structuration Theory

1- Time – Space Stretch

Giddens (1984) refers to the institutions as the long lasting features of social life as reproduced practices across time and space, as reproduced rules and resources of the operating concepts that includes context, positioning, reflexivity, regions, regionalization and locale (setting). The context concept refers to the social and physical environment of agents in relation to each other in the 'strips' of time-space when the gatherings take place (Giddens, 1984). This includes the poultry farm environment of interactions and number of workers, repetition of activities (routinaization). In the time-space stretch the position of the actor is fundamental to the social interactions, 'social positions are constituted structurally as specific intersections of signification, domination and legitimation which relates to the typification of agents' (Giddes, 1984).

The concept of roles is relevant to this study as the roles of human actors in the social system with their positions relative to one another leads to expectations and contextual demands on their actions (Jones & Karsten, 2003).

According to Giddens (1984), 'A locale is a physical region involved as part of the setting of interaction with definite boundaries, which help to concentrate interaction in one way or the other'. Each poultry farm is a 'locale' with a various 'zones' or regions where different rules of interaction exist. These include administrative buildings, and different poultry housings. According to Giddens (1984), regionalization is a temporal, spatial differentiation of regions either within or between locales and occurs in modes of form like form of boundaries, span as extension of time and space, character (hatchery building, training workshop) and duration. Such characteristics play an important role in

drafting guidelines and directives as issues under consideration maybe related to these characteristics.

2- Agent and Agency

In Giddens' theory of structuration all actors (human agents) are knowledgeable individuals, socially competent, having reflexivity are consciously aware of their environment and understand what they do while they do it (Giddens, 1984). According to Giddens agency is an actor's capability of doing things, to intervene or refrain from intervention and does not necessarily refer to individual's intentions but rather the capability of taking action or not, a degree of autonomy in our actions.

The reflexive monitoring of activity is an every day action that involves the conduct of the individual and that of the others. Giddens (1984) explains that 'agents engage in social practices, sometimes intentionally, sometimes reflexively, and sometimes unconsciously, to produce and reproduce structures at any given point in time'. Gidden (1984) further states that 'in circumstances of interaction the reflexive monitoring of action incorporates the monitoring of the setting of such interaction'. Reflexivity operates at three levels, verbal expression or explanation (discursive), practical knowledge, and the unconscious (Giddens, 1984). It is through personal interviews with semi-structured questions that the poultry workers are able to say, or to give verbal expressions about their own actions and social conditions, "awareness which has a discursive form" (Giddens, 1984, p.374).

Turner (1991) describes the ontological security as the need to establish 'the sense of trust that comes with being able to reduce anxiety in social situations'. One of the key drivers of halal is trust (Nasr, 2010). Thomson (2001) states that trust is one of the foundations of successful collaborations. Thus it is necessary to establish the degree of trust within the poultry workers social system by relevant interview questions.

3- Duality of Structure

Giddens refers to structure as 'rules and resources, recursively implicated in the reproduction of social systems' (Giddens, 1984:377). The mediation between agents through rules and resources is what gives meaning to social system. Giddens uses the phrase 'in and through' to refer to the recursive concept that refers to the actions that have consequences. The generalisable procedures that actors understand and use in different

circumstances are referred to as the rules (Turner, 1991:532). All the poultry farms follow routine procedures. Rules are used to make decisions and in justifying the allocation of resources as well as having structuring qualities in the 'forming, sustaining, termination and reforming of encounters' (Giddens, 1984). Comparative analysis of interview transcripts with reference to discursive formulation could identify the type of rule that underlies a large number of farm procedures, which signifies 'reproduction of institutionalized practices' (Giddens, 1984).

The face-to-face level of interaction is referred to as social integration, where as interacting with those who are physically absent or separated by distance in time or space through for instance email or telephone is referred to as system integration (Giddens, 1984). Section 3.2 described the three dimensions of signification (meaning), domination (control), and legitimation (norm) that are embedded in the structure of Giddens structuration theory and the three modalities that link them together. In this respect figure 3.5 visualizes the conceptual model that offers the potential for examining historical interactions and relationships to gain insight into the constraining and enabling forces of social structures of this research In an attempt to code the information correctly.

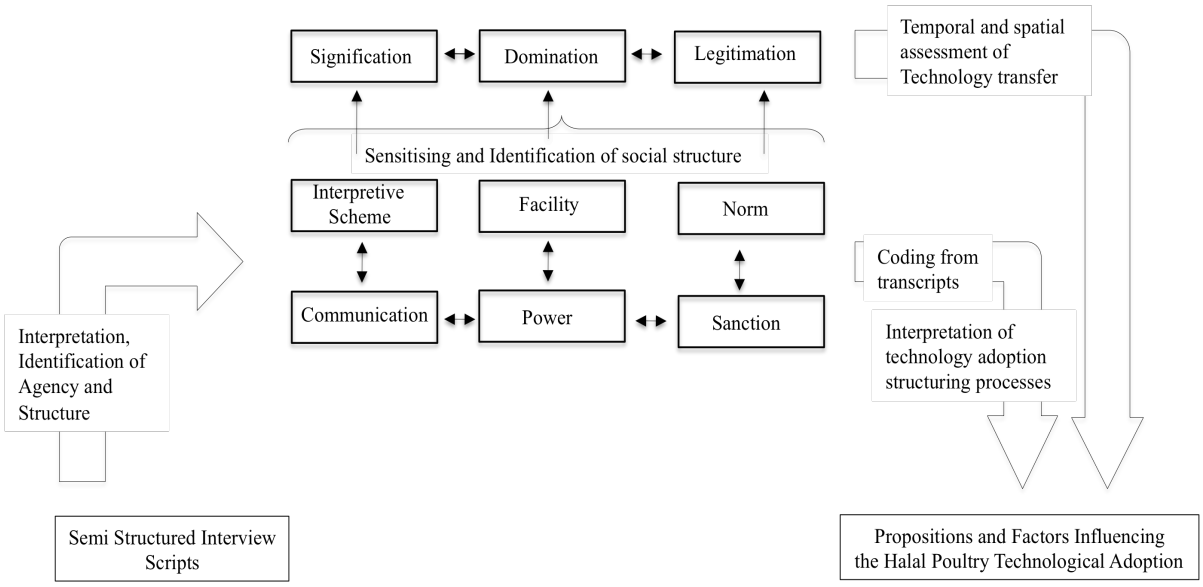


Figure 3.5: Conceptual Framework

Giddens recommends that his theory of structuration should be considered as sensitizing device with all concepts of his theory explicitly applied, as Giddens does not favour

checklist style of analysis. Giddens theory at an ontological level is designed to be self contained and all-inclusive.

3.4 Summary of Chapter

This chapter has presented an overview of Giddens Structuration theory, and the way in which this has been adapted for an explanation of implications of technology adoption in poultry farming in Iran. This was followed by a discussion on how the concept of structuration theory has been applied to the current study. The final part of the chapter developed a theoretical model with which to examine the adoption of technological innovations, focusing on the interplay between the human agency and structure. In this chapter the categories that are considered important for the realization of aims and objectives of this study in relation to the duality of stucture and three modalities of structuration theory were highlighted. The chapter extended the scope of Giddens structurational perspective to the adoption of technology. Based on the theoretical model a conceptual model was proposed to guide the research design in realsiation of this study aim and objectives that are reported in the next chapter.

CHAPTER FOUR: RESEARCH METHODOLOGY

4.1 Introduction

The first part of this chapter examines the philosophical position of the research to identify the strengths and limitations of the undertaken research study. Consequently, a review of the research paradigms from different perspectives is provided. The second part of the chapter, the research design, based on the understanding of the philosophical position in addressing the research question, describes the research design in terms of data collection methods, procedures for analysing the data, and reporting the research findings.

4.2 Research Methodology

Methodological choices draw on implicit assumptions about the nature of 'reality', the science or theory of being (ontology) and what is understood to be knowledge of this reality (epistemology).

The epistemological position reflects the view of the known and how it is known. There are two major distinctions in relation to the philosophical understanding of ontology. One is expressed by foundationalists (ontological materialism) who view the world as a real world independent of us, with our knowledge and life built on these foundations. The second (ontological idealism) believes there is no real world, and reality is socially and discursively constructed in the mind of the observer (refs needed here)

In a non-philosophical sense, ontology takes a more narrow meaning and refers to the description of what exists specifically in a determined field. For instance, this includes every entity that exists in a poultry operation and supply chain, and the relationships and hierarchy between these entities. Therefore, unlike philosophers, the researcher is not concerned about the true essence of these entities within the system or whether they are more real than the processes that take place in the system; rather the researcher is focused on naming and grouping similar parts and processes together into categories (refs). In the domain of social ontology, the idea is to describe society and its different parts and processes to identify and understand the underlying structures that affect individuals and groups.

The research question for this study is: how does structure enable or constrain the adoption of technology within the construct of a halal concept in the poultry production in Iran? This question is underpinned by four wider aims:

- To explore the role of human agency, technology and the institutional characteristics of poultry farming
- To explore factors that enable or constrain the adoption of technological innovations in the halal poultry supply chain
- To analyse, within the available information, the role of technology in the diffusion of innovations within halal poultry production in Iran
- To propose a model that captures the effectiveness of diffusion strategies that enable and/or constrain the adoption/implementation of new technologies

The underlying principles that guide our claim to know things is called epistemology (Harding, 1987). Philosophy refers to epistemology as the study of knowledge, with a set of epistemological questions about knowledge, such as what knowledge means, how does one acquire knowledge, and what the basis is for true knowledge. There are also two major branches of epistemology that have developed over time. These two branches are empiricism and rationalism.

Empiricism states that true knowledge is founded on empirical experiences of the world around us, implying that objectivity is possible (Guba, 1994). Rationalism, on the other hand, argues that observation is never objective, as it is affected by social constructions of 'reality' and relies on reason and the rational mind (hence rationalism) rather than experiences and observations of the material world as the sources for new knowledge (Hossain, 2014). Epistemology is also used in a non-philosophical context. Epistemology is particularly important in the scientific domain, as it highlights the limits and possibilities of producing and reporting new knowledge. Formal epistemology in a non-philosophical sense addresses specific questions such as what is knowledge, how can a belief be justified, and also the question of how we know that something is true (Hudson, 1991). Instances can be drawn from mathematical logic, statistics, computing and the study of symbolic systems such as thoughts and knowledge in the field of genetic epistemology and other scientific fields. Social epistemology is concerned with social context, not only with regard to beliefs and disbeliefs of individuals, but also in relation to

the creation of new knowledge about social practices (Gilbert, 1989). This also includes aspects of social practices that focus on studies of technology and technological innovations.

A paradigm reflects the researcher's ontological and epistemological positions in relation to the research study. The path to an explicit philosophical position can be more easily navigated by considering the two issues of appropriateness and robustness. A philosophy is *appropriate* when it focuses attention on the basic characteristics of the research question: for example, to illustrate the process of developing an explicit philosophical position in supply chain management, such as improving the effectiveness of technology diffusion. The effectiveness can be seen as having three key drivers: 1) the framing of strategic intent by management; 2) the coherence of the organisational policy framework and 3) performance (or outcome) measurement. The connection between process issues and outcomes, which are used to judge effectiveness, is dynamic, interactive and complex, and it operates at multiple levels with the individual actors in the organisation, and the extended supply chain. Sobh and Perry (2006) conclude that although there is no objective rationale for selecting one paradigm over the other, the researcher's job is to be consistent with the assumptions and to make sure that these do not conflict. A research paradigm is a set of basic beliefs (Guba and Lincoln, 1994) that is determined through a combination of ontology, epistemology and methodology, which provide the framework to conduct a research inquiry (Lindgreen, 2008).

As discussed above, the two differing perspectives in relation to ontology and epistemology are reflected in different research paradigms. Knowledge construction has historically been dominated by a positivist approach to social reality (Brinkman and Kvale, 2014). Positivism is the cornerstone of quantitative research that adopts a foundationalist ontology, assuming that there is one objective reality: its epistemology therefore assumes that it is possible to obtain objective facts and knowledge of that reality by explaining causal relationships about that reality (Lindgreen, 2008). In the positivist ontology there is an assumption that reality is comprised of pre-existing patterns or orders that are stable, discoverable, predictable and not dependent on any context (i.e. generalisation of rules). However, the aim of this study is to examine the subjective perspectives and perceptions of a number of participants in a social system affected by their contexts. From an epistemological point of view, positivism is not considered

suitable for this research in that it requires the researcher to be totally objective. The researcher and the researched phenomenon are considered independent, which means that the researcher must study the phenomena without being influenced by it or influencing it (Guba, 1994). On epistemological grounds, positivism thus fails to recognise the inevitable influence of the researcher in constructing the phenomena. A relativist or interpretivist paradigm takes the opposite position to the positivist paradigm. Interpretivism does not make objective statements about the real world but assumes that people interpret their environment and create meaning for it. The ontological position adopted is that reality is socially constructed and therefore a social phenomenon and does not exist independently from individuals' interpretation of their environment.

The purpose of this study is to examine how structure influences adoption of technology in a halal poultry production. Therefore the assumption is that ontologically, in reality, structures exist and it is accepted that they are socially constructed. Based on these assumptions, the study therefore aims to examine and explain the causal links and the relationship between the adopters of technology and management of organisations within the social system. The subjective views of the interviewees in relation to the adoption and diffusion are therefore critical in this study.

Rogers' (1995) model, which is an influential model in agricultural innovations, identified a number of factors that affect the likelihood of adoption, in particular the perceived attributes of innovation. Rogers' innovations theory (2003) provides a theoretical framework for examining the process of technology adoption. Rogers regards the diffusion of innovations as a social process, through which information is transmitted through communication channels within the social system, giving the innovation a meaning through the process of social construction. It must also be mentioned that the aim of this study is not to collect data for a mathematical model to recognise patterns and make adoption predictions, but rather to gather and build a group of answers (new knowledge) based on the participants' reflections in different contexts, which give different meanings to generative mechanisms through their own experiences and provide rich accounts of interactions in the context of duality of structure.

4.3 Research Paradigm: Constructionism

This study assumes that reality (structure) may exist outside the minds of the individuals, it also accepts that it is socially constructed. In the constructionist paradigm meanings are constructed as individuals engage with the world they are interpreting. There is acceptance that objects have no meaning but are involved in the generation of meaning.

Rogers (2003) states that the adoption of innovation is conceived to be socially influenced and dependent on the interaction within the social structures. The study accepts the constructionist's paradigm. This approach provides an understanding of reality and of how people interact with social structures. As mentioned earlier, the study assumes that institutional structures are real. The important factor in this study is the understanding of how reality is constructed by individuals in relation to halal as a social rule within the poultry industry and the wider community of actors involved in the poultry supply chain. The interaction, with technology is interpreted differently by each individual. These interpretations of technology are formed in the social context (karsten, 1995). Rogers' diffusion model, based on the communication channels (Rogers and Shumaker, 1971), helps to understand the social relationship and interactions between the individuals. The aim of this study is to build a group of answers based on reflections of the participants that are in different contexts. Therefore an appreciation of different meanings generated by participants through their own experiences is fundamental to this study. An overview of research paradigms is provided in Appendix 1.

4.4 Research Plan

The aim of the research plan is to develop research methods for data collection and necessary information to realise the intended objectives of the study. According to Christie et al. (2000), case study research attempts to understand the nature of the research problem, forming and revising the meanings and structures of the case under study. When human activity is embedded in the real world it can be studied or understood only in its context (Yin, 1981).

The current research is suited to case study research as one of its primary aims is to build an understanding of the adoption and diffusion of technology through analysis of interaction between agency and structure in a number of poultry farms. Five case study farms were examined, to allow for different contexts of technology adoption to be

examined. Within each case study a number of respondents were interviewed. These case studies included poultry farms with vertical supply chains, semi-vertical and horizontal supply chains across a mix of breeder and layer farms: the study did not include slaughter plants. Each individual case study is unique in capturing the details of producers' operating conditions in the desired location. A cross-case study analysis will follow the individual case studies. Table 4.1 provides an overview of the five studies.

Site	Focus	Data Collection
1	Vertical Supply Chain	2 Senior Management, 3 Middle Management, 3 Employees
2	Semi-Vertical Supply Chain	1 Senior Management, 3 Middle management, 4 Employees
3	Horizontal Supply Chain	1 Senior Management, 2 Middle Management, 3 Employees
4	Horizontal Supply Chain	1 Senior management, 2 Middle Management and 3 Employees
5	Horizontal Supply Chain	1 Senior Management, 3 Middle Management, 4 Employees

Table 4.1: Overview of Case Studies

Drawing on structuration theory to conceptualise the diffusion of technology composed of three modalities, the micro-analysis focuses on how and what participants drew on in their own context when adopting technology. Using Giddens' structuration theory, three components of interpretative scheme, facility and norm formed the basis of data collection.

The interview design focused on how structural, cultural, and agential elements influenced each other in the development of this process. Thus the interview questions were meant to capture shifts in meanings, social structure, and their associations with specific participant actions. The macro-analysis was conducted using two guiding questions: what were the causal mechanisms for the diffusion of technology within the organisation, and how did contextual influences and conditions shape the diffusion of

technology? The diffusion processes (mechanisms) were drawn from the literature and contextualised to structuration theory.

4.4.1 Role of Literature Review

The purpose of a literature review is to provide an understanding of the gaps in the subject domain with relevant and significant problems highlighted to identify the research question. The first phase of this study was a preliminary review of the literature on the adoption of technology and developments in the poultry value chain in developed economies and in Iran; a conceptual framework was also developed. An open and ongoing approach to the literature review was adopted and it resulted in a continual modification and development of this review throughout the life cycle of the project.

4.4.2 Research Boundary

Miles and Huberman (1994) explain that the unit of analysis mirrors the objectives of the study and provides the foundations for the comparison of results in respect of the subject under study. This research project refers to the study that is concerned with the diffusion and adoption of technology in the poultry supply chain within a halal environment. Defining the boundary of the research problems helps to avoid collecting unnecessary data (Yin, 1989). In this study, however, the objects are the individual experiences of respondents in relation to their social reality of the adoption and diffusion of technology, social realities of the poultry farms' organisational structures, strategy, resources (storage, equipment, training, financial management), and subject (symbolic) reality, which refers to perspectives held by individuals.

The mechanism to examine and understand the interaction between agency and structure is provided by structuration theory. There are two sources for the data collection, these being: 1) potential adopters, who are the personnel involved in the implementation of technology through their part in the development or delivery – these comprise operational managers, employees and those whose role requires their involvement; 2) the set of people who are related to the 'structure' of the institution – these are defined as staff members whose roles are more supportive, for example, senior management, administrators and technical staff; this category of participants have influence on the authoritative and allocative resources.

4.4.3. Multiple versus Single Case Study

The limitations associated with single case study research are well-documented in the literature; misjudging single events, exaggeration of available data and generalisation of conclusions have been identified by Voss et al. (2002) as problems. Multiple case study research reduces these limitations, and collecting data from different sources also generates a richer understanding.

Eisenhardt and Graebner (2007:27) draw attention to the advantage of using multiple cases, which allows for comparisons that shed light on "whether emergent findings are simply idiosyncratic to a single case or consistently replicated across the cases". Whilst there is agreement that multiple case studies enrich findings and provide more robust theory deeply rooted in the evidence, deciding on the number of case studies is also not without its challenges: two to fifteen cases are seen as suitable (Miles and Huberman, 1994). In considering the difficulties of coping with the volume of data and complexities on the one hand, and also of being able to generate theory on the other hand, Eisenhardt (1989) suggests between four and ten cases.

In order to ensure collection of rich data from the relevant participants, five case studies were examined to allow different contexts of technology adoption and diffusion in the poultry farms of the north-eastern province of Iran to be examined. As this study aims to examine different contexts of technology adoption, each farm had to have gone through some technological modernisation, or be in the process of technological transformation. For each case project there needed to be scope for interaction between the individual adopters and the structure.

4.4.4 Data Analysis Approach

In the domain of data analysis and reasoning for qualitative data inference, Ali and Birley (1999) suggest inductive and deductive approaches for data collection. In case study research an iterative approach of going back and forth between theory and evidence, in what is called a retroductive approach, can be used (Harrison, 2002). In the retroductive approach the researcher begins by following inductive reasoning and by being receptive to what emerges from the data. As the work progresses and themes begin to appear, this can lead the researcher to confirm findings by adopting a deductive approach (Patton, 1990). This retroductive approach was used to understand and explain the situations in

which interplay between agency and structure occurs, through iteration and identification of causal mechanisms. Identification of the causal mechanisms required obtaining detailed knowledge about the processes underlying the behaviour and the context.

4.4.5 Data Analysis Process

From the interview transcripts, thematic analysis was used to examine the qualitative data. Murray (2003) explains that thematic analysis allows for certain themes or patterns to be searched for across the entire data set, as opposed to within a data item. This is an important issue for this study, since it attempts to identify and explain the factors related to the perception of adoption of technology from a number of perspectives, and specifically to identify the interaction between agency and structure. Content analysis was not used since its focus is on relying on frequency word counts to identify patterns within the data (Boyatzis, 1998), which is not useful for this study. The aim of the study is to explore and explain the causal links within the social context by developing an understanding of the underlying structures and mechanisms. The process depicted in figure 4.2 describes the deployment of inductive and deductive analysis, and how themes were generated from the raw data to uncover meanings in relation to the adoption of the innovation for the participants.

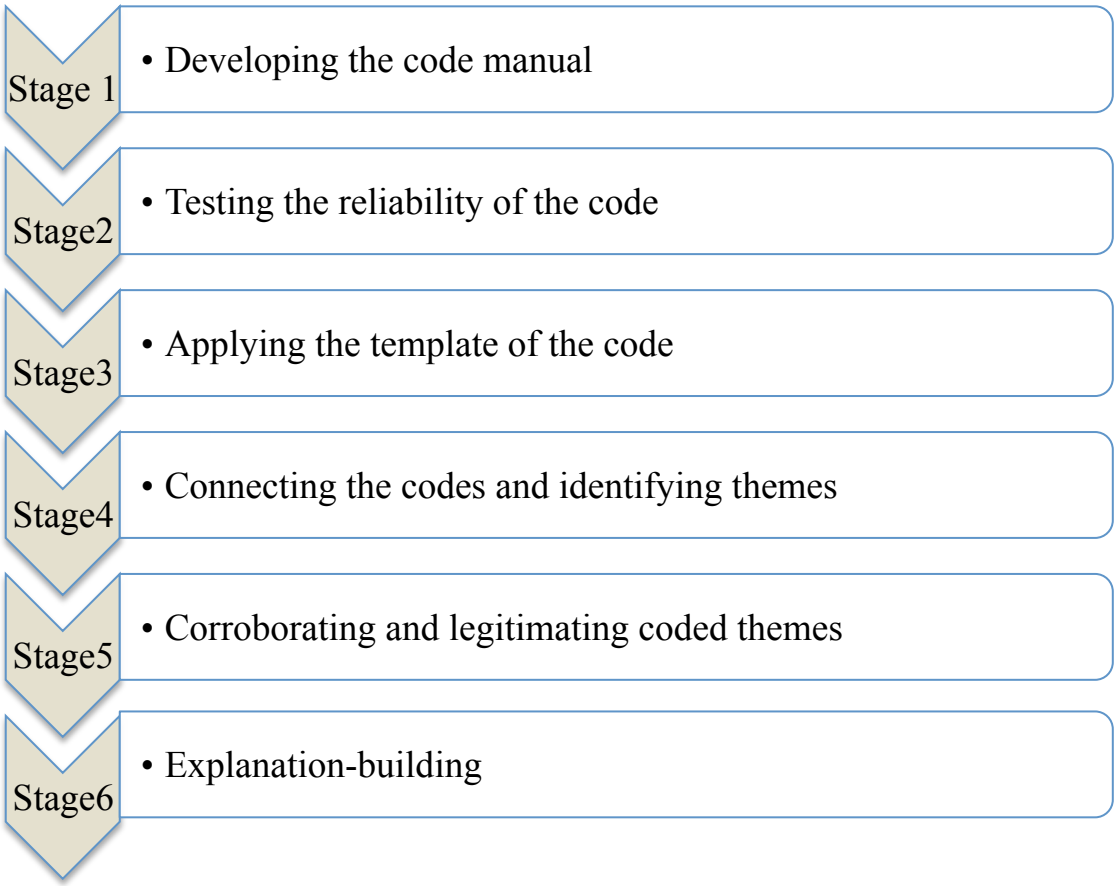


Figure 4.2: Process of Data Analysis

Stage 1: The code template was developed from the research questions and Giddens' theory of structuration and the six related categories of three modalities. The codes were labelled, named and defined, with the definition of what the theme related to and a description explaining how to recognise when the theme occurs.

Stage 2: After the coding of the document, two interview transcripts from Case A and Case B were selected as test pieces and were compared with others from an experienced researcher who had used the same predefined code template, and it was agreed that no modification to the code template was necessary.

Stage 3: Since the interviews were conducted in Persian and had to be coded before being translated into English, the researcher decided to code the text manually rather than using a qualitative software analysis. An open-minded approach was adopted to allow any unanticipated themes and opportunities to emerge from the data, as recommended by Trace (2001); efforts were made to avoid any pre-existing themes being considered.

Whilst the analysis of the interview transcripts was guided by the preliminary codes, the inductive codes were designated to portions of data that illustrated a new theme observed in the text. These additional codes were either separate from the predetermined ones, or they expanded on a code from the manual. The codes were applied to the interview transcripts by matching the segments of the data selected that were representative of that code. To determine similarities and differences between views held by individuals, a process of comparison was carried out. Patterns were systematically examined within each case to identify key dimensions and emerging themes. The final level of analysed themes was cross-examined with each of the five cases for similarities and differences, as recommended by Miles and Huberman (1994). A table showing the emerging themes and sub-themes from each case was produced to aid understanding of any connection that might exist across cases.

Stage 4: In this stage, the codes and identifying themes in each case and across the five cases discovered themes were connected. In a similar way to stage 3, a comparative analysis was carried out to determine similarities and differences between views held by individuals. Similarities and differences within and across cases were emerging at this stage, showing areas of consensus in response to the research questions and areas of potential conflict. For example, differences were expressed by the varying levels of support and effectiveness of communication between management and staff.

Stage 5: During this stage, the previous stages were examined closely to ensure that the themes represented the initial data analysis and assigned codes. The interaction of text, codes, and themes required several iterations before the analysis advanced to an interpretative phase in which the units were connected into an explanatory framework. Overarching themes were identified that were felt to capture the phenomenon of adoption and diffusion of technology. Themes that were specific to each case and themes that were evident in all cases were identified in order to draw conclusions about interaction between agency and structure.

Stage 6: The primary aim at this stage was to develop theory from five case project examples chosen to represent diversity on some dependent variable (in this study, different supply chain context). Explanation-building is developed from pattern-matching

by conducting an analysis of the case study (Tellis, 1997). As discussed earlier, this is an iterative process where a theoretical statement is drawn from the literature and data collected from the case studies, followed by a process of refining and revising the proposition. This analytical strategy was used to construct propositions (Hartley, 1994) through two levels of analysis of the data of individual cases and comparison of cases (Yin, 1989).

4.4.6 Presenting and Writing up the Emergent Theory

In multiple case studies the information is collected from a number of sites at different times and presenting the findings can prove challenging, since there is no standard template for formulating the emergent theory. Eisenhardt and Graebner (2007) describe presenting case study findings to develop a theory in sections, or by distinct propositions that are supported by evidence from at least some or all of the cases. As it is not possible to support each proposition with every case within the text that proposes an emergent theory, the use of tables summarising the related case evidence is essential to demonstrate the depth and detail of the findings. The use of tables is not to produce summary statistics about the set of observations (Eisenhardt, 1989); rather the goal is to aid the process of analysis and, by providing sufficient evidence, strengthen the credibility of the findings. The approach of discussing each proposition with links to the supporting evidence ensures that the propositions are consistent with the cases, as the process guarantees the match between theory and data (Eisenhardt and Graebner, 2007).

4.5 RESEARCH PROCESS

4.5.1 Interview Questions

Drawing on structuration theory to conceptualise the diffusion of technology composed of three modalities: interpretative scheme, facility and norm, with micro-analysis focused on examining how participants drew on and mobilised their context in adopting or otherwise. The data collection was conducted based on these three modalities.

4.5.2 Modality: Interpretative Schemes

The questions in this modality were focused on how respondents developed meanings from the structure through communication. Questions about signification were focused on the development and communication of technology strategy and interaction between respondents and other key personnel (management, vet officer, and other staff). The

communication of technology through different media was not the focus of the study; it was more important to establish how respondents interpreted their interaction and communication with others. In relation to interpretative schemes, two concepts of signification and communication formed the basis of the interview questions and it was noted how the respondents drew on their interpretative schemes to make sense of interactions with others. The second set of questions focused on practical knowledge, to examine how the respondents were able to use this knowledge to justify their actions.

Interview Question	Inductive Source
What is (was) the role of the respondent in the development of technology strategy? What are the communications mechanisms for implementing technology and what is the role of halal?	Tham and Wener (2005) Maguire (2005), Surry (2005)

Table 4.2: Interview Questions (Interpretative Scheme)

Communication from top management is perceived to be an important factor. Additionally, communication at local level has been shown to help in understanding and making sense of new innovations. Thus, the interview questions set out to identify how respondents, through interpretative schemes, perceived their adoption of technology.

4.5.3 Modality: Facility

The components of Facility are power and domination, and the second set of questions therefore related to the structure of domination, control of materials and objects (allocative resources) and command over individuals (authoritative resources). The questions focused on allocative resources such as specialised technical support (Jones and Moller, 2002), training, and availability of technology (Brill and Galloway, 2007). The questions aimed to explore how authoritative and allocative resources have influenced the respondent's role and perspectives.

Interview Questions	Inductive Sources
What resources were made available to respondent?	Galloway (2007),
a) Specialist training or consultation	Maguire (2005),
b) Halal guidance	
What kind of support was made available to the respondent (managerial, national/local authorities)?	Salmon (2005),

Table 4.3: Interview Questions (Modality: Facility)

4.5.4 Modality: Norm

The dynamics of interaction between respondents and their local community play an important part in their adoption decisions. The interview questions here focused on the respondents' relationships with their local peers. Studies have shown levels of adoption of technology are influenced by social and cultural factors, and loyalties within groups (Gibbs and Gosper 2006, Oliver et al., 2002). According to Orlikowski (1991) "individual actions are guided by the application of normative sanctions expressed through the cultural norms prevailing in an organization", and the aim of the questions therefore was to establish how individual actions are influenced by these cultural norms. Additionally, the questions focused on the respondents' perspectives of adoption of technology of 'near' peers.

Interview Question	Indicative Sources
What were the main drivers and sources of innovation behind technological improvements?	Moser (2007),
What has been the effect of poultry community (peer influence, halal standards) on adoption of technology?	Eynon (2005),
Have you had any directives/sanctions to enforce new technologies?	Salmon (2005),

Table 4.4: Interview questions (Modality: Norm)

4.6 Interview Process

The main method of data collection used in this study was the semi-structured interview. There are a number of benefits in using semi-structured interviews. Tellis (1997) argues that semi-structured interviews provide important qualitative information that help the researcher to gain a better insight and become more familiar with the subject under investigation. Another advantage of using semi-structured interviews is the flexibility in structure and direction, allowing respondents to freely express themselves on relevant issues that they regard as important (Rodham, 2000), which therefore leads to a natural flow of conversation (Gillham, 2000).

The first phase involved face-to-face discussions with the CEOs of the five poultry producers. Each of the respondents was made aware of the research project and the possible length of the interview, and a request was made for a private office to allow interviews to be recorded. All the interviews were conducted face-to-face and recorded. Interviews lasted between 90 and 120 minutes. The interview structure consisted of four phases. In the introductory phase, the researcher summarised the key aims of the study, explaining the ethical issues (in terms of confidentiality), and ensured the respondent

agreed with the recording of the interview. During the second phase of the interview, the researcher asked the respondent to identify their role within their farming organisation.

During this phase the respondent was also requested to provide an overview of the technology strategy, value chain and its drivers; the aim was to establish an understanding and an overview of the external and internal environment. The third phase required the respondent to discuss the institutional structure, in terms of management support, training and development, organisational (internal and external) support structure, and financial supports that are in place to encourage adoption and diffusion of technology. In the final phase, the respondents were asked if they felt that there were any other issues which needed to be discussed and had not been highlighted in the interview. The researcher thanked respondents for their cooperation before closing the interview.

An important factor in these interviews that needed attention was the researcher's understanding of the language in which the respondents were expressing themselves. In order for the researcher to appreciate their meaning it was necessary to allow the respondents to tell their story in their own words. Blaikie (1995) expresses this in the concept of lay language. As the relationship between lay language and technical language involves building the latter from the former, the concepts in the research paradigm determine what is seen as social reality.

4.6.1 Data Collection Process

Data collection lasted over fourteen months and covered five poultry farms and thirty-six interviewees. The interviewer allowed flexibility to ensure participants were able to identify and talk about areas that were important to them. The interviews were all conducted on the respective organisational sites and the participants were chosen by their respective organisation. The interviewees illustrated the existence of strong feelings and direct experiences of the adoption and diffusion process for the supply chain and the formation of the value chain. Transcribing and translating the interviews was a very time-consuming exercise (ratio of interview length: time to transcribe was 1: 10). The individual tapes were transcribed and provided a complete and accurate record of what was said, and each was meticulously checked against the original audiotapes.

4.7 Summary of chapter

This chapter presented the philosophical position of the research and discussed different ontological and epistemological paradigms. A review of competing research paradigms from different perspectives was provided and research methodology was discussed considering ontological and epistemological perspectives. The purpose of the research design in aiding the data collection to uncover themes and determine meanings was also discussed. The problems and benefits of choosing single or multiple case studies were presented and examined to illustrate the decision-making process employed in choosing the right number of interviews and cases required to obtain rich data. The data analysis and the eight-stage analysis process were presented in detail. The interview questions and the process of choosing the relevance of the questions in relation to the research question were discussed. The chapter also covered the presentation and writing up of the emergent theory, including the process of selecting interview questions and the interview process. The next chapter will discuss the findings from the data collection.

CHAPTER FIVE: RESEARCH FINDINGS

5.1 Introduction

This chapter reports on the findings from the five poultry farms in relation to the research question: how does structure enable or constrain the adoption of technology within the construct of a halal concept in the poultry industry in Iran? and related issues identified in the literature review, focusing on the role of perception of adoption and diffusion of technology amongst the adopters. Interviews were conducted with members of staff who were considered to be involved in the supply chain as well as the adoption and diffusion of technology in the institutions. This included a mixed group of individuals from marketing, sales, production, purchasing, engineering, information systems and finance, and senior managers and veterinary doctors. The data collected from interviews that were conducted at each case project are presented and discussed case by case and by cross-case analysis in this chapter. Participants were allowed to talk freely even when a specific question was not asked and as a result some information was given outside the scope of the research; not all participants contributed equally. The following sections describe and discuss the 'change characteristics' that are established by need, pressure, motivation and purpose associated with change. The discussion involves analysis of the interplay between individual human agency and the 'structure'; the roles and responsibilities of those involved in the interviews and their institutional hierarchy are discussed and explained.

5.2 Overview of the Case Studies

Five case studies were chosen from Iran's poultry industry in the Khorasan province (located in north-eastern Iran, with a semi-arid climate) that consists of a range of businesses: breeders' organisations, breeding farms which produce eggs for hatching; poultry farms which hatch these eggs and sell chicks, and farms that raise layer pullets and laying hens. Amongst the ancillary industries are egg or hen processing factories, slaughterhouses and feed manufacturers. In addition, there are service providers and suppliers in the areas of livestock feed sales, transport and logistics (for animals, feed, manure and poultry products), veterinarian support, banking and the middlemen that are actively present in all of the above entities. The five case studies that were examined allowed for different contexts of technology adoption and diffusion to be explored in relation to their level of engagement with industry's supply chain. The decision to use

multiple case projects was not based solely on an appropriate number, but rather by the theoretical framework and research question. It is suggested in the literature that it is important to control the contextual environment through the selection of the cases (Voss et al, 2002). The case studies must allow for the full investigation of the subject under study (Patton and Appellbaum, 2003). However, as this study aims to investigate different contexts of technology adoption and diffusion, each case study needed to have undertaken technology-based change, in order to provide a scope of interaction between the individual adopters (agency) and the structure.

Case A had developed a technology strategy, an approach designed to allow for continued progress in technological change. Case B had a top-down approach, in which the top management adopted the strategy of a blended technology approach. In this case study, the modification of technology to suit local requirements was considered a priority. The top-down approach allowed for interaction between individual adopters and the structure. Case C used technology-driven production and had a technology plan, which involved middle managers. Case C was working towards a vertically-integrated operational model. Cases D and E were technology- dependent and relied on innovation and technology to guide them through the challenges of the supply chain. Cases D and E had developed technology-based operational directives and encouraged a bottom-up approach.

Welch et al (2002) state the importance of gathering useful data from influential and well-respected individuals, who meet the initial criteria. Contacts were made directly with the senior management staff responsible for each case study and a description of the research project and the level of commitment expected from the organisation was communicated. The respondents were chosen by their organisations and included people who had been or were currently involved in technological change and the supply chain. Table 5.1 summarises the theoretical sampling method based on Giddens' structuration theory, which was used for data analysis, and the contextual factors relating to each case study.

Case	Theoretical Sampling			Contextual Factors		
	Interpretative	Facility	Norm	Structuration	Supply Chain configuration	Focus and status
A	Development strategy	Centralised support structure	Top Down structures with examination of sanctions	Top down strategy with interventionist approach	Vertical integration	Individual / complete d
B	Blended technology directives	Centralised support structure	Top Down structures with possible sanction	Top down strategy allowing analysis between agency and structure	Semi vertical	Team/ current
C	Development Plan/strategy	Centralised support with possible conflicts of power	Top Down structures with possible examination of sanctions	Top down strategy with centralised supprt allowing interaction between agency and structure	Semi vertical	Individual /current
D	Technological directives	Driven by central support unit transparent policy	Influence from farming community, possible sanctions	Top down approach with scope for analysis between agency and structure	Horizontal	Team/ current
E	Technological directives	Innovative Centralised support	Scope for analysis and community influence	Bottom up approach	Horizontal	Team/ current

Table 5.1: Overview of the Cases

5.3 Data Analysis

In order to integrate the micro and macro levels of analysis to explain the interaction between individual actions and structural influences (Rogers, 1988; Hung, 2004) Giddens' structuration theory was used as the methodological framework for data analysis. In accordance with Giddens' suggestion of using the theory of duality of structure, the three modalities of interpretative scheme, facility and norm with their corresponding themes were used for the identification and interpretation of the interrelations between individuals and the social structure, as discussed in more details in sections 3.2 and 3.3. Signification (Theme 1) and communication (Theme 2) are the focus

of the modality of the interpretative scheme; the first theme in this modality is concerned with how the individual makes sense of adopting a technology (signification), which is also related to how individuals justify their actions (legitimation). Evidence suggests that this sense-making is the main decisive factor behind decision-making about adoption or rejection (Maguire, 2005). Theme 2 in the structuration of the interpretative scheme is concerned with the communication and interaction that takes place between an individual and others within the institutional context. In order to communicate, people draw on interpretative schemes from symbolic structures of signification. In this study, the first component of this theme is the interaction between an individual and the technological development strategy, and the second component is the role that this strategy plays in motivating or discouraging the individual in the decision to adopt or reject new initiatives for change.

Theme 3 and Theme 4 are related to the modality of facility, which focuses on the forms of power that individuals are subjected to in a system of domination, made possible due to the existence of social structures of rule and authority. In the modality of facility, the themes are domination and power, drawing on the understanding that power is a relational concept: resources drawn upon by one party would be used to secure compliance, despite the resistance of the other party. This concept manifests itself in specific resources such as 'allocative', which relates to control over material objects to enable things to get done, and 'authoritative' resources, which is to do with expertise, knowledge and status used to establish command over others. The allocative resources also incorporate the availability of resources that support or influence the adoption of technology (Theme 3). In poultry production, these resources could be educational programmes, raw materials information, or technical training. An authoritative resource refers to non-material resources and is concerned with managerial command over the activities of adopters (Theme 4). Theme 5 and Theme 6, in the modality of norm, are about legitimation and sanction. Legitimation is concerned with cultural norms, moral orders and values, and therefore is about how individuals justify their actions when reproducing social practices of accepted behaviour in their social (cultural) environment (Theme 5). In Theme 6, (sanctions) the focus is on how individuals choose to respond to the constraining aspect of power through sanctions. In imposing sanctions, people rely on norms, which are part of a social structure of morality, and of a system of legitimation. A summary of definitions and descriptions of these themes are presented in table 5.2.

Nos	Theme	Definition	Description
1	Signification	To produce sense and meaning from the structure	Sense-making by the form of communication and interaction with others
2	Communication	Process of sharing information	Top-down, personal and bottom-up means of interaction
3	Domination	Dominant use of resources	Command over people by controlling resources
4	Power	To influence and shape others' behaviour	Keeping control of resources to maintain power
5	Legitimation	Cultural and morally accepted norms	Expected obligations from individuals
6	Sanction	Constraining aspects of power	Imposing penalties as enforcement

Table 5.2: Themes of Modality of Structure

5.4 Case Study A

This case study is one of the largest poultry production holdings in the Middle East, with different units in different provinces and regions of Iran. The company is a vertically-integrated poultry producer, with their own pedigree stock (line) of great-grandparent and grandparent generations, and one of the few existing vertically-integrated operations with ownership of most aspects of its poultry production processes. Vertical integration is an established strategy for resisting the shocks of market price fluctuations. The company farms, hatches and raises chickens, is also involved in packaging its own brand of feeds, and owns a fleet of refrigerated trucks. The interviews were carried out with eight participants from different parts of the organisational hierarchy, representing different sections of the organisation. They included senior management, middle management and members of staff with responsibilities for the provisioning of supplies and distribution, as well as the day-to-day running of the farm. The farm's CEO respondent, R1A, was in charge of technological strategy planning and development. The strategy plan was designed to ensure the farm's progress from a business point of view, and technological innovations were viewed as enabling tools to achieve the farm's business goals. Table 5.3 presents a summary of the participants' roles and responsibilities.

Respondents	R1A	R2A	R3A	R4A
Role	CEO of the farm	Manager for Development and Innovation	Marketing and Sales Manager	Production Manager
Main duties	Responsible for the formulation of and leading the development and implementation of the farm's long-term and short-term strategy	Responsible for getting the product out to market, maintaining strong industry relationships	Responsible for creating and implementing marketing programmes, working with sales	Maintaining safe practices, ensuring all aspects of running of the farm
Respondents	R5A	R6A	R7A	R8A
Role	Veterinary Officer.	Poultry Field Support Officer	IT Manager	Finance Manager
Main duties	Responsible for the health of the flock, vaccines, carrying out regular inspections	Organising and coordinating the farm's procedures, assisting poultry vet officer	Responsible for the troubleshooting of IT services- internal and external networked communications	Responsible for the financial planning/ forecasting and financial health of the farm

Table 5.3: Roles and Responsibilities of Participants in Case A

5.4.1 Modality of Interpretative Scheme

The respondent R1A started by pointing out the existing weaknesses in the poultry supply chain in general, and the difficulties that these weaknesses have created for someone in his position in particular, by saying, "our poultry supply chain is not delivering, and if not sorted out may have disastrous consequences for the whole industry". The respondent was also critical about their processes and structures, "our business processes are not doing what they should do, like producing our own brand". These perceived failings were used by the respondent to support his strategic view of the use of technology, "what we need is a plan to treat advances in technology in supporting everything else.....we have to increase the use of technology in the infrastructure of our business".

The respondent's view on the varying degree of adoption of technology within poultry farms was that in Iran there are a limited number of poultry farms which are modern, and the majority of farms are just locked in the past and are managed in a traditional way. He legitimised his argument for having a strategy for technological improvements by commenting that a planned strategy would facilitate identifying the specific needs of different sections, "we need to have a plan that is driven by policies, an enabling policy rather than a controlling one, for the industry's supply chain we actually need a fresh start".

The respondent described his role in creating a technological improvement plan by emphasising his position as Chief Executive Officer, having developed a plan for the introduction and adoption of new technologies, and presented it in a meeting to executive management. The respondent further explained, "I informed the executive management of the plan and the steps we were going to take for its implementation and told them if they don't like it I will not do it". The respondent believed that management commitment to technology adoption plays an important role, commenting that "the test is in the implementation, whether it will succeed or fail depends on the level of commitment and willingness of senior management to see it through". On the subject of halal, the respondent was adamant that their product was halal, and believed that slaughtering is a measure of halal "we outsource our slaughtering to a well-equipped and modern slaughter plant which is halal-certified".

Respondent R2A complained about the number of intermediaries in the poultry market and the inability to keep the ownership of the product in the supply chain, as a result of the involvement of middlemen, saying, "if I know that once my product enters the supply market it would remain under my name, naturally I will be encouraged to improve the quality and offer the best packaged feed and provide the best day-old chicks and broilers to the market, but unfortunately it is not like that".

The respondent also indicated that the adoption of technology in the industry is not at the same level: there is willingness amongst poultry producers to use industry standards and modernised systems, but lack of knowledge and resources is the main constraining factor for many of his peers in the industry. The respondent confirmed that he is aware of the technology development plan proposed by R1A and discussed amongst the senior

managers. However it was suggested by the respondent that his role was limited in contributing towards the development of this strategy, “the structure and scope of the strategy was already decided and there was no opportunity for input from other senior managers”.

The respondent did not know exactly how the strategy was going to be communicated to the rest of the personnel, saying “well, I don’t know if the rest of the personnel are informed or I suppose it will be through their managers”. Respondent R3A was the marketing and sales manager and claimed that he was not involved in the approval of the technological strategy plan. The respondent, because of his responsibilities, was very much involved in interactions with his colleagues inside and outside of the farm. The respondent confirmed that there is a vast gap in the uptake of technology within the industry. He regarded the technology as a means to overcome the supply chain system inefficiencies, “in my role I need the technology to help me get rid of middlemen so that I can enter into contracts and negotiate with suppliers and buyers directly”. The respondent was of the opinion that the communication channel must be more robust and take into account opinions and feedback from the rest of the staff “the decisions are made at the top and then it is communicated down through the hierarchical management system. The people who actually do the work should be given the chance to have a say as well”.

Respondent R4A was in charge of the production of the farm. His role included the coordination between different activities of the farm and ensuring the trouble-free functioning of day-to-day activity. He had a very positive view on innovation and use of modern technology, and commented “technology plays an important role in my work, I am always on the lookout for an innovative way of doing things, technology has made many of the processes transparent, simpler and more reliable”.

This respondent’s views on the adoption of technology revealed a mixed attitude amongst others towards the change that is associated with technology,

> “Personally, I am glad that there is willingness for implementing and using new technologies in our firm as it speeds up the production time and adds value to our products, but despite the advantages it is a huge task to get everyone to use it and use it properly, and there are those who are reluctant to change”.

According to the respondent, the resistance to change or the slow rate of adoption of technology was partly due to mismanagement. He expressed his views by saying that there was ".....an ineffective management system, inadequate training schemes and lack of inspiring programmes. I could go on and on".

The respondent's involvement in the development of the technological strategy plan for the introduction of new technologies was the same as respondent R3A. This respondent explained that he has had minimal interaction; he was informed about the plan and asked for his input as a formality. The respondent expressed his concerns about the way the strategy plan is communicated, "I think what is missing here and what does not allow these plans to gather momentum and become established is the absence of explanation from the top management as to why we have to make the change".

Respondent R5A was the farm's veterinary doctor, who was involved in the selection and ordering of a series of building management equipment such as machinery for the automatic control of the air quality inside the housings to maintain the degree of humidity and oxygen level available in the air and keep the temperature at the right level. The respondent was also responsible for the flock's vaccinations, as well as medication and feed mix. The respondent complained that not all the members of staff showed the same level of enthusiasm in learning and cooperating when their routine method of work is changed,

> "From experience, I know how hard it is to get some of the staff to do what is required of them, even though they possess the required skills. It is even harder when it comes to new ideas or new methods of doing things unless they change their perception and agree that the new technology makes sense".

The respondent claimed that he was aware of the farm's policy plan for technological change but had very little input in its design and content; nevertheless the respondent was happy to have a strategy for change rather than not having any plan at all. The respondent did not believe the firm's procedures for obtaining vaccine supplies was adequate. He believed that some of the vaccine supply sources were not trustworthy, and it was the managers' responsibility to provide solutions for this problem, saying,

> "I need vaccines that I can rely on for their quality and effectiveness, out-of-date vaccines or even fake vaccines are known to have been available in the market and I must have confidence that the vaccines that we are supplied with come from a credible source."

Respondent R6A was the field support worker, with duties of assisting respondent R5A, the veterinarian doctor. The respondent was aware of the initiatives for technological strategy through his line manager, and explained that in their section all the new procedures and new methods or training for new equipment were delivered to them by respondent R5A, and that all the guidelines and explanations would then be available on the notice board. The respondent was pro-change, saying, "I have noticed there is less smell in the housings and chickens look healthier and chicks look more pinky since we have installed the new automatic ventilation control system".

Respondent R7A was one of the mangers from the IT department, responsible for the company's internal networked communications systems and software products. He said the improvements that have been seen over the years in poultry production have been because of technology, "traditional poultry farming is a thing of the past; we have to push forward with new systems and ideas if we want to remain competitive". The respondent's positive view of technology was apparent in his comment about the new monitoring system that was installed in production buildings,

> "the closed circuit TVs have not only enabled the production manager to monitor all the buildings at the same time without physically being there, it has also provided the personnel that work in those buildings with an added sense of security and peace of mind"

The respondent viewed this enabling factor of technology as a decisive factor in adoption of technology. The respondent was aware of the technology strategy plan and viewed it positively, claiming that it had added value to their products and has enhanced their methods of delivery.

Respondent R8A was head of finance, and responsible for the financial planning and smooth operation of the financial department of the firm. The respondent's interest in the

technology was because of his dependency on the financial management systems used for forecasting and future planning as well as book-keeping, which were technology-dependent. He expressed this by saying, "the technology approach to financial services is unavoidable these days. Managing a large company's finances requires skills and know-how that can only be supported by technology". The respondent confirmed that he was keen on the adoption of technology and commented, "I attended a short course on financial management systems and decision-making which was very beneficial to me and the company, I have to keep myself up-to-date with the new developments". The respondent was not familiar with the technology strategy plan in detail, but he viewed it as necessary and vital,

> "I have to make sure the funding is available for any new developments. It is not really for me to allocate the funding on the type of technology, but it is my job to make sure it is spent according to the guidelines and procedures. Without investing in new technologies we cannot really move forward".

5.4.2 Modality of Facility

On the subject of facility, respondent R1A (CEO) explained that his strategy for the introduction of technology allows the management of different sections to have control over their decisions about the suitability of the technology based on their own professional experience and perception of what is good for them, "I believe what works for one may not necessarily work for another". He continued by explaining that embedded in his strategy plan for introducing new products and processes is the notion of providing the staff with knowledge and information first, "I believe introducing anything new, whether on the line of new equipment or processes, there should first be a period of training to support the required knowledge and information".

Respondent R2A (development and innovation manager) was of the opinion that technology can solve the current crisis that the poultry industry is facing. He observed,

> "we need to follow and use the same system of supply chain that has been developed in the last 60 years in the world, so all the poultry producers across the country and supply chain providers can work like partners in a stable supply market".

He further commented that this change required educational programmes, "to move away from an underdeveloped and chaotic model to an international model requires a lot of education and change in attitude at first". The view of respondent R3A was that getting personnel more involved in the process of drafting the strategy plan would "institutionally strengthen" the diffusion of the technological initiatives. His reason for this was, "because the ideas are coming from the people who are involved with it and not emerging from someone's proposals that this is what they think should be done, and also when the idea is from you, you would make every effort to make it work".

The respondent believed that the level of training needed to be varied, as there was a wide variation of technical knowledge amongst the people who worked in the same unit. The respondent further expressed that in the sales and marketing department, there are people who are talented, innovative and capable in using software systems for producing different management reports, and yet there are also those who need basic IT training.

Facilitating the adoption of new technology is not a straightforward job. Respondent R4A, production manager, explained by giving an example,

> "when I wanted to introduce to my staff and encourage them to learn about a new management system of production that we were planning to use, I used to organise group events and run the software and tried to explain the advantages and the strengths of the new product".

About the effectiveness of this approach he added, "it was only when they tried the system by themselves, then they started to show some interest and got engaged with the product by asking questions and making comments". The respondent believed that people seemed to be interested in engaging with the practical side of new products rather than the theoretical aspect. The respondent further elaborated on his thoughts by commenting,

> "in a practical approach, once everyone has tried the new technology they would be more interested to share their opinion and ideas about it with others. I believe for a successful approach there has to be this culture of directing innovative plans into the 'why' domain, that is to drive forward the new ideas with the label of 'why we are

doing it' at the forefront and for the development to take place at the operations level".

According to the respondent, in order to succeed with diffusion at the grass roots level, the challenge was to engage people by doing something that attracted their interest, by involving them in something exciting and innovative. In this respect he said ".....in order to engage people it is important to have inspirational training programmes".

Respondent R5A was in charge of running training sessions for the members of staff that had to work inside the housings and those who were handling chicks and chickens. The respondent suggested that the basic training in using the technology should be supported by the availability of information.

> "In training sessions I intend to make sure that all the important information is communicated in an effective way in order to reduce the risk of diseases, and then I make the information available on the firm's web site for ease of access and availability at all times".

The respondent was pleased that the firm's IT department had helped him in updating his information with attractive content and had made it available online, "I knew who could provide me with the right content; having access to the right resources is important". Respondent R6A (field support officer) confirmed that he has been to various training sessions and the use of technology in demonstrating the use of correct methods has been useful to him. In this regard, the respondent said,

> "I have attended different training sessions that were organised by our line manager, for instance the 'disinfection programme'. When it was shown with video presentations of how it is done in more advanced countries it was very educational for me".

The respondent also added that not all of the training events had been useful for him, "sometimes I just don't get it and have to ask my line manager again and again". In terms of availability of support, the respondent acknowledged that if he was unsure of doing

something he could get help, “when something comes up that I don’t know how to handle it there are people that I get help from”.

Respondent R7A (IT manager) was critical of the varying degree of technology penetration in the poultry industry, saying, “our online ordering system has been operational for quite a long time now but we are far away from the time when all of the orders will be placed through this system”. The respondent perceived the overall training and support they provided as adequate, since they provided all the information needed in support of the technical trainings. The respondent suggested that their approach did engage the majority of the personnel, saying, “after trainings we always receive a large number of questions raised by the participants”. The respondent concluded that local managers have also played an important role in the uptake of technology. The respondent perceived that top management had little influence in the adoption of technology and staff motivation, since there was little interaction between them and the rest of the personnel. The respondent viewed the role of middle managers in promoting the adoption of new technologies as very important, saying, “I think the line manager’s commitment to succeed and the attitudes of other colleagues act as motivational factors”. Respondent R8A (finance manager) believed that training sessions followed by regular meetings and communication of ideas and experiences with people who had been successful in adopting and using new technologies was perceived to be a useful resource. The respondent expressed this by saying, “learning about experiences of others who have done it before has helped me a lot, especially in a specialist subject like financial management, therefore receiving training at expert level I believe is very useful”.

The respondent believed the way forward to overcome the existing inefficiencies on the adoption of technology within the firm and in the poultry industry is achieved by education, “to reap the rewards of the technology we have to realise its benefits so we need more training and learning inside the firm and outside”.

5.4.3 Modality of Norm

On the question of modality of norm, respondent R1A sought the approval for his technology strategy plan from his senior managers. The respondent legitimised his action by saying, “in a meeting with executive management I informed them of the plan and the approach that we were going to take and told them if they don’t like it I will not do it”. By

gaining the support of his senior management, through a form of 'authoritative resource' and through a top-down approach, he was able to push forward and get closer to the diffusion of his technology strategy plan. On the question of peer influence, the respondent claimed, "of course we are influenced by what our competitors are doing, we don't want to be left behind, but under the current circumstances the whole industry is suffering from uncertainty, which limits our future long term planning". It was clear that the respondent had a hierarchical approach as the means of communication with the rest of his work force. Influencing the staff through support structures of training and information-sharing was within the control of senior management.

Respondent R2A (development and innovations manager) reflected on previous attempts at 'top-down' approaches to solve the poultry supply chain problems, and acknowledged that lessons had not been learnt, "I believe we need to simplify rather than add complexity to the existing supply chain structure". The respondent viewed the diffusion of technology as a concept that is dependent on the management's willingness and commitment to improvements. The challenge for the management, according to the respondent, was to "do something new, something innovative, something to engage people and keep the momentum going".

Respondent R3A (marketing and sales manager) was more concerned about the relevance of technology in his domain of work. On the issue of halal, he thought that everything they produced on the farm was halal, and he supported his argument by saying, "we receive regular inspections from the ministry of agriculture and have always conformed with the ministry's directives regarding the health of the flocks and everything that we produce on the farm is halal".

The respondent, because of his rank, had direct contact with others and this caused some tensions in his meanings of signification. He was keen on following the institutional approach of diffusion, and in his interactions with others he had to appreciate the local context (resistance to change).

Respondent R4A (production manager) acknowledged that he has been sharing his views with other members of staff,

> "I have worked quite closely with other managers in managing projects, the work gets done when people are supportive and engaging, you can say there has been a networking kind of set up, we shared ideas and in this way a kind of informal collaboration took place which was sometimes even reflected upon in the formal meetings".

Respondent R5A (vet officer) indicated the rationale for adopting the technology as being underpinned by a pragmatic need to address the failures of the supply market and to ensure the quality and safety of their products. On the question of halal guidelines, the respondent was very blunt, saying,

> "yes we have operational guidelines and inspection visits from the ministry of agriculture and we have never had any issues with the inspections but I am not sure administering out-of-date vaccines, or even worse than that, fake vaccines, is considered halal. I am fortunate that we produce our own feed, as I am told that even the corns available in the market contain more moisture than they should".

Respondent R6A (member of staff) was pleased with the influence and interactions with his line manager,

> "the virtue of forward thinking and improving the way we do things is good for business and good for us and the customers who are buying our products, for instance as a result of the new ventilation system and doing things properly there is less odour in the buildings and the chickens seem to enjoy the better air quality, so this is a good thing".

The respondent had regular interactions with other members of staff and was somewhat influenced by their opinion. As he said, "I come into contact with a lot of people on daily basis because of my various duties and we share opinions with each other and I like to listen and learn from them".

Respondent R7A (IT manager) perceived the interactions between colleagues and information sharing to be an important factor in adoption and support of change in progressing from old to new, "by attending the training events and by sharing ideas with

other people you will get a sense of what is going on and what other people are doing". The respondent displayed what Rogers (2003) calls the characteristics of an innovator, by being proactive in the adoption of technology. This rationale (discursive consciousness) was based on the pragmatic environment (traditional poultry farming is a thing of the past). The respondent had many interactions with local management colleagues, helping them in designing supportive content and up-to-date information for their training programmes.

For respondent R8A (finance manager), the adoption of technology was driven by his perception of pragmatic needs: adopting new technology required a comprehensive approach, but it was the way forward in safeguarding his career and in providing solutions when making complex decisions, "in the beginning it may take some time to learn and to set up the system but after that it is only a question of updating your system and your knowledge".

The respondent further acknowledged that his interactions with the top management have offered the most appropriate support, "personal contacts and interactions with top management have actually given me the support that I need to acquire new technologies for my department". The cross-case analysis of this case study is discussed in the next section.

5.5 Cross Case Analysis, Case A

In this section, each of the identified themes and sub-themes from data analysis are discussed. The data analysis attempted to identify and explain the factors related to the perception of adoption of technology from a number of perspectives, and specifically to identify the interaction between agency and structure. These themes and sub-themes have emerged from within the case analysis that acknowledges the views of eight participants in relation to the three modalities of interpretive scheme, facility and norm. Cross-case analysis of participants presents a difference in the sub- themes. The sub-themes identified, as enablers in relation to adoption of technology, are Supportive Management, Technical Support and Training, Strategies/Targets, and Resources (time to attend training sessions).

Signification and communications are the two inter-related components of Interpretative Scheme that the participants relied upon to make meanings and sense of the adoption of technology. According to Giddens (1984), communication is the general element of interaction, and it is through this interaction that individuals construct meanings. The key areas that were identified in the literature for adoption of technology were top-down communication schemes, through strategic planning or organisational guidelines, the influence of local communities, and also pragmatic motivations. In terms of technology, diffusion studies have identified the top-down approach as being common when senior management develops a strategy to be communicated through the organisation with the expectation that it will bring about organisational change (Salmon, 2005). The findings from the case study showed that the CEO of the company (R1A) developed the technology strategy. The technology strategy was in response to the external supply chain's inability to provide standard supplies (R5A, R6A). The consultation had taken place with the senior management, and personnel at the staff level were not consulted during the development stages of the strategy. There were no mechanisms in place to propagate the strategy plan to the rest of the staff (R1A, R2A). In terms of Giddens' signification concept (producing meanings of the structure through communication) the members of staff were in agreement about the relevance of the strategy plan. They presented a number of reasons why it was necessary to have a plan; although not all were aware of the details of the plan (R6A, R8A) there was a perception that strategy was important for all.

The analysis showed that the participants drew on their knowledge and work experience to justify their actions in respect of why and how they adopt new ideas. The motivations included psychological motivation, as expressed by R2A, "this is the way forward" or pragmatic motivation such as being the right thing to do (R4A, R7A, R5A, R2A). They legitimised their actions by their own experiences and understanding of the needs of their industry. At the higher level of management, the reason for their actions was based on the external drivers (pressure from supply market), instability and rapid fluctuations of the market.

On the concept of modality of facility, which consists of the two components of power and domination in Giddens' duality of structure, in the concept of power, two types of resources are referred to: allocative resources (command over goods and materials) and

authoritative resources (command over people). The analysis of the case study shows the domination of the resources through the control of training and support for the staff. This has resulted in the adoption of more inclusive approaches to engage the staff, such as bespoke training programmes (R3A, R4A). There were varying degrees of interactions with allocative resources; there was more interaction and engagement when the allocative resource was more closely matched with individual needs and requirements (R4A, R6A). In terms of authoritative resources, most participants were in favour of the top-down approach. In the concept of power, the theme emerging across all responses was the need for top-down directives (R1A), and bespoke support (R3A).

On the two components of legitimation and sanction, for most of the staff the key influence was their relationship with their manager. The role of the local management was perceived to be an important enabler and influential in diffusion and adoption of technology (R4A, R5A, R6A, R7A). Another enabling factor in terms of legitimation was the influence of adoption from other members of staff who had adopted the new technology and were satisfied with the change, providing a source of motivation for other staff. In terms of sanctions, there were no indications of sanctions being forced upon the personnel. The potential adopters were keen on better and more direct training and support and using the experience of others outside the organisation. Top-down directives seemed to have been accepted and were effective.

5.6 Case Study B Company Profile

This case study did not enjoy the benefits of ownership of a vertically-integrated operational structure as with the previous case study. The operational structure was based on a semi-vertical integrated operation system, which meant that only some of the production supplies were owned and managed by the farm, and for the rest of the supplies the farm was dependent on the network of poultry market suppliers.

The farm's poultry production was initially set up with a few hundred day-old chicks in the late 1950s, and by the 1970s they had become one of the main suppliers of day-old layer chicks, supplying poultry farms all over the country and extending their poultry operation to other provinces, claiming more than 60% of the sector's market share.

The farm has been amongst one of the first established scientifically-designed modern poultry farms, with an imported flock with proven track records of an efficient breed. The flock had been scientifically-bred to achieve the highest performance with minimum cost, which changed the rules in terms of profitability for egg production. The farm is privately owned, with a hatchery unit, and has been very successful in sustaining its high quality production. In this case study, the farm's manager was tasked with developing the technology strategy as part of the company's policy. A blended technological approach was adopted and non-standard farming practices were not allowed. The technology strategy was crucial to reconciling the need for consistent high quality production. Table 5.4 presents a summary of participants' roles and responsibilities in the farm.

Respondents	R1B	R2B	R3B	R4B
Role	CEO	Operations & Modernisation Manager	Marketing and Sales Manager	Engineering and Maintenance Manager
Main duties	Responsible for the formulation of and leading the development and implementation of the farm's long-term and short-term strategy	Responsible for getting the product out to market, keeping up-to-date with industry progression	Responsible for creating and implementing marketing programmes, working with sales	Maintaining safe practices, maintaining all equipment of the farm
Respondents	R5B	R6B	R7B	R8B
Role	Veterinary Officer	Personnel Manager and Accounting	Communications Manager	Member of Staff
Main duties	Responsible for the health of the flock, vaccine, carrying out regular inspections	Responsible for the financial planning/ forecasting and financial health of the firm	Responsible for monitoring devices and internal and external networked communications	Organising and coordinating the farm's procedures, assisting poultry vet officer

5.6.1 Modality of Interpretative Scheme

On the question of technology strategy policy, the CEO (R1B) of case study B explained that in relation to the move towards a scientific approach to managing their production, all the associated discussions had taken place at senior management level when the company was initially set up, and an ongoing technological policy was drafted and communicated down to other personnel. Communication of the strategy plan was also a top-down process. Respondent R1B further added that,

> "the farm manager was tasked to investigate and recommend the most technologically suitable solution/solutions which could be adapted and customised to match with our climate and operational capabilities, what we call a blended technological strategy. We also took the advances in management studies as a continuing priority".

The second respondent, R2B, the farm's operational manager, was more focused on the implementation and operational part of what the strategy plan had to offer. The respondent talked about different issues that ought to be considered in a blended technology approach. On this issue, the respondent commented "we must take health and safety issues seriously". The respondent said that he was committed to making their plan a successful one. The respondent described his perception by saying,

> "we have had to ensure that everyone is told and fully informed of what they have to do and what is expected of them, what is their role within the bigger picture of moving with technology by encouraging them to proactively improve their knowledge by taking part in educational training sessions, which are organised either internally or externally, in another word we operationalised the strategy plan".

Both respondents expressed the view that their business was halal, as the feed that they used was free from any ingredients that might be considered haram, and they were not in charge of any slaughtering processes that could compromise the halal status of their product. R2B stated that "we run a hundred percent halal operation".

Respondent R3B (marketing and sales manager) thought that meaningful communication plays an important role, not only for communicating new ideas and hence making

progress more fluid, but also for building good relationships. The respondent accepted that the approach was very much driven from the top, as suggested in his comment "it is a project desired from the top".

The respondent was pleased with the enthusiasm shown for technology amongst some of the staff, and stated that it was essential for him to be aware of technological advances in marketing. "I have been impressed with how some of the staff are actively engaged in increasing their knowledge, although there are varying degrees of enthusiasm, but it is good to have like-minded people". He further added, "I think this is due to the high quality and informative nature of training classes that we have offered them".

For the others that were not so keen on technological changes his theory was,

> "I think the level of literacy is an important factor in giving you the confidence to learn new stuff, and unfortunately in the poultry industry a low level of education is widespread, and even in our firm only a small percentage of staff have a higher education degree".

The fourth respondent, R4B, was head of engineering and maintenance and also a member of a group that was in charge of running training sessions. The respondent claimed that getting involved in developing training materials was due to his own motivation for making sure that the right information was being communicated. He added that,

> "the better and more staff are educated about their role, equipment that they use, and avoiding risks, it makes my job easier. Sometimes it takes a long time for people to accept doing things differently or using new machinery may also have its benefits"

The respondent emphasised that clearly there is a need to have and to communicate a clear vision towards the use of more advanced technologies in the firm. The respondent further commented, "I am happy that the management at the top are technology-minded and have a policy in this respect". The respondent interacted with senior management through formal meetings, "if there are any major developments to take account of in terms

of operational matters or strategic development that need to be addressed it will be brought up in the meetings with senior management".

The veterinarian officer, R5B, perceived the technology strategy plan as a necessity for sustainable production. The respondent acknowledged that there are varying degrees of engagement amongst staff, saying, "some members of staff are really keen on following the procedures and learning new things but there are others that show very little interest". The respondent confirmed that he played no role in the drawing up of their technological policy plan, "I was not involved in developing the strategy plan with the senior management".

The respondent praised the success of the blended technology policy with a clear communication approach in successfully mapping out the idea of 'blended technology' by saying, "what we have is a good roadmap on how to combine new methods with traditional methods, and how our blended technology can make an impact". According to the respondent, having a clear direction would encourage successful adoption of new technology. The respondent R6B, personnel manager, had played a part in the creation of the technology strategy policy; the respondent had worked with the farm manager and provided input with regard to the organisational structure. The respondent explained,

> "I believe in this role you have to have the bigger picture in mind all the time and observe how other firms are planning for the future in moving forward, in this way you will be able to fill up the existing gaps, but that has to be systematic and planned, more than anything we need qualified personnel and educated people, then we can make progress".

Respondent R7B (communications manager) commented that he enjoyed technological challenges and likes his job as an engineer dealing with the vast number of different technologies employed on the farm. The respondent believed that one of the drivers to adopt the technological approach was the need to move on from traditional methods, and to develop effective methods of production in response to the challenges introduced by modern intensive farming in industrialised countries. This was reflected in his comment "the traditional approach to poultry farming is limited in many ways compared to

intensive farming that has been introduced after the Second World War, which would consequently lead to increased income as one of the main objectives".

The respondent's perception of halal practice was focused on halal slaughtering and trust, as indicated by his saying,

> "everything that is used on the farm is halal, we don't have a slaughtering plant and the mechanisms that we use have no relation to halal, but the only thing that I can say is we trust the suppliers that the feed or vaccine that they give us is not mixed or contaminated with haram".

Respondent R8B was a member of staff who had a variety of duties. The respondent was neither aware of the technological development strategy, nor was he concerned that he was not consulted about it, "must I know about it? I am not sure if I have to know it. I know that using modern equipment and computerised systems has helped us to be amongst one of the best farms in the region." The respondent commented that from his experience of working on a few farms in the past, working on a modern farm is more satisfying and fulfilling. The respondent identified a number of reasons for resistance towards new technologies by saying "the problem is people tend to do things how they are used to and this is the root of the friction, on the other hand there is also fear of not knowing everything in case you make any mistakes".

5.6.2 Modality of Facility

Respondent R1B confirmed that the engineering and communications unit provided different levels of training and support. The respondent added that they are quite different from the majority of firms in offering varying levels of technical support, "we rely on our customised technical training and support to cater for different levels of education amongst staff, we are not dependent on external training courses that are run from time to time". The respondent described their training programme as comprehensive, including topics such as the use of computers and hand-held devices for entering data and transferring data to the main computer, preparing reports and keeping logs of vital daily information. The technical support was centralised and controlled by the engineering unit. The respondent further added that, "if the staff needed any further support they could go

to the engineering unit and receive help from a member of staff". Responding to the question of resources available to staff the respondent replied, "in addition to the training programmes there is also a common room where there are a few computers with internet access for staff use".

Respondent R2B, operations and development manager, explained that communicating the reasons for introducing new methods or installing new equipment is at the heart of their training design and strategy. The respondent stated,

> "there is an opportunity for staff to undertake training, which is a mechanism of communicating the new methods, the reasons for the change that is being introduced and most importantly why we are doing it".

In discussing the resources required in assessing the training needs, the respondent commented,

> "these training sessions draw on different groups of experts, for instance if the subject is related to information systems such as installing a new program then you need to bring in an IT expert, or for a new hygiene regime you have to call on the expertise of the farm's vet doctor".

The respondent was also critical of the lack of engagement, and explained that not all the staff engaged with the training materials, hence the reason for technical support: "the technical support fits in at a few different levels, from basic understanding to more technical details". In terms of resources for the technological developments, the respondent indicated that these resources had to be approved by R1B, and included attending seminars and visits to overseas farms.

The respondent also referred to the lack of resources that exists in the poultry industry,

> "what we do internally to maximise production and produce better quality products by improving our systems and knowledge is directly affected by the behaviour of the industry's supply chain".

The respondent's view about the halal aspect was,

> "what can I say? There are different facets to halal, there are various directives on managing the farm from the ministry of agriculture and local authorities....., as much as it relates to this farm there is an overall willingness to do things properly and according to our Islamic beliefs, but we have no control over what takes place outside the boundaries of this farm, we tend to do business and get our supplies only from the sources that we can trust".

The respondent acknowledged that there were no incentives or rewards for halal. The marketing and sales manager, R3B, pointed out the usefulness of the training programme, stating that "everyone can benefit from the trainings as they are motivating as well as essential and that's why internal trainings are compulsory". From his point of view, "the more I know about our products the more convincing I can be in attracting new deals and in searching for the right suppliers". The respondent referred to technology as an important tool in his daily activity and carrying out his work, "we are connected to the internet and I can gather useful, daily up-to-date poultry information from different websites. I receive hundreds of text messages from endless dealers (middlemen) offering anything and everything". The respondent further explained that,

> "I tend to do business with people who are known to me and can be trusted, the business ethics or even religious ethics are in short supply, unfortunately you hear a lot of lies, sometimes I even run background checks with other colleagues with regard to new customers, clearly the instability in supplies pushes you out of your way".

The respondent added that the management has been very influential in encouraging the adoption of technology, "the forward thinking and being pro-technology of the senior management has undeniably showed us the way". In discussing the development of training events, respondent R4B stated,

> "depending on the subject, I work with 3 to 4 other colleagues, we held formal and informal meetings regularly, I have an open door policy and once the content is

prepared one or two of these people would deliver the subject and I monitor the effectiveness and level of engagement".

The main barrier, he thought, was the level of education of the staff,

> "not everyone is at the same level, and therefore we tend to overcome this problem by going through different levels of information exposure, it is also a case of going away and experiencing it hands-on kind of thing, there is only so much you can deliver theoretically".

The respondent continued, "we can not only rely on training to bring about change and improvements, change and improvements come from desire to change, that's why we emphasise the reasons for introducing change in our trainings". According to the respondent, the main barrier to the adoption of technology is the absence of fundamental resources such as an integrated scientifically-coordinated supply model free from monopoly of wheelers and dealers, a proper supply chain,

> "I think it is essential to see the bigger picture, and in relation to the industry's resources, there is no point in driving an expensive new car on a road where there are potholes as big as your car".

The vet officer, R5B, confirmed that training events have been organised by R4B, and that he has also been cooperating when the subject matter was related to veterinary issues. The respondent added,

> "the training sessions on their own are helpful in raising awareness generally but on the subject of animal health and meeting the requirements of the regulations it is my responsibility to ensure that everyone understands what they are supposed to do and do it according to the instructions, not what they think is right. Trying to get some individuals to learn and use the technology available to them is a major challenge and in this respect technology has been a great aid to me, there are control mechanisms and monitoring mechanisms and informative data available to me, for instance I can see who is entering which housing buildings at what time with or

without protective clothing, I can do random sample checks on the feed without referring to any outside lab, I can check the recordings of the CCTV cameras".

The respondent claimed that "when it comes to halal, yes on the face of it all is halal, but when I am not sure that the vaccine I am using today on the chicks will protect them or not, weeks later when they are sold to another unfortunate farmer, because the vaccine was fake or out-of-date, what would you call this?"

The personnel and accounting manager suggested that in this part of the organisation they have an infrastructure built on advanced accounting technology, and that some of the personnel had specific qualities,

"it is our belief that farm management studies must have priority and be a continuing one, we have tried to get the best personnel for the key positions, we have one of the most reputable vet doctors, and although not all staff are IT literate, the important thing is to believe in your product. According to our marketing manager (R3B) we could have had our own brand a long time ago but this requires market demand for product recognition and country-wide management processes in place, which do not exist at the moment".

The respondent speculated on a number of reasons why some of the staff are reluctant about the uptake of technology,

"we are moving towards intelligent devices, intelligent buildings, intelligent video monitoring, intelligent cooling systems, intelligent temperature control systems. I believe one reason could be fear of making mistakes and not knowing how to correct them, another reason could be lack of knowledge and I think the training programmes are helping".

It was confirmed by respondent R7B that technology played an important role in the daily activities of the farm,

"I think our organisation is miles ahead of many of the other farms in the area; because of the innovative thinking and investments we have a modern

> communication system in place in the middle of nowhere, (beam-to-beam internet broadband communication) whereas on the nearest farm to us people can hardly even use their mobile phones because of weak signals. Here, members of staff are encouraged to participate in the technology programmes and learn about the benefits of modern farming by learning from those already ahead. There are articles on the company's website about the latest innovations in the poultry industry from around the world, and not only from the western countries".

The respondent explained the organisation's management philosophy by talking about their plan, "we take this view in our technology strategy or move to modern farming that it is very important to have a plan, as having no plan is planning for failure". Respondent R8B, whose duties were mainly concerned with providing support for the farm's vet doctor amongst other duties, had not been involved in the discussions,

> "I have not been involved in the discussions for developing a strategy for technological improvements but I have noticed some of its benefits, for instance I have learned through the training programmes, how important it is to follow and actually act according to procedures, which is the only way to see improvements, otherwise having procedures and not acting on them and doing things as you have been used to in the traditional way is like you don't have any procedure, before I didn't know this".

The respondent added that he had also attended trainings organised by other authorities, "I think trainings organised by other bodies are more about covering general issues and that's why they are not very useful, whereas ours are more directly related to what we do". On the question of halal, the respondent's view was,

> "halal is from our religion Islam and we have to do everything that is halal and according to the Quran, but these days many people don't, people lie a lot to sell their goods and this is not Islamic and I think it is not halal".

When asked about the treatment of animals, the respondent replied, "animals are always the victims".

5.6.3 Modality of Norm

Respondent R1B claimed that the move towards technology adoption is inevitable and suggested that, "the pressure from the market makes it impossible not to adopt the path of technological improvements, but unfortunately traditional farming still forms a large proportion of our poultry industry". He further commented on the role of management in this respect,

> "as owner-managers we realise the importance of the role of management towards the adoption of technology, I think education plays an important role here, the more educated the senior management the more chances of pushing for adoption of technology-based solutions and modern farming".

The marketing and sales manager, R2B, operationalised their technology strategy and stated that, "the use of Information Technology is a vital part of my day-to-day work". The respondent claimed that there is a need for a top-down approach as well as a bottom-up approach, when he stated, "the institution's strategy has to be driven from the top down without a doubt, and also when there are enthusiastic members of staff who are driving the idea of technology change forward with innovative solutions and ideas they should be listened to". The respondent added that there was also a need for sharing experiences,

> "what would really be helpful is to be able to share with other peers the good practices, to learn from those who have implemented something that has really worked, or even to share your experiences of things that have not worked or if modified would result in a better practice".

Another respondent, R3B, noted the top-down pressure as an effective means of persuading all the staff. He suggested that a top-down approach with pressure to meet the minimum requirements would result in engagement of all the staff. The respondent further confirmed that setting minimum targets has proved useful in engaging the staff since, "targets are ensuring the engagement of the staff with clear minimum expectations in adopting and implementing the technology".

"What makes progress slow is the resistance of some of the staff to change, I don't think there is a fundamental objection but rather an unwillingness to let go of the old habits and adopt the new", responded engineering manager R4B. The respondent further commented on halal as,

> "the slaughtering process, and we do not use the technology related to slaughtering, but the treatment of chickens varies from farm to farm, external circumstances without a doubt have a direct effect on the way animals are treated and handled in the farms, at the moment there are regulations but that is just what they are, regulations".

According to the farm's veterinary doctor, R4B, the top-down approach was a must-have. He stated "that is the only way that you are going to get something done". The respondent considered himself to be at the centre of health-related matters for the animals and suggested, "there are areas that you cannot cut any corners and procedures must be followed as they are, and we cannot have it any other way". The respondent was in favour of more regular systematic visits from the ministry of agriculture inspectors,

> "it is necessary that there should be a programme of systematic regular visits by the ministry's vet officers, as it is possible to miss important vital signs related to the flock's health and buildings management issues in the short period of time of an inspection".

In terms of halal, the respondent was of the opinion that halal is more powerful than regulations,

> "look at the notion of halal as a code of conduct, it has got a built-in power of persuasion, there is a sense of carrying out religious duty as well as doing your job, which adds another dimension to it, when you tell the workers that they are responsible ethically as well as their job requirement to record the amount of water and feed that has been used correctly, and not by guessing the figures when they forget to enter the data since daily comparison of this data is one of the ways of detecting early illness in the flocks, as well as indicative of a few other issues, they tend to do it more consciously and you get more reliable data which you can trust".

The personnel and accounting manager prioritised between technology adoption and keeping afloat, "in an ideal situation technology should be high on the agenda but our industry's situation is neither ideal nor stable, that's why a technological approach is not being seriously considered". The people's fear of change was cited by R7B, the communications manager, "the fear of changing the established working practices, coming under pressure from others by saying and acting in a way as to suggest that.....oh I don't believe in what he is doing".

The respondent claimed that the lack of trust is another obstacle, saying, "if anything goes wrong there is always this line of blame directed by others at the one introducing the change by saying that it was not something that we had been used to". Respondent R8B expressed that top-down directives were the only approach he was familiar with, "it has always been like this, that the management decides what needs to be changed and how it should be done, we are asked from time to time about our opinion but really the decision is made at the top". The respondent expressed concerns about halal by saying,

> "I have worked in this farm for many years and what is important here is to tell the truth, especially when you have made a mistake, because covering up and lying is not Islamic, but unfortunately the people's culture has changed. Technology can help us to minimise mistakes and improve efficiency but even though people know that they are being watched they still tend to lie if they are asked about something that has gone wrong".

5.7 Cross Case Analysis, Case B

The interpretative scheme is the focus of analysis in the first section of this discussion as it is the scheme that agents draw upon to make sense of their use of technology. According to Rogers (1995), in terms of signification the communication of an innovation forms an important part of shaping the levels of adoption. In terms of diffusion, communication is the "process by which participants create and share information with one another in order to reach a mutual understanding" (Rogers, 2003:18). In this case study, however, the decision about the technology strategy plan was reached in the way that Rogers (2003) calls 'authority innovation'; the senior management had been involved in the discussions and development of what was agreed upon as the technological

development policy and there were no mechanisms in place for consultation or feedback with the rest of the staff. The organisation adopted a unique bespoke approach and called it a blended technological approach, motivated by the perception that innovation will make improvements. The greater the perception of the relative advantage of an innovation is, the faster the rate of adoption (Rogers, 1995). The purpose of the blended technology approach was to make the technology transfer more consistent and compatible with the previous system wherever possible. R5B perceived the new system to be a necessity; the innovation was perceived to be easy to understand, hence making adoption easier. The management and staff were in agreement that an adequate level of training and support was provided (R3B, R5B, R8B).

The attitude of the management team and willingness of the respondents in taking up new methods exhibited the characteristics of innovators and early adopters. R7B and R5B were captivated by the technology and R5B considered himself to be able to understand complex technologies and welcomed the blended technology for its consistency in moving from the old to new in a measured way.

On the subject of facility, domination is dependent on allocative and authoritative resources. The support was coordinated through one central system. The support was available to all the staff and on all the topics and if the expertise were unavailable in the unit, experts were brought in from relevant sectors. Authoritative resources refer to command over individuals through transformative capacity that generates these commands (Giddens, 1984). This was evident in the blended technology strategy that required introduction of new technology to meet its requirements. In this case study the engineering unit seemed to be in possession of control and power as the centre in control of both resources, which may lead to less innovation (Rogers, 2003) as there may be limited ideas considered by a few strong managers. But the firm seemed to have found a solution by designing the blended technology, which encouraged interactions and engagement of a wider audience at the operational level (R5B, R7B).

Reflecting on the structuration between agency and structure, it was clear that there was harmony between what was happening at the top and what was happening at the individual level. The management and staff perceived that training and support was adequate and effectively coordinated. Rogers (2003) defines a social system as the

engagement of interrelated units, such as individuals or informal groups, and argues that the rate of innovation adoption is dependent on the formation of these social systems. In this case study the social interactions were very evident, as in the comments from R4B about interacting with people from other sectors. The findings from this case study confirmed the findings from the earlier research, which identified social systems as one of the determinants of the level of adoption.

On the subject of modality of norm, actors in terms of legitimation and sanctions, depending on the context, draw upon rules and norms that are considered to be legitimate social practices. The staff responded well to the sanction of meeting the requirements of the blended technology strategy (R3B, R4B). Halal as an Islamic social rule and a code of conduct in relation to the treatment of animals was claimed to have been compromised by external conditions such as supply of out-of-date and fake vaccines (R4B). It was evident from the findings that staff were encouraged to work ethically and sought solutions to resist the external pressures in influencing bad practice.

5.8 Case Study C

The case study was an established industrialised poultry production family-run business with a total of 250,000 pieces of broiler parents stock distributed within a number of plants. The plant under study was located at a reasonable distance from residential areas to reduce the intensity of odours, and taking advantage of natural terrain and landscaping. The company produced over 35 million hatching eggs and benefited from having their own incubator units and a proper waste management system with adequate removal, storage, treatment and disposal of manure. The company's commercial broiler chicks are well-known for their quality and efficient meat conversion. The company is planning to roll out its own feed production mills according to international standards in the near future, but at the present time is very much dependent on the industry's supply. The company has been awarded a number of good practice awards and is accredited with certificates of compliance with internationally-recognised certificates. The company has created jobs in the area and is the employer of a workforce of over 500 people.

The company was set up with the vision of modern farming and had developed a technology plan. The technology strategy was adopted after a series of discussions at senior management level. The farm manager was charged with the implementation of this

plan. Communication of the technology plan was a top-down process. Table 5.5 presents a summary of the participants' roles and responsibilities.

Respondents	R1C	R2C	R3C	R4C
Role	Managing Director	Project Manager (Development)	Procurement Manager	Project Team Member
Main duties	Responsible for the formulation, development and implementation of the farm's short-term and long-term strategy	Responsible for getting the product out to market, keeping up-to-date with industry progression	Responsible for creating and implementing marketing programmes, working with vet doctor for quality assurance	Maintaining safe practices, maintaining all equipment on the farm. Good practice
Respondents	R5C	R6C		
Role	Veterinary Officer	Member of staff		
Main duties	Responsible for the health of the flock, vaccines, carrying out regular inspections	Interaction with both management and staff. Overseeing the procedural compliance		

Table 5.5: Participants in Case Study C

5.8.1 Modality of Interpretative Scheme

Respondent R1C was the managing director of one of the larger plants of the company. One of his roles was to oversee the smooth integration of the technology strategy plan on the farm. He worked closely with a number of the farm's managers on a daily basis. The respondent was directly involved in the development process of the technology strategy planning, "I have always had this vision that a successful poultry plant is designed according to modern technology and should follow a process of ongoing updates, that's

why we continuously review our systems and equipment". The respondent claimed that despite his position as the managing director, he sometimes finds it overwhelmingly difficult to correlate the existing mentality of other managers with the strategy plan. The development project manager R2C indicated a difference between support of technology-related projects and actually carrying out the projects,

> "I receive good support for technological change from other managers, but when it comes to implementing it and actual compliance with the change, the process is sometimes rather slow and it makes you think whether you have been receiving only lip service".

Respondent R3C, the procurement manager, claimed that a large amount of his time is spent on gathering information, which is vital for reaching the right decisions in his cost-benefit analysis when using the supply chain structure for placing orders; in this respect the technology is an inseparable part of his work. He stated that, "if you have access to good data you can make use of economic analysis methods and have a systematic economic approach to ordering the goods, but in an ever-turbulent and unstable supply market, the analyses are to limit the risk factors and to take necessary measures in managing the increase in expected final value".

The respondent further claimed that the vision of the organisation was to shield itself from market uncertainties by becoming self-sufficient and independent from market fluctuations and by taking steps towards a vertical integration structure, and this strategy was to be implemented step-by-step, as it demanded a lot of investment and expertise. The respondent further commented, "in my position the strategy plan is very motivational as in the scenario of being independent from the supply market and with a degree of stability I will be able to apply my skills and know-how in a more effective way".

The respondent indicated that there is a fear of technology amongst a number of staff, which is hindering the adoption of technology, "....in some cases there is a fear of using technology and that fear is the slowing down factor in the adoption rate of technology, it is the fear of trading something you know and are used to with something you don't know". The respondent declared that in terms of communications he was not aware that all of the personnel were conscious of the details of the technology strategy plan, but they

knew that technology plays an important role in shaping the way systems and processes are employed.

> "details of the plan have not been communicated with all the personnel but it is hard not to make a distinction and notice the influence of technology between this plant, with all the modern machinery and procedures and regulations in support of these systems, in comparison with traditionally-run plants".

The respondent confirmed that the strategy was developed by the senior management and communicated through the top-down approach with the rest of the management team, "the technology approach plan has been developed from the top down, although feedback was sought from the middle management team, but we didn't get the ordinary workers involved". The respondent offered a number of reasons for not being successful in getting everyone on board, "the communication channel has not been very effective because there are a few ranks you have to get through before you can reach the staff members".

Respondent R4C was a technology project team member and one of his responsibilities included information and progress updates on different technologies employed by the farm. The respondent showed little interest in the firm's strategic plan, "I don't know the exact content of the strategic plan, but I know that there is a strategy for producing all or at least most of the raw materials that are needed for the farms".

In terms of communication, the respondent revealed that he was informed through informal relationships with other colleagues, "partly because of my job I keep in close contact with people involved in the development department and quite early on I have the chance to get to know things".

The veterinary doctor, R5C, was also involved in running workshops, mentoring a number of staff that were involved with veterinary and animal health issues. The respondent draw on his own experience in relation to his expertise and argued that lack of knowledge is the main obstacle in implementing scientifically-driven procedures, "the worrying factor is that people have their own ideas of what is good practice, and this is how the new procedures would lose their importance and the preconceived ideas would take priority". The respondent claimed that he had to draw on his own creativity and

knowledge in engaging members of staff to see the benefits of good practice and let go of their own way of thinking what seemed to be the right way, “I had to come up with innovative ways, such as the use of animations in demonstrating consequences of bad practice and benefits of good practice”.

Respondent R6C was a member of staff with the role of assisting the veterinary unit. The respondent’s meanings of signification were formed through his interaction with the veterinary activities on one hand, and interactions with regular staff members on the other hand. From his interactions with the staff he concluded that they lacked knowledge and understanding of new technologies; this became apparent in his comments, “the ordinary staff don’t always know about the technical stuff and what is involved, for instance there are some types of vaccine that the content must not be shaken as it will lose its effectiveness but no matter how many times you repeat this, when you are not supervising the vaccine dose gets shaken, people have this image that the drug capsule must be shaken before its use”. According to the respondent, for the change to happen, first the understanding and technical knowledge of the adopters must change, as they fail to see the need for understanding the technical issues and they do not understand what is actually involved, “they don’t think that they should also acquire some technical knowledge, not like an expert but a minimum understanding of what is what”.

5.8.2 Modality of Facility

Control in directing and facilitating the adoption of technology was noted through the respondent’s views on the project management unit in providing the needed expertise, “we realised from early on that there was a need for a centralised approach for providing the necessary knowledge, expertise and services if we were going to be successful in managing a modern poultry production”. The respondent further stated that, “the needs of the staff also had to be realised through establishing their requirements, as there is a willingness to move forward with technology”.

The respondent claimed that the supply chain must be technology-driven and he viewed himself as a driver for change, not only in the plant under his responsibility but also for the wider aspect of the country’s poultry supply chain, “technological change is a necessity for the poultry supply chain, we have a modern farm but not a supply chain that can meet our demands and provide a sustainable supply, and I am pushing for change; on

the farm level the priority is given to educating the staff and then technology but I think for the supply chain, technology must come first and education second". The respondent claimed with the advance in science and technology, together with the organisation's dedication to improvements, they have produced good managers and technical people who are making contributions to their organisations up and down the country, "I believe the biggest barrier is the lack of knowledge, that's why in the project unit we have tried to address this by having classes and in fact teaching the subjects and listening to the staff, and encouraging suggestions for change".

Respondent R2C was the head of project unit and viewed his role as the one responsible for narrowing the knowledge gap of the staff as indicated in his comment,

> "the investment in new technologies and equipment and machinery are all funded privately and there is no room for gray areas and uncertainties; it is my job to identify these gray areas and provide solutions in the form of classes, explanatory booklets and articles on the website if necessary, and in this unit we aim to provide centralised support for the staff who need it".

The procurement manager, R3C, explained that the project unit is in charge of controlling and delivering the provisions regarding technological changes, in particular in preparation for the set-up and running of the feed mill factory, which will bring some degree of freedom from the mainstream supply chain, "they are basically the people who say what you can do and what you must not do", the respondent commented on the role of management in adoption of technology, "the senior management have been proactive in making use of technology and being vocal about the benefits of using the new technologies, and I think this has made a difference and acted as an enabler".

The project team member, R4C, claimed that company's financial strength has been an enabler in providing support for the staff, as they have had to rely on their own resources, "there are opportunities for financial aid in support of modernisation and technology adoption for poultry farmers, which is provided by the government and ministry of agriculture (Jahade Keshavarzi) but the process is lengthy and may take a long time for approval and there is no guarantee that you will qualify for the grant; that's why we have

not even applied for it". The respondent claimed the project unit can function properly because of resources made available to it by all the managers,

> "to satisfy the requirements of a scientific and innovative approach, which costs both money and expertise, it has been agreed by all the managers to allocate time for those personnel that are needed to join the project unit because of their expertise, and therefore the project unit draws its resources from personnel of other sections of the farm as and when necessary".

Respondent R5C, the vet doctor, who was also in charge of the veterinary unit, confirmed that although the farm employs skilled poultry workers they still need to go through the farm's own certification training, "I tend to work with people who are technically aware of their duties, you may have the best systems in place but your system is as good as the people who are working on it".

The respondent claimed that different levels of perception have helped both the project unit and the staff to learn from each other, "there has been a bit of learning on both sides, sometimes people are unaware of '*why'* they have to do certain things and once they know why then they show more interest and start asking questions". The respondent explained that lack of proper control on imports of vaccines and feed supplements has made his job ever more difficult and he has had to come up with innovative and investigative ways with R3C to ensure they get the proper supplies,

> "I am working closely with R3C before entering into any contracts for supplies of supplements and vaccines, the market is infected with fake drugs, out-of-date vaccines and fake supplements; it is hard to believe. There are regulations and there are laws but the watchman is asleep, the presence of dealers in the supply chain and their power to dictate and control the market is jeopardising the future of the industry".

The respondent acknowledged the support from the management team, "the difficulties existing in the state of the supply chain is realised by the management and R3C and myself have their support in making sure we get the right stuff". Respondent R6C implied that there is a good understanding between the workers and the management, "when there

is a problem the important thing is to find the root of the problem and that is what the management is trying to do and this makes staff try and do things properly and trust the management". The respondent claimed that technology has been useful in filling up the gaps that have appeared in the supply market, "there is a question of trust for the products that are available in the supply chain, we basically have to use technology as a tool for uncovering impurities and be able to trust that what we get is genuine, before you could trust the people, now you have to establish that trust with technology, for instance by tracking the origins of the products or examining some random samples, but this is both costly and time-consuming and not always possible".

5.8.3 Modality of Norm

Respondent R1C, although in favour of the top-down approach as effective, also talked about the bottom-up approach as a way to support innovation, as reflected in the following comment, "the bottom-up approach is as important as the top-down approach for the realisation of innovative ideas, this is what we have not yet succeeded in implementing in our organisation".

The respondent confirmed that peer influence has been a factor in his approach towards the adoption of technology, "of course on the larger scale you seek to find out what has been the secret of others' success or where they have gone wrong, and I have always been on the lookout". Respondent R2C stated that there are incentives for technological improvements in terms of low interest rate finance, "there are low rate finance arrangements for buying machinery from the ministry of Jahade Kashevarzi (Agriculture) and some banks; whether you can get it or not is a different matter". According to R2C, peer influence (poultry community) has been quite decisive in the adoption of modern farming in recent years, but only adopted by a few, "there have been a large number of bankruptcies amongst poultry producers in recent years, of course there are many reasons for this but those with traditional farming methods have been amongst the first casualties".

Respondent R3C acknowledged that the expectation was that all the staff used the technologies that were available to them, "obviously it is expected of all the staff to make use of all the technologies that are made available to them, and support is also available for those who need it, this is the way forward and there is no other option".

The respondent additionally explained, “this is more so in the operational sense, where you cannot afford to make mistakes, that’s why there are monitoring mechanisms in place”. In terms of the top-down approach, the respondent viewed this approach as the right thing to do, “I think the top-down approach and hands-on monitoring has been the right decision, and motivational as well as practical”. The project team member, R4C, claimed that peer influence has been a valuable source of aspiration, “seeing others that are comfortable with using the technology up and down the farm is motivating as well as encouraging in following good practice”.

Respondent R5C, although in agreement with regulations, had mixed views, “there are a growing number of regulations regarding hygiene and preventative measures and other issues that are communicated from the relevant agricultural authorities regularly and are followed by health inspectors whose reports could be influenced occasionally, and there are our internal regulations which must be followed thoroughly and are not subject to any compromise”.

5.9 Cross Case Analysis, Case C

In this case study also, discussion and analysis follow the same pattern. First the significance of technological innovation is examined as respondents drew on their stocks of knowledge and through their interactions with others to construct meanings and signification. Then the elements of power and domination are examined and the final section explores the cultural norms and sanctions that may encourage or discourage the adoption of technology.

The analysis of the interactions between the participants by virtue of their interpretative scheme were enabling as well as constraining. Respondent R5C drew on his creativity in order to develop more attractive ways of communicating with other members of staff. Respondents R5C and R6C were able to articulate the reasons for their actions; this rationalisation of action and providing reasons for the action is what is referred to as ‘discursive consciousness’ by Giddens. The two respondents R2C and R5C, based on their stocks of knowledge, were able to adopt influential positions and were in control of their own areas of expertise. The interactions between members of staff provided meanings of signification. Respondent R2C claimed that other sector managers were not

serious in their response to his call for new technology projects, and this resulted in slowing down progress.

The senior management, in consultation with middle management, developed the technology strategy plan and a top-down approach of communication of the strategy plan had not been effective in reaching all the staff. Fear of change and lack of technical knowledge were cited as constraining factors (R5C, R6C).

On the subject of power and domination, the project manager was in charge of centralised allocative and authoritative resources, which imposed power and domination through centralised control. The lack of consultation on a wider scale (beyond the management level) had resulted in indifference to technology adoption. The relationship between members of staff (R5C, R6C) and the management was an enabler of technology adoption. The management support in terms of motivation and providing resources was confirmed by respondents. Management support and commitment is perceived to be a factor that can either enable or hamper the adoption of technology (Surry et al., 2005). Another important enabler was the financial strength of the farm (R4C).

On the subject of legitimation and sanctions, the case study had developed a technology strategy plan at the senior management level with a top-down approach. The strategy plan had received mixed reactions: those in favour of technology adoption showed enthusiasm (R1C, R2C, R5C, R6C) and there were others who offered verbal support but showed little effort in the adoption and diffusion process. The institution did not have any mechanism in place for considering bottom-up initiatives, which restricted the innovation process. This was in direct contradiction with the literature on innovation processes that suggests the need for open and responsive structures that allow for diffusion of innovation (Roffe, 2004).

There was evidence of cultural norms (halal) that influenced the adoption of technology (R2C, R5C, R3C), suggesting that the adoption of technology can help revive the social rule (halal) that is disappearing within the organisation and within the supply market, so in this sense the 'lack of trust' had become a motivational factor and an argument for adopting technology. Respondents perceived that technology may be able to restore the faded notion of trust in the poultry industry, which is embedded in the halal concept, by

removing possibilities for fraud and corruption. In general, the management had succeeded in creating an environment that supported good practice.

5.10 Case Study D

This plant is privately owned and specialises in intensive farming of broiler chickens, and in terms of supplies it is totally dependent on the current poultry supply chain. The farm conducts three to four grow-outs per year. The farm is semi-industrialised with some traditional methods of farming. Grow-out houses were equipped with enclosed watering systems and funnel ventilation. Each grow-out house traditionally houses a flock of between 18 to 20 thousand pieces of one-day-old broiler chicks. One of the achievements of the farm's management has been the reduction of the mortality rate over the years, which currently stands at about 10% to 12%. The farm has an in-house veterinarian. The farm had gone through transformation from being a traditional farm to a semi-modern farm in recent years. The farm's performance was dependent on the industry's supply chain behaviour. The management of the farm viewed technological innovations as vital for the existence of the farm. Technology-based directives had provided realistic solutions in reducing the rate of mortality in the farm by a large margin. Table 5.6 presents the roles and responsibilities of the participants in this case study.

Respondents	R1D	R2D	R3D	R4D
Role	Farm Manager	Assistant Farm Manager	Account Manager	Farm Supervisor
Main duties	Facilitating the production and market delivery of products by implementing processes and procedures	Responsible for getting the product out to market, keeping up-to-date with industry progression	Responsible for creating and implementing marketing programmes, working with vet doctor for quality assurances	Maintaining safe practices, maintaining all equipment on the farm. Good practice
Respondents	R5D	R6D		
Role	Veterinary Officer	Member of staff		
Main duties	Responsible for the health of the flock, vaccines, carrying out regular inspections	Interaction with both management and staff. Overseeing the procedural compliance		

Table 5.6: Participants in Case Study D

5.10.1 Modality of Interpretative Scheme

Respondent R1D was the farm manager, and described his role as being responsible for facilitating production and delivering the products to the market, and to some extent incorporating new technologies in the production system to improve efficiency and avoid potential problems. He stated, "we don't have a technology strategy plan documented in the organisation, but technology is the key factor in improving our efficiencies". The respondent continued,

> "on the production front things have to happen, targets should be met, for me these targets are quite clear, from the supply side I have costs to manage such as feed cost and chicks cost and these can be kept under control with technology".

The respondent however did not perceive himself as a technical person, “I like technology, but find it a struggle especially when it comes to computer-controlled stuff, but technology should be viewed as a resource that can be used as a tool to make whatever it is you are doing better”. The respondent was guided in his actions by drawing on two stocks of knowledge, firstly his role as the manager to make a difference, and secondly his view on technology as an enabling factor.

The second respondent, R2D, was the assistant manager of the farm and viewed himself as a technical person, “I am quite good with technical stuff and I think I am an innovator by nature”. The respondent stated that the targets he was given were decided already and he played no part in decision-making, “I needed to work out how to do things to meet the targets, which seemed unachievable at first”. The respondent thought the big challenge for him was to overcome the fear of change. He expressed this by saying “when you try something new the not knowing factor and uncertainty is the fearful part”. The respondent relied on management support for change, “in a traditional set-up it is harder to introduce changes, but when you have R1D pushing for innovative solutions it is easier”.

The respondent drew on his stocks of knowledge such as interest and ability to use technology in guiding his actions. The account manager, R3D, was required to manage the business relationship with the suppliers. The respondent perceived his role as extremely difficult without the support of his team in providing him with up-to-date information, as there are many external drivers undermining the supply market,

> “I am not in a position to close a deal for say the next six months, as prices change dramatically and unexpectedly very frequently and without a clever team behind you, you are likely to make wrong decisions and cause the firm a lot of hardship”.

The respondent pointed out the governing culture of the supply chain, “the certainty has been drained out of the supply market by the dealers that dictate the prices and control the poultry market; it is not the producers and it is not the consumers, it’s a group of well-connected dealers that determine the prices in the poultry industry”. The respondent asserted, “under such circumstances the only innovative action is to break free from these dealers, that are present in every aspect of the supply chain”.

Respondent R4D was the farm's supervisor, with an agricultural engineering background and experience of working in both modern and traditional plants. He claimed his contribution came through his past experience in providing practical solutions to reducing the mortality rate of the flocks. The respondent claimed that he worked closely with R2D when technology-related matters were involved,

> "I played a consultative role on the one hand and an implementer on the other; it is important to see things from the correct perspectives, you cannot expect your flock to gain weight quickly without giving them the right amount of protein and supplements, you cannot get the right amount of protein from contaminated feed or fake supplements, which are freely available in the supply market".

The respondent claimed that they have been able to get some of the traditional practices changed,

> "although the work may seem similar to what has been going on for ever, the innovation is embedded in the guidelines of the new model of doing things, it seems to me that the chaotic state of the industry is pushing farmers to become more self-reliant and innovative".

The respondent relied on his experience and knowledge to guide his actions. Respondent R5D claimed that there was an organisational drive towards adoption of technology, "the managers have introduced very specific guidelines based on their findings from more advanced farming practices". The veterinary officer stated that to optimise productivity there has to be an educational plan,

> "we need to have information to be able to survive. I need to be able to track the source of the medications and antibiotics and feed ingredients that I am using and this is facilitated by having the right technology; information technology has taught us that overcrowding of the chickens is counterproductive".

5.10.2 Modality of Facility

Respondent R1D stated that the support and resources available to the management are decisive factors in terms of getting staff on board,

> "of course, the more resources are available to you, you have more tools at your disposal to communicate your message and get things done, but the fact is we have limited resources in terms of educating and demonstrating the use of technology to staff members, but in order to make up for the lack of this enabler we have designed our own rules and regulations which we guard religiously, one outbreak of disease due to negligence, too many mortalities due to mis-handling are issues that we cannot afford to have".

The respondent acknowledged that there is a good understanding between the management team and staff, as the management conduct a transparent policy and tend to keep everyone in the picture of what is happening. The assistant manager, R2D, confirmed that there has been a change in practice in terms of communicating new ideas,

> "we organise more meetings and produce more informative materials, for us technology is a tool to survive and it is not something of a luxury, quite to the contrary, it is a tool you cannot live without; everyone knows how the poultry industry is turbulent and you have got to be clever to survive".

The respondent stated that the support of senior managers was important in the adoption of new techniques, and the relationship was perceived to be innovative in its approach, "it is important to have the support of the senior management, since there is one less obstacle to overcome and it also makes a difference in your interactions with others". The respondent explained that one of his resources in gathering information is the internet and poultry websites, "some of the poultry websites are really helpful in spreading the news, for instance if there is an outbreak in the part of the country that your supplier is from then you can take action before it's too late'.

The respondent stated that managerial support has played an important role for him,

> "the good thing is that I have a lot of interactions with the senior managers and if there is any technology that would make my work more effective I am sure that it will be authorised and a budget for it will be made available, our supply chain suffers from severe defects and that has taken and is taking its toll on the farmers, there is uncertainty all over the supply chain and unfortunately the burden is on us

to reduce these uncertainties as much as we can. The ministry of agriculture (Jahade Keshavarzi) has been trying for years to solve the problems but year after year the same cycle is repeated, that's why with the aid of technology hopefully we can see beyond the labels and lies to a degree and avoid falling into traps".

For respondent R4D, the detailed technically-drafted new guidelines for managing flocks were perceived to be an asset. He commented that "this is a huge step forward, when everything else seems to be working against you and you manage to reduce the flock's mortality rate it is nothing short of a miracle". The respondent acknowledged that the management is very keen and supportive of innovative ideas that improve the farm's performance. He perceived the farm manager's supportive attitude as a motivator that encourages the rest of the staff and management to be proactive. Respondent R5D confirmed that the communication between management and staff has been very fluid, "the senior manager has an open door policy and has motivated staff in believing that they are part of an organic organisation that is moving forward through innovative ideas and solving problems, and not through a command and control type of relationship".

The veterinarian doctor explained that their success has been due to two different approaches, "showing understanding when there was a lack of knowledge and being very strict in demanding compliance with our guidelines and directives".

The respondent expressed the opinion that in terms of halal, the current state of the supply chain dictates how the animals are treated, "talking about this issue in general, the farmer that is faced with losing all of his investment due to the instability of the poultry market, he will cross the guideline limits set by the authorities for the level of antibiotics, and even extends the duration of this before the birds are taken to slaughterhouses; the consumers think they are just buying chicken but they are in fact buying chicken that is filled with medication, antibiotics and other stuff not suitable for animal feed, and therefore not suitable for human consumption. Is this Islamic? I don't think so".

5.10.3 Modality of Norm

Respondent R1D stated that from different farming authorities such as Ministry of Agriculture (Jahade Keshavarzi) and provincial poultry associations, there existed a large number of directives for poultry producers on what to do and what not to do in terms of

hygiene and veterinary issues, which required compliance from the producers. In the respondent's view, these directives and regulations, although informative, did little to advance good practice,

> "what matters to me most is what we have objectively and scientifically derived for good practice within the housings, and in relation to the animal treatment and respect we do not do things because we are told by so and so, we do things because they are the right things to do".

The state of the supply chain was perceived to be untenable according to the assistant manager, R2D,

> "the existing problems of the supply chain either make you to some extent or break you; in the face of difficulties that we are facing of unstable and rising prices of feed and other stuff from the supply market we have had to become more efficient and innovative on our side but if you are told by the authorities to keep your prices down or they will make you to keep your prices down by import of chicken meats from other countries, then no matter how innovative you are, you will not be able to stay in business, as simple as that".

Staying in business was perceived as success and as a main driver for respondent R3D, "there is a desire to be successful in the face of adversity from the top management and that is passed on to all of us and we all share the same interest". "We have our own directives and guidelines of how to do things" claimed respondent R4D, "although there are guidelines, but there is also an implicit pressure to provide innovative solutions".

This respondent perceived his role as being central, as he had interactions with a large group of people on a daily basis in which he needed to show them how they could use the technology in their related activities. The respondent claimed that R1D had been instrumental in taking the farm forward, "he is one of the best managers I have come across, he knows what he wants and he is not corrupt; that's why everyone respects him and we try to do our best".

5.11 Cross Case Analysis, Case D

To make sense and construct meanings from the individual's own actions and that of others, respondents have to draw on interpretative schemes. How the actors make sense of the technology is one of the critical factors in the adoption or rejection of technology. In this case study, the senior manager was the drive behind the motivation for technology adoption, and all the respondents acknowledged this fact. There was no strategy plan drafted for this plant, but there were set targets that had to be met (R2D). The respondents were aware that their actions could be a deal-breaker. On the effect of strong managerial personality, Thieme et al. (2003) argue that the better the senior management, the more likely it is that there will be close cooperation and cross-functional activities amongst staff members. This fact was evident in the comments made by R2D, R3D, and R4D. The assistant manager (R2D) drew on the support from the senior manager to challenge the traditional practices; such support from the senior management can result in change (Henry, 2001). It is evident that individuals used their position to draw upon interpretative schemes, which Giddens refers to as social positioning. According to Giddens (1984), in social positioning an actor has been given a definite identity within a social group.

On the subject of power and domination, the control was with the senior management to shape the direction of developments by setting operational targets. The respondents perceived that they were able to insert their influence by having a transparent policy. The respondents perceived the guidelines for achieving the targets as innovative and an asset (R4D). Flexibility and ease of communication was another enabler in raising the staff's confidence and gaining their trust (R5D, R6D). In this case study, there was evidence that interactions between different sectors were harmonious and there existed a sense of competition in proposing new innovative ideas.

There was a technical guideline imposed on the operations staff, which was considered as an asset. There was flexibility and an open door policy on innovative ideas for the guidelines, and at the same time very harsh conformance to the guidelines was required from all without exceptions. There were various sanctions for non-conformers, such as peer pressure and reporting to higher managers, which seemed to be an effective policy. Giddens (1984) states that these kinds of sanctions on conformance need some sort of agreement from those who are subject to them. The directives from the local authorities were not perceived as important, but the internal guidelines were treated seriously.

5.12 Case study E

Case study E is a layer chicken farm, privately owned and situated in a mountainous area. It sits back, well away from the main road. The farm occupies rather a large part of the side of the mountain. The farm is part of a chain of poultry plants and this unit specializes in layer breeders. What is significant about this plant is the fact that it has been free of any outbreaks of disease for over a decade; it is separated from the neighbouring area by tall trees. The farm benefits from modern technologies and the majority of the employees, except a few managers, are provided with accommodation units close to the farm. At the entrance of the farm there is a designated disinfection area for trucks. The farm has been given an award for ingenuity in design. Technology and innovation play an important role in the farm's management philosophy. The farm's manager invented a cost-effective and highly efficient heating system that was copied by many other local farmers. Table 5.7 presents a summary of the roles and responsibilities of the participants in case study E.

Respondents	R1E	R2E	R3E	R4E
Role	Farm Manager	Assistant Farm Manager	Environmental Manager	Farm Supervisor
Main duties	Facilitating the production and market delivery of products by controlling processes and procedures	Responsible for daily activities of the farm, liaising with management and other personnel	Responsible for environmental issues, state of housings and waste disposal issues	Maintaining safe practices, supervising the workforce
Respondents	R5E	R6E		
Role	Veterinary Officer	Farm Maintenance Manager		
Main duties	Responsible for the health of the flock, vaccination supervision, carrying out regular inspections	Maintaining and keeping facilities of the farm up to date.		

Table 5.7: Participants in Case Study E

5.11.1 Modality of Interpretative Scheme

Respondent R1E was the farm manager, with over thirty years of experience in poultry farming. He was involved in various poultry projects, including building a new broiler parent farm. He is considered to be an expert in this field. The respondent was asked about his success in managing a healthy farm, free from disease.

> "well, one of the biggest fears of a farmer is the possibility of disease, where you can lose all your flock in a very short time, which is bad for the farmer, bad for the environment and bad for the insurance company, that is if the farmer is insured and the insurance company pays up, so if you can think of ways to reduce this threat then you have done a whole lot of people a big favour".

The respondent elaborated further by acknowledging that leading by example is the best role model that management can adopt. The respondent confirmed that he has personally been involved in all aspects of the farm activity and stated, "I can almost visualise the situation when they report a problem or when someone has come up with a new idea".

On the question of technology strategy planning the respondent claimed,

> "yes, we do have a strategy and the one objective of this strategy is to be innovative all the time; we do this by attending poultry exhibitions inside the country and in European countries and without a doubt we have benefited from them greatly, I send different people to different exhibitions and then in a meeting we study their reports so everyone will have a chance to get to know what is going on in the industry and also to learn about what is expected of them when they attend an exhibition or training session".

According to the respondent, a successful business is only successful because of the commitment of its staff; without commitment it will be difficult to move forward,

> "I want commitment from my staff in the same way that I am also committed to them, the staff that are using staff accommodation have the same facilities that I use at home with the same standard".

Respondent R2E was the farm's assistant manager and believed that engaging with technology was an important part of their work,

> "we cannot run the farm without the technology, it has become an inseparable part of how you do things and we understand its importance and we can see how other countries do things and we try to learn from whoever can teach us something".

The communication channel used a top-down approach, with consultations. The respondent believed that the management respected everyone's opinion by adopting a policy of drafting a proposal and then consulting everyone for their input before reaching a decision on matters of development. The respondent called it participation first and engagement later.

Respondent R3E was the environmental manager for the farm, and argued that the creation of his position has been as the result of his farm commitment to technology,

> "the studies have shown that we have to have respect for our environment if there is going to be a sustainable existence, our technology strategy is not only about the poultry farming but it is also about us and the environment, this is in accordance with Islam and Islamic teachings as land is not only for us to treat it as we like. I never knew before that our first Imam, Hazrate Ali, has said that according to Islam we are not allowed to pollute the air and water, and since I have learned about this I think my job is very important, a job that did not exist a few years ago, if we don't change by progress with time the change may come in an unpleasant way, it is our policy to provide some free compost to the local agricultural farmers; the result has been unbelievable, sometimes if they have a problem they come to us searching for an answer".

Respondent R4E was the personnel supervisor and believed in long-term employment as a sign of stability and loyalty to the strategy plan, claiming, "our employees have been here for a long time, because they feel they belong here, other farms have tried many times to entice our workers, years ago when I told some of the new workers that you have to have respect for the chickens they laughed at me". The respondent stated that in terms of perception of technology, the workers see themselves as smaller than technology, and

lack of knowledge frightens them, but once they become aware of the facts then they embrace change. The vet doctor explained,

> "yes, we have not been hit by disease but this has not come about just like that, we have a very stringent regime when it comes to hygiene and environmental issues and this has come about by passing on the acquired knowledge, experience and of course by being prepared to bear the financial cost".

This respondent drew on his understanding of religion to observe the relationship between technology and halal,

> "well, if technology is teaching me and asking me to respect animals this is also what my religion is telling me and has made it my duty to respect animals, I don't see any contradiction between them, what is forgotten or misunderstood is the religion itself, people take pride in the fact that their earnings are halal, the question is, is it really halal when you sell out of date vaccines, fraudulent supplements and also allowing such activities to take place, it is a failure on the part of authorities as well, the size of this practice is threatening the whole industry, yes we try to keep disease at bay in our farm by keeping far far away from un-Islamic behaviours too".

Respondent R6E claimed, "technology has made my job much more interesting, I am happy that what I once saw on TV in a farm in another country is now in our farm and that makes me proud".

5.11.2 Modality of Facility

Respondent R1E concentrated on the slow adopters and how they have tried to provide a solution in their strategy plan to address this problem. He stated,

> "the big challenge for me, which took me a while to figure out, was what was at the core of not looking forward to change amongst some members of staff, then I made it part of the strategy to address the slow adopters",

The respondent pointed out the support that has been provided to the staff, "the support has been designed to be comprehensive and educational by addressing the whys and hows

of things". The respondent however discussed the effects of external factors on poultry production and compared it to a boxing game, then carried on to suggest,

> "the supply market, instead of being our partner, has become our competitor; the price control and interventions of the authorities are other disabling factors, the breakdown of trust in goods' worthiness as well as people's commitment (I have a bundle of unpaid cheques) has affected the industry in many ways, so in order to survive and not compromise on your ethics you have to become innovative with new ideas to keep ahead of the game and our staff are aware of these facts as well, and in this game they don't want to come out losers".

Respondent R2E explained that, "the road to acceptance and innovation starts with education and ends with education, at first you will find people who are not as receptive as others but with a bit of patience they also start to show interest, which is rewarding for them and us as trainers". Respondent R3E expressed the importance of the right kind of training in the adoption rate, as he believed their experience of teaching by using pictures and use of animations as a method of focusing on the right practice has been quite successful, "our success in the adoption of technology is due to the fact of pictorially showing examples of different practices in other farms". Respondent R4E claimed, "our Islamic culture has been an enabler of adoption of technology in some ways; when people know that it is according to the Quran to be kind to animals they even take extra care when looking after them".

5.11.3 Modality of Norm

Respondent R1E explained, "yes we have directives but alongside directives we also have educational programmes about the directives, we don't believe that directives on their own will achieve a lot for you; on the contrary directives alone could even be counterproductive".

The respondent claimed that the Islamic culture creates a sense of duty that is unparalleled in any other discipline,

> "what is unfortunate is the fact that I as a Muslim have learnt to do certain rituals without knowing the true meaning of it and that's why in our daily activities we

> don't actually call upon these resources to guide our actions, there is a culture of talk and no action when it comes to religious matters and this is very evident in our everyday life, widespread fraud of any type that you can think of exists in the supply chain".

Respondent R2E claimed, "the design and delivery of our trainings are unique, that is why we have been successful in changing people's practice; it is a question of making people resourceful". Respondent R4E, who had been in his position for over 25 years, claimed, "once people know what is the right way of doing things and learn that they can actually have an influence on how things are done then they start to think about how they can make a difference, the sanctions here in most cases are the people themselves". The vet officer, R5E, claimed that, "for instance we take bio security very seriously here and it is not only me as the person responsible that has to worry that everything is done properly, I am sure that all the rest of the personnel also feel the same way as I do, and if one makes a mistake it will not take long before it gets spotted and acted upon by someone else without looking for blaming someone or looking for reward; this is a valuable thing that is rarely found".

5.12 Cross-Case Analysis, Case E

This case study presented two main structures of signification in the interpretative schemes that respondents drew upon in their interactions. First, the social interaction between the management and staff in facilitating the technology transfer formed the first structure. The second structure was through the strategy alongside consultations; these were the structures of significations for the participants. All the respondents without exception were able to describe their actions by drawing on the farm's strategic aims and objectives of adoption of technology. The respondents demonstrated consistency in their meanings of signification in their interactions. The management provided a common sense of purpose through the technology strategy for the respondents to help them explain and rationalise their actions.

All the respondents perceived the technology to be aligned with their roles, and the perception of changing their practice did not undermine their position when facing uncertain situations. They therefore remained in their comfort zones and continued with their routine patterns of behaviour. This is what Giddens refers to as ontological security

as the "confidence or trust that the natural and social worlds are as they appear to be, including the basic existential parameters of self and social identity" (Giddens, 1984:375).

On the concept of power and domination, respondent R1E was recognised as an established and experienced manager with a good track record in the industry, which legitimised his position within the farm. The farm's performance in remaining disease-free for a substantial period of time was due to the authoritative structures of domination brought about by R1E.

On the subject of modality of norm with the two components of legitimation and sanctions, the design of directives, which were accompanied by a series of consultations as well as trainings made the adoption of technology perceived as necessary. The role of Islamic values in general, and the concept of halal in particular, were claimed by R3E, R1E, and R5E to have been instrumental in acting as both legitimising and sanctioning factors.

5.13 Chapter Summary

This chapter presented a profile of each case study, the role and positions of the participants, and the views held by the respondents, focusing on the stocks of knowledge in order to make sense and construct meanings of signification. Similarly, the chapter also demonstrated the concept of power and domination in the interactions between the respondents. The findings confirmed the elements of power and domination in the form of directives and mild sanctions in relation to authoritative resources. The respondents also demonstrated in a dialectical form the ability to influence and make a difference to the state of the affairs, since they also had access to allocative and authoritative resources. The findings from the interviews were presented using Giddens' duality of structure for each case project, and a cross-case analysis with sub-themes that had emerged from the data analysis was presented. The interviews highlighted the difficulties and various organisational problems of the Iranian poultry industry. In the next chapter, the findings from data analysis will be discussed. The final level of analysis of the themes is cross-examined with each of the five cases for similarities and differences, as recommended by

Miles and Huberman (1994), which will be used to identify factors that are most likely to influence the adoption and diffusion of technology for poultry farming in Iran.

CHAPTER SIX: Discussion

6.1 Introduction

The aim of this chapter is to discuss, compare and contrast each of the themes and sub themes that have emerged from the data analysis and discuss and elaborate on them in the form of a number of propositions. Guiding interaction are structural properties (institutionalised features), the shared or redundant knowledge of how one interacts within the social system. The propositions will be developed in relation to the literature previously discussed to propose a model to address the research question posed by this project: "*How does structure enable or constrain the adoption of technology within the construct of halal concept in poultry production in Iran?"*

6.2 Analysis and Discussion Case Study A

A number of themes have been identified from within the case analyses. These represent the concurrence of views across the eight participants regarding the three modalities: 1) interpretative scheme (communication of meaning), 2) facility (used in the excise of power relations), 3) norm (applied to the sanction of social behaviour). The cross participant analysis shows a difference in the sub-themes that have been identified by the respondents. There are a number of sub-themes that have been identified as enablers for the adoption of technology. These are: communication, supportive management, technical support and training, resources and strategy.

6.2.1 Signification and Communication

This section examines the interpretative schemes used in the communication of meaning that respondents in case (A) drew upon to make sense of the adoption of technology. In the interpretative schemes, communication is the general element of interaction and this interaction forms the basis for how individuals construct meanings (Giddens, 1984). Three key areas have been identified in the technology diffusion literature that can be linked to Giddens' interpretative scheme. The influence of top-down communication has been proposed as an important factor in the diffusion of technology (Lisewski, 2004). Local communities and near peers can also have an important bearing on the decision of adoption (Eynon, 2005). Individuals also draw on psychological (Maguire, 2005) and

pragmatic motivations (Moser, 2007). These are discussed in relation to the findings from this case study.

In terms of technology diffusion, studies have identified the top down approach, as being common when senior management develops a strategy to be communicated through the organisation with the expectation that it will bring about organisational change (Salmon, 2005). The findings from the case study show that the Chief Executive Officer (CEO) of the company (R1A) developed the technology strategy. The technology strategy was in response to the external pressures, such as supply chain inability to provide standard supplies (R1A, R2A, R5A, R8A). The development of the technology plan was CEO's responsibility in which limited consultation with senior management had taken place (R2A, R3A, R4A, R5A). The other personnel were not consulted during the development stages of the strategy and there were no mechanisms in place for effective propagation of the strategy plan to the rest of the staff (R2A, R3A). In terms of Giddens's concept of signification, which relates to how individuals produce meanings of the structure through communication, the respondents were in agreement about the relevance of the strategy plan. They presented a number of reasons why it was necessary to have a strategy plan and although not all were aware of the details of the plan (R6A, R8A) there was a positive perception about technology, and it was perceived, as having a strategy plan for technological improvements was important (R4A, R5A, R6A, R7A, R8A).

In Giddens' framework, interpretative schemes relate to stocks of knowledge that agents draw upon in the production of interaction. The analysis shows that the participants drew on their work experience knowledge to justify their actions in respect of why and how they adopt technology. The motivations included: psychological motivation, such as "this is the way forward" (R2A), perceived usefulness (R5A) and pragmatic motivations such as being the right thing to do (R4A, R7A, R5A, R2A). They legitimised their actions by their own experiences and understanding of the needs of the poultry industry. At the higher level of management (R1A, R2A) the reason for their actions was based on external pressures; from the supply market.

The analysis showed that the local context was a significant factor in decisions for adoption of technology. The majority of respondents expressed concerns about losing trust in goods from the supply market. Giddens (1984) argues that the force underlying

individual motivation is psychological anxiety, which in this case is the knowledge of threats from a non-performing supply market. This anxiety then acts as a motivator to mitigate the need that causes anxiety. The respondents sought alternatives such as being self sufficient and not dependent on the external supply market to reduce the cause of anxiety. It can also be argued that not being able to trust the supply chain, which is a fundamental Islamic value and a halal attribute could be another source for psychological anxiety. In terms of legitimisation not being able to trust the supply market had legitimised the use of technology. Respondents drew upon the rules and normative practices governing legitimate social practices within their social group (Clegg et al, 2003). Saunders (1998) argues that it is these social practices embedded within the organisational culture, which influence the use of technology rather than the technology itself. From an agency perspective, norms are organisational conventions or rules governing legitimate conduct and the adoption of technology "does not occur blindly but is guided by the application of normative sanctions, expressed through the cultural norms and sustained through rituals, and tradition" (Orlikowski, 1991:10).

6.2.2 Power and Domination

According to Giddens (1984:169) "structure is always both enabling and constraining, in virtue of the inherent relation between structure and agency (and agency and power)". The concept of power in Giddens's duality of structure is closely linked with two types of resources. Allocative resources refer to "transformative capacity generating command over goods and materials" and authoritative resources, which involves "transformative capacity generating commands over people or actors" (Giddens, 1984:258). These resources focus on the components of power that individuals use to affect others (Rose, 1998). The analysis of the case study shows that the domination of the resources occurs through the control of training and support for the staff. This has resulted in the adoption of more inclusive approaches to engage the staff, such as bespoke training programmes (R3A, R4A). There were varying degrees of interactions with allocative resources; there was more interaction and engagement when the allocative resource was more closely matched with the individual needs and requirements (R4A, R5A, R6A). In terms of authoritative resources in this case most participants were in favour of the top down approach (R2A, R4A). In relation to the concept of power in Giddens's framework the resources "are media through which power is exercised, as a routine element of the instantiation of conduct in social reproduction" (Giddens, 1984:15) the theme emerging

amongst all respondents was the need for more consultation (R2A, R3A, R5A) along with bespoke training sessions (R3A, R5A).

6.2.3 Legitimation and Sanctions

On the two components of legitimation and sanction for most of the staff the key influence was their relationship with their line manager. The role of middle management was perceived to be an important enabler and influential in diffusion and in the adoption of technology (R4A, R5A, R6A, R7A). Another enabling factor in terms of legitimation was the sharing of practice with other members of staff who had been satisfied and successfully adopted the new technology to provide a source of motivation for other respondents. In terms of sanctions limited knowledge of halal and animal welfare was the prevalent theme amongst the respondents (R3A, R4A). The potential adopters were keen on better and more direct training and support and using the experience of others outside the organisation. Top down directives seemed to have been accepted and were effective.

The analysis of the case study reveals that external conditions had, to a large degree, been responsible for the 'preventive innovation' that takes place in situations when there is a need to prevent something negative from taking place in the future. The social interaction and sharing practices played an important role in the opinion shaping of the staff. The farm management provided the 'how-to-knowledge', which is highly important in the adoption process (Rogers, 2003). The management made provisions in the strategy plan for the local managers to voice their concerns and make additions according to their needs and requirements, which in Giddens' terms refers to the dialectic of control.

6.3 Case Study B

6.3.1 Signification and Communication

According to Rogers (1995) in terms of signification, the communication of an innovation is an important factor in shaping the levels of adoption. In terms of diffusion, communication is the "process by which participants create and share information with one another in order to reach a mutual understanding" (Rogers, 2003:18). In this case study however, the decision to have a technology strategy plan was reached in a way that Rogers (2003) calls 'authority innovation', whereby all the discussions for the development of strategy plan had taken place between the CEO and the farm manager

(R1B, R2B), and the technological development policy was drafted. There were no mechanisms in place for consultation or feedback with the rest of the staff. The farm adopted a unique bespoke approach and called it a blended technological approach, which was driven by the perception that innovation will make improvements. The greater is the perception of the relative advantage of an innovation, the faster is the rate of adoption (Rogers, 1995). The management-imposed strategy did not have an adverse effect on the adoption of technology as evident by comments from respondents (R2B, R3B, R4B, R5B). The purpose of a blended technology approach was to make the technology transfer more consistent and compatible with the previous system wherever possible; R5B perceived the new approach to be a necessity, as the innovation was a factor of sustainability, and hence made the adoption easier. The management and staff were in agreement that an adequate level of training and support was provided (R3B, R5B, R8B).

The attitude of the management team and willingness of the respondents in taking up new methods exhibited the characteristics of innovators and early adopters. R7B, R4B and R5B were confident in their ability to adopt the technology, and believed the blended strategy offers consistency in moving from the old to the new in a measured way. In structuration theory agents have a degree of autonomy in their actions (power to do otherwise) and agency refers to how agents decide to shape their relationships with others, and structure refers to the rules and resources used to govern the scope of individuals agency, in this case study there was agreement between what was perceived as relevant by the management (R1B, R2B) and members of staff, who were the prime adopters of the blended technology (R5B, R7B). This is what Pozzebon (2004:251) refers to as 'instantiation of each other'.

6.3.2 Power and Domination

Structuration theory refers to resources as "media through which power is exercised, as a routine element of the instantiation of conduct in social reproduction" (Giddens, 1984:15). Domination depends on mobilisation of two types of resources: allocative and authoritative. In this case study training was coordinated through one central system. The support was available to all members of staff and if the expertise was not available in the training centre, experts were brought in from other relevant sectors of the farm. Authoritative resources refer to types of transformative capacity generating command over individuals (Giddens, 1984). In this case study the engineering unit seemed to be in

possession of power and control as the centre in control of both resources. According to Rogers (2003) this may lead to less innovation as a limited number of ideas are considered by a few strong managers. But the farm seemed to have found a solution by designing the blended technology, which encouraged interactions and engagement of a wider audience at the operational level (R5B, R7B). This was evident in the blended technology strategy that required modifications of new technology to meet the farm's requirements.

In reflecting on the structuration between agency and structure, it was clear that there was a harmony between what was happening at the organisational level and what was happening at the individual level. The management and staff perceived that training and support was adequate and effectively coordinated. Rogers (2003) defines a social system as the engagement of interrelated units, like individuals or informal groups, and argues that the rate of innovation adoption is dependent on the formation of these social systems. In this case study the social interactions was evident as in the comments of (R2B, R4B, R5B) in interacting with people from other sectors. The findings from this case study confirmed Rogers (2003) statement that the rate of innovation adoption is dependent on the social systems.

6.3.3 Legitimation and Sanctions

Depending on the contexts, social actors draw upon different legitimate rules and normative practices for legitimation and sanctions. The staff responded positively to the sanction of meeting requirements of the blended technology strategy and top-down approach was perceived as an effective channel of communications (R3B, R4B, R8B). Halal as an Islamic dictum was claimed to had been compromised (R4B, R5B) due to external pressures by practice of supplying out of date and fake vaccines. It was evident from the findings that staff members were encouraged to work ethically and management succeeded, to some extent, in promoting the adoption of technology based on the local requirements (R1B, R2B).

6.4 Case Study C

6.4.1 Signification and Communication

The analysis of the interviews in this case study showed that the interpretative scheme between the respondents was both enabling and constraining. Respondent R5C drew on

his past experience in order to develop more attractive ways of communicating with other members of staff, which helped to guide his actions in uncertain and ambiguous situations. Giddens refers to 'discursive consciousness' as "What actors are able to say, or to give verbal expression to, about social conditions, including especially the conditions of their own actions" (Giddens, 1984:374). Respondents R5C and R6C were able to articulate the reasons for their actions and this rationalisation provided reasons for their action and to what is referred to as 'discursive consciousness'. The two respondents R2C and R5C by virtue of their interpretative schemes (stocks of knowledge) were able to adopt influential positions and were in control of their own areas of expertise. The meanings of signification were established through the interactions between members of staff. The respondent R2C was critical of the lack of corporation from other managers, who were not serious in their responses to his call for sharing their resources. Fear of change and lack of technical knowledge were cited as constraining factors (R5C, R6C).

6.4.2 Power and Domination

On the subject of power and domination the project manager was in charge of a centralised allocative and authoritative resources that imposed power and domination through centralised control. Giddens (1979:100) argues that the actual materiality of resources is not significant, but rather, the "capabilities or capacities of agents to command either allocative or authoritative resources". The lack of consultation on a wider scale (beyond the management level), and a top-down approach had resulted in an indifference to the technology adoption (R4C). The senior management support and commitment was perceived to be an enabling factor (R2C, R3C). According to Surrey et al (2005) management support is perceived, as an important factor that can enable or hinder the adoption of technology. The relationship between members of staff (R3C, R5C, R6C) was an enabler of technology adoption. Another important enabler was the financial strength of the farm, which saved time by not relying on external funding (R4C).

6.4.3 Legitimation and Sanctions

The communication of meaning, the operation of power relations, and the enactment of normative sanctions occur simultaneously and in an integrated fashion in social practices and interaction. Giddens (1984) argues that actors draw upon modality of norm for the sanction of social behaviour. This case study had a technology strategy plan developed by senior management, which was communicated by top-down approach. The strategy plan

had received mix reactions; those in favour of technology adoption showed enthusiasm (R2C, R5C, R6C, R1C) and there were others who offered verbal support but showed little effort in the adoption and diffusion process. The institution did not have any mechanism in place for considering bottom up initiatives, which restricted the innovation process. This was contradiction with the literature on innovation processes that suggests the need for an open and responsive structure that allow for diffusion of innovation (Roffe, 2004).

There was evidence of cultural norms that influenced the adoption of technology. Trust building is one of the applications of halal in halal supply chain (Tieman, 2011). There was a perception amongst the respondents (R2C, R5C, R3C) that in the absence of trust in the supply market, technology was adopted to reduce the degree of mistrust of the supply chain. In this sense halal (inherently good) as a value emerges out of the very way in which figurations of relationships are patterned and operate. Halal encourages good practice and opposes fraud and corruption (Jordac, 2010). Thomson (2001) states that trust is one of the foundations of successful collaborations. In general, management had succeeded in creating an environment that supported good practice (R5C). Giddens refers to institutionalised features as structural properties of the social system, giving 'solidity' across time and space (Giddens, 1984:24). From the findings of this case study it is evident that respondents perception of poultry supply chain was that it did not include halal as structural property.

6.5 Case Study D

6.5.1 Signification and Communication

In this case study respondents drew on interpretative schemes to make sense of actors' own actions and the actions of others.). It is evident that individuals used their position to draw upon interpretative schemes, which Giddens refers to as social positioning. According to Giddens (1984) when an actor has been given a definite identity within a social group "the social positions are constituted structurally as specific intersections of signification, domination and legitimation which relates to the typification of agents" (Giddens, 1984:83). At the structural level the senior manager was the drive behind the motivation for the technology adoption; a fact acknowledged by all the respondents. Although, there was no strategy plan drafted for this farm, but there were set targets that

had to be met (R2D). The respondents were aware that their actions were existential for the farm. On the effect of strong managerial personality, Thieme et al (2003) argue that the greater the senior management the more likely that there will be close cooperation and cross-functional activities amongst staff members. This fact was evident in the comments made by a number of respondents (R2D, R3D, R4D). The assistant manager (R2D) drew on support from the senior manager to challenge and replace the traditional practices in the farm and this type of support from senior management resulted in change (Henry, 2001).

6.5.2 Power and Domination

Senior managers had power and domination control and used it to shape the direction of developments by setting operational targets. The respondents perceived that they were able to exert their influence through the implementation of a transparent policy. Respondent R2D draw on his stocks of knowledge of technical understanding in guiding his actions. The respondents perceived the guidelines for achieving the set targets as innovative and an asset (R4D, R2D). Studies have shown that communication at team level (R3D) helped in making sense of technology and providing psychological support (Mason, 2003; Oliver, 2005) Flexibility, such as open door policy and ease of communication was another enabler that helped to raise the confidence of staff members, hence reinforcing their trust (R5D, R6D). In this case study there was evidence that interactions between different sectors were harmonious and there existed a sense of competition in proposing new innovative ideas (R3D, R4D, R2D).

6.5.3 Legitimation and Sanctions

Giddens (1984) states that power can be a source of constraint and a means of getting things done. There was a technical guideline that provided a rigid and standardised approach imposed on the rest of the staff, which was perceived as an asset. In this case study there was flexibility and an open door policy on the innovative ideas and for developing guidelines and but, at the same time, conformance to the guidelines was required from all without exception; there were various sanctions for non-conformers such as peer pressure and reporting to higher managers, which seemed an effective policy. Giddens (1984) states that these kinds of sanctions on conformance need some sort of agreement from those who are subject to them. The use of sanctions was justified in order to allow for sustainability and it was argued that uncertainty of the supply market and

inability of the farmers to pass on the actual cost to the consumers had left no room for complacency (R1D).

6.6 Case Study E

6.6.1 Signification and Communication

This case study presented two main structures of signification in the interpretative schemes that respondents drew upon in their interactions. The interaction between the management, in facilitating technology transfer, and members of staff formed the first structure. The second structure was evident through the technology strategy plan alongside consultations; these were the structures of significations for the participants. All the respondents without exception were able to describe their actions by drawing on the farm's strategic aims and objectives of adoption of technology. The respondents demonstrated consistency in their meanings of signification in their interactions. The management provided a common sense of purpose through the technology strategy for the respondents to help them explain and rationalise their actions.

All the respondents perceived the technology to be aligned with their roles and the perception of changing their practice did not undermine their position by facing uncertain situations, and they therefore remained in their comfort zones and continued with their routine patterns of behaviour. Giddens (1984) describes this as 'ontological security' where through the experience of positive and stable emotions, chaos and anxiety is avoided and meaning is given to individual lives. Turner (1991:532) describes this as "the sense of trust that comes from being able to reduce anxiety in social situations". The Islamic values, once understood logically and objectively by the respondents, facilitated their understanding of technology and reduced the threat of uncertainty, which created a stable environment and consequently ontological security for individuals. In this respect, the Islamic value (halal) had acted as an enabler in the smooth adoption of technology (R3E, R4E, R5E, R1E).

6.5.2 Power and Domination

On the concept of power and domination the respondent R1E was recognised as an established and experienced farm manager with a good track record and reputation in poultry industry, which legitimised his position within the farm. The farm's performance in remaining disease free for a substantial period of time was due to the authoritative

structures of domination brought about by R1E. Giddens (1984) explains authoritative structures of domination in the following way: authoritative structures of domination are constructed through the institution's authority relationships involved in mobilising power, which is related to the way interests of different groups are represented in a social group. Giddens (1984) further explains the relationship of authoritative structures and legitimation structures as being connected through the institution's authority relationship, since the authority relationship may be normative in generating a view of which interests are perceived as legitimate. The control over the customised training programmes, and participation in poultry related conferences and exhibitions (R1E), provided the mechanism for structures of domination in allocative resources.

6.5.3 Legitimation and Sanctions

Modality of norm with the two components of legitimation and sanctions was evident in the development of the farm's directives, which were the outcome of a series of consultations and training sessions (R1E, R2E, R3E, R4E). Sharing the knowledge of the risks posed by the supply market legitimised the adoption of technology, as it was perceived necessary. The role of Islamic values in general and acting to some degree in accordance to halal requirements was claimed by R3E, R1E, and R5E to have been both legitimising and sanctioning.

6.7 Explanation Building

6.7.1 Modality of Interpretive Scheme

Signification and communication are two interlinked components of the interpretative schemes of Giddens's structuration theory. Rogers (2003) explains communication as a "process of sharing information between participants for reaching a mutual understanding" and communication thus plays an important part in promoting levels of adoption. In the technology adoption literature it is argued that it is through communication that individuals make sense of innovation in order to accept or reject it. The analysis of data in this project has shown that in terms of interpretative schemes for the five case studies the areas of significance have been strategy development/directives and communication.

6.7.2 Development of Strategy

Three of the case studies had developed a documented strategic development plan where as the other two had a pragmatic plan (Case D, E). In all five cases the decision for the strategic technology plan was reached at the senior management level. A top down bureaucratic approach with development and consultations was evident in all case studies. The literature on technology adoption suggests that top managers that develop strategy need to consider stakeholders at all levels. The findings from this study demonstrate that this was addressed by developing adequate and relevant bespoke training courses. The training and support programmes helped to increase the rate of compliance with technology and in all five cases technological solutions were perceived to provide future prosperity.

6.7.3 Communication

There were two methods of communications; communication through mass media and face-to-face communication through one to one meetings and training and support sessions. Diffusion is also a kind of communication where the message communicated is about a new idea (Rogers, 2003). The use of institutional intranet and email services formed a channel of communication in two of the case studies (Case A, C). Despite the availability of this method of communication in reaching a large number of staff it was evident that many were unaware of the strategy plan. Rogers also argues that mass media communication messages are not effective in influencing levels of adoption as they often fail to deliver the specific messages needed by individuals to confirm their beliefs. The need for a clear vision has been the subject of recommendation from a number of studies (Surry, 2005; Fish 2007). In Case C an innovative method of using animation and diagrams generated more interest and better understanding of the initiative as it provided a discursive knowledge and enabled the respondents to rationalise and explain their actions.

In all cases there was a claim that face-to-face interpersonal communication was provided. Rogers (2003) argues that once individuals have established a need for innovation then they are ready to enter into exchanges about that innovation, with the exemption of early adopters for whom interpersonal influence is not necessary because they possess a venturesome orientation and are able to cope with uncertainty. From the analysis provided it is evident that the majority of staff members in all five cases were early adopters.

6.7.4 Summary and Propositions

Overall the findings from this project demonstrate that:

1. Decision making about technological strategy rests with senior management
2. Top down communication approaches are useful
3. Interpersonal interactions are used to provide support and motivation

A clear strategic vision has been cited in the literature as a requirement for a successful un-fragmented adoption of technology. In all case study scenarios the strategic vision for the adoption of technology was in answer to the call for survival. This message was communicated and received by the majority of staff members and hence the following propositions can be formulated:

P1: A top down communication approach based on interpersonal interaction influences the adoption of technology

P2: For adopters of technology institutional technology strategies are significant.

6.7.5 Social Positioning

According to Giddens (1984) the positioning of the actor in social encounters is fundamental to social life. The managers that were responsible for ensuring the successful operation of the farm and the smooth integration of technology had social status and this helped them in their duties (Case C, D, E). In Case E, the farm manager was granted the social positioning rather than this being self-imposed, and was regarded as an expert because of his track record. Managers with social position were looked upon, as managers with a mandate to 'challenge existing practices' and 'push the boundaries. In all five cases social positioning status was also afforded to the veterinarian doctors because of their expertise. Giddens (1984) refers to this type of social positioning as giving an actor definite identity within a social group.

6.7.6 Motivational Factors

The respondents of the five case studies identified different intrinsic motivations for the adoption of technological innovations. These motivations included pragmatic drivers such as improving the mortality rate of the flock (Case D), detecting fake and fraudulent

supplies (Case B), reducing mistrust of the supply market (Case D), the desire to succeed and intrinsic drivers such as curiosity towards new innovations. Other factors that were identified included animal welfare and environmental issues (Case E) from an Islamic (halal) perspective. Respondents from all five case studies that had interaction and were engaging with the supply chain questioned the integrity of the supply market. Breakdown in the relationship of trust and confidence was the result of supply market exhibiting characteristics associated with what is opposite of halal, which is called haram (forbidden, not permissible). This further confirms that for a true halal product (wholesome) all the entities of production from farm to fork must be included in the halal certification. Halal is not only non-cross contamination with haram and the method of slaughtering, but it is about the complete cycle of production – as it was originally intended – to include the treatment and welfare of the animals.

6.7.7 Psychological Anxiety

Rogers (2003) suggests that "preventive innovation" occurs when the avoidance of an unwanted event in the future is the reason for the individual's adoption of a new idea. At case farms C, D and E preventive innovation was one of the motivating factors for the adoption of technological change to shield the institution from market uncertainties and the danger of bankruptcy.

6.7.8 Ontological Security

The analysis of the case study farms illustrated an underlying trend that some members of staff were reluctant to trade their old ways of working for new technology; instead they wanted to maintain the status quo. This is defined by Giddens (1984) as ontological security, keeping the same routine behavioural pattern in order to continue to experience positive and stable emotions and to avoid the uncertainty and not knowing that is associated with change. Although ontological security might have serious implications for the adoption of new technology, our case studies revealed that ontological security was overcome in the form of technically informative and educational training sessions, which were perceived to be consistent with the respondents' perceptions of their roles.

6.7.9 Summary and Propositions

The findings can be summarized in the following way:

- Social positioning can increase the rate of adoption
- Social positioning is either self-imposed or implied by others
- Psychological anxiety is a motivator for adoption
- Halal

The findings of this study have shown that individual feelings of anxiety can be an important factor in the adoption of new technology. This study has therefore confirmed the findings from other studies that suggest preventive innovation as a motivator (Kelley, 2003; Smith, 2001). The analysis show that absence of halal in the social system led to mistrust of the supply chain and acted as a motivational factor when present. The following propositions are offered in relation to psychological anxiety and motivational factors:

P3: Contextual and intrinsic drivers are motivational for the adoption of technology.

P4: Halal is critical as a guiding principle

P5: Social Positioning increases the rate of adoption

6.8 Modality of Facility

The two interlinked components of modality of facility are the concepts of power and domination and these are linked to allocative and authoritative resources. Rose (1998) states that as components of power individuals draw on these two resources to influence others. In this study the use of power and domination is evident in various resources of strategic plans, senior management and centralised structures.

6.8.1 Top down and Bottom up Approaches

Individual users of technology are often motivated to initiate innovation and findings suggest that this bottom up approach has more chance of succeeding than a top down approach (Carr, 1999). The hierarchical command and supporting centralised structures

controlled by management had restricted the process of innovation in Case A and C. The strategy at Case B, D and E was designed to encourage bottom up approaches, which was in line with the literature that recommends that senior management must recognize that innovative ideas can originate from individuals or from a small group (Roffe, 2004).

6.8.2 Authoritative Resources

Rogers (2003) discusses the concept of "authority innovation" as a situation where the organisation's leaders make decisions without meaningful input from the potential adopters. There were variations in approach to the diffusion of technology in the five case studies. But the top down approach in which a few individuals at the top made the diffusion decisions was common in all the cases. The top down approach seemed to have been an accepted method of diffusion amongst the respondents except for a few that expressed concerns about the lack of consultation (Cases A, C).

6.8.3 Centralised Structures

In all the case studies the institutions' technical support and training were coordinated and delivered through centralised units. The members of these units were perceived to be experts in their area and the model of knowledge transfer and communication was therefore constructed as a linear model. Some of these units employed innovative ideas in order to make a better contact and encourage engagements (Case D, E, B). From Giddens's perspective these material resources of training and support are not considered significant since they have no structural relevance; in other words they have a virtual existence but they will only be relevant if they are instantiated in situations through structural principles and the activities of agents (Giddens, 1987). In case studies D, E and B the instantiation of training was evident in the activities of agents in adopting and engaging with technology.

6.8.4 The Role of Management

Support from senior management was perceived to be an enabler in all the case studies. In Case B respondents claimed that the support of local management was an encouraging factor that led to an accelerated adoption of technology. The interpersonal interactions and communication between individuals and the section managers proved to be an effective factor in motivating members of staff to adopt the technology in cases B, E, D. In these

case studies the role of middle management was evident and active in all levels. The support of senior management was perceived to be significant.

6.8.5 Summary and Propositions

In summary we can state that:

- There were variations in top down and bottom up approaches
- Centralised support systems were initiated through a top down approach
- Members of staff perceived top down and centrally managed structures as appropriate
- Allocative resources were effective only when materialised in the activities of agents

Technical training and ongoing support is referred to as a necessity in the literature (Surry, 2005). The findings from this study show that allocative resources such as technical training and support were actualized in situations through structural principles. The following propositions can be formulated:

P6: Centralised support and training mechanisms are significant when they are used in situations by adopters.

P7: Senior management plays a significant role in the adoption of technology

6.9 Modality of Norm

The third modality in Giddens's duality of structure concerns norms; understood as the moral codes that govern the understandings and sanctions of human interactions. These moral codes are both empowering and constraining when legitimizing or sanctioning individual interactions in the adoption of technology.

6.9.1 Top down Directives

In three of the case studies there were directives that needed to be adhered to (Case E, D, B) and sanctions for non-compliance could come in the form of mild reminders (Case C) or reports to higher level management (Case D). The directives proved to be more

effective than local authority directives, as there was a perception that local authority directives could be subject to compromise and rule bending while institutional directives would not be compromised (Case D, E). Senior management adopted mechanisms that to some extent encouraged the practice of the moral code of halal in promoting honesty and good practice amongst all the staff and in particular the operational staff (Case B, D, E). In all cases members of staff interviewed did not report any severe sanctions and there was a perception that directives were helpful and constructive. Giddens (1984) expresses the view that in the face of the most oppressive sanctions individuals are not wholly incapable of resisting.

6.9.2 Authoritative Management

In all five cases there was no objection to the adoption of technological solutions, but there were challenges in the form of the 'fear of change' associated with the introduction of new practices, which resulted in the slow rates of adoption (Case A, C). Top down directives were accepted and deemed necessary. Although this approach was viewed as a way of controlling and monitoring the activities of a large number of personnel it was seen as necessary, not least because the critical state of the supply market justified it as means of survival (Case D, B).

6.9.3 Peer Influence

The CEO of Case C confirmed that the decision for adoption of technology and the establishment of a modern industrialised poultry farm was inspired by the success of others. Rogers (2003) states that the exchange of ideas takes place more fluidly between those who think alike. In the case of plant B the adoption of technology was reached as the way forward from early on and the success of the company within a short period of time was copied and imitated by others in the industry, as they were perceived to be the pioneers. Social learning theory argues that people learn new behaviours by observation and replication of novel behaviour demonstrated by others and once positive outcomes are detected they are more likely to adopt that behaviour.

6.9.4 Summary and Propositions

The following summarises the findings:

- Top down directives have had a positive impact

- Directives need acceptance and compliance from adopters to be effective
- The successful adoption of technology by peers significantly encourages adoption by others

Findings from this study contradict the literature on top-down approaches, which suggest that top-down approaches can have a negative influence (Oliver, 2005). The findings from this study revealed, that in the poultry domain the opposite is true: in terms of structuration theory the domination of technology through top down directives has been asserted successfully. The success of peers as opinion leaders in the adoption of technology was confirmed by all five case studies. The following propositions can therefore be derived:

P8: Top down directives influence the adoption of technology

P9: Peers can have a positive influence on the successful adoption of technology

Figure 6.1 demonstrates the factors that have been identified to influence the adoption of technology in poultry farming in Iran.

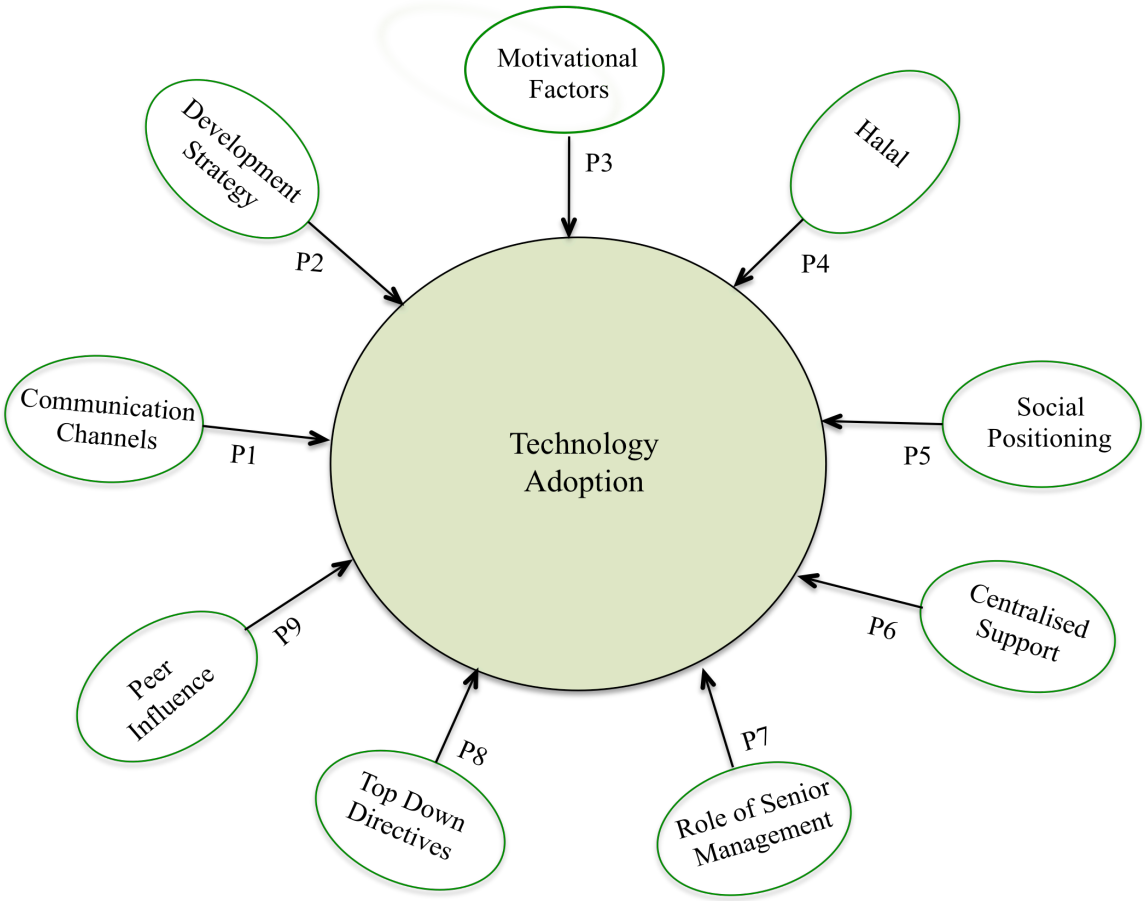


Figure 6.1: Technology Adoption and Diffusion Model Influencers

The model has realised one of the objectives of the research by proposing a model that incorporates factors influencing adoption of technology from a halal perspective.
This model has emerged from the final level of analysis of the study based on Giddens's theory of duality of structure with which both institutional attributes and individual perceptions are taken into account to establish a link between macro level and micro level interactions. The factors influencing adoption are formulated in nine propositions.

Technology adoption depends on the perception of change or stability in terms of the interactions between individual and organisational influences (Hung, 2004). Carr (1999) is of the opinion that adoption theories should concentrate on the potential adopters and contextual characteristics in which they use the technology. For halal poultry production

to reach its optimum potential not only the business functions and business flows must be coordinated within the company and across the supply chain, but also halal should be treated as one of the structural properties.

6.10 Chapter Summary

In this chapter a discussion in relation to the themes and sub themes that emerged from the concurrence of views across each case study based on Giddens's theory of structuration were presented and discussed. A number of sub-themes such as communication, support and training, and resources were identified as enablers of technology adoption. The top down communication approach was the theme of communication in all five cases and proved accepted by the participants as an effective mode of communications. The local context also played an important role in the adoption of technology. Analysis revealed that psychological anxiety as a result of a lack of trust in the poultry supply chain had acted as a motivator to technology adoption in order to regain confidence in the supply chain products. The role of allocative and authoritative resources in establishing domination by controlling the training sessions and providing support were discussed in each case. A common theme of 'preventive innovation' caused by the external pressures from the supply chain was identified in all five cases.

The blended technology approach adopted by case study B has proved successful in recognizing the local needs and in providing solutions in relation to the local context. This approach and positive attitude towards change exhibited by the management demonstrated the characteristics of innovators and early adopters. Halal as an Islamic dictum and guiding principle was claimed to have been ignored and in many cases not fully understood by the participants, thus leading to a breakdown of trust between the co-workers as well as different entities in the supply chain. Except for Case E, there were no effective mechanisms to communicate the available technology plan or directives to the rest of the staff. The evidence of cultural norms influencing the adoption of technology was discussed. In Case D the use of sanctions were perceived as justified as they enabled for sustainability. The directives issued by local authorities were not treated seriously as they could easily be compromised; however the farm's directives were taken seriously.

The analysis of data has shown that in terms of interpretative schemes for the five case studies the areas of significance have been strategy development and communication.

Three of the case studies had developed a documented strategic development plan whereas the other two had a pragmatic plan (Case D, E). On the question of communications there were two methods implemented: communication through mass media and face-to-face communication through one to one meetings and training and support sessions. A clear strategic vision has been cited in the literature as a requirement for a successful un-fragmented adoption of technology. In all case study scenarios (except Case A) the strategic vision for the adoption of technology to a large degree was in response to external pressures. Nine propositions were proposed from the analysis of the following topics; development of strategy, communication, motivational factors, psychological anxiety, ontological security and role of management in line with authoritative management. The propositions were used to construct the technology adoption and diffusion model.

CHAPTER SEVEN: CONCLUSION AND FUTURE WORK

7.1 Introduction

The aim of this chapter is to discuss the contribution of the thesis to the theoretical knowledge and methodology made by the research. The chapter discusses the limitations of the research and provides suggestions for future studies.

The aim of this research was to investigate: how does structure enable or constrain the adoption of technology within the construct of a halal concept (which is about do's and don'ts for individuals, in relation to intellectual intakes and nutritional intakes) in the poultry industry in Iran? Through this aim, the research pursued the following objectives:

- To explore the role of human agent, technology and institutional characteristics of poultry farming in Iran
- To explore factors that enable or constrain the adoption of technological innovations in halal poultry farming
- To analyse, within the available information, the role of technology in the diffusion of innovations in halal poultry production in Iran
- To propose a model that captures the effectiveness of diffusion strategies that enable and/or constrain the adoption/implementation of new technologies

The organisational context chosen was that of five poultry farms with different operational structures in the north east of Iran. In order to understand the role of human agency and structure that influences the adoption and diffusion of technology, Giddens' structuration theory was considered to be appropriate, as it focuses on the interplay between social structures and human action. In the investigation of the issues associated with the aims and objectives of this study, eight propositions were formulated. Each proposition helps to understand different aspects of the key question. The conclusions drawn from the analysis of the propositions, along with general findings from the data analysis, enabled the formulation of theoretical statements.

7.2 Role of Technology Strategy

The organisational characteristics and their strategy for diffusion of technology is the focus of propositions 1 and 2. The findings from the case studies showed that senior

management developed technology strategies, except in one case, which received and considered contributions from the potential adopters. This form of organisational centralisation in relation to decision-making, which involves only a small group of people, is negatively associated with the diffusion of innovations (Rogers, 1995).

Analysis from the data collected suggests that poultry personnel perceive development of the strategy as 'work for the management' and the implementation of the strategy as their own work. The findings also reveal that the decision to adopt technology is not influenced by the institutional technology strategy but by motivational, intrinsic, and pragmatic factors (Proposition 3). The data analysis discloses a diverse range of reasons why individuals chose to adopt technological innovations, including external pressures from the supply chain, interventions from authorities, and a desire to succeed and fight for survival. These diverse motivators provide an in-depth insight for customising institutional frameworks. Proposition 7 provided evidence that poultry farm staff are obedient, and at the same time active recipients of technology strategies.

The centralised support structures were evident in all five case organisations (Proposition 5). These centralised structures were designed to support and facilitate the adoption of technology by training programmes, educational meetings (Case E) and IT support. The majority of the participants in the case studies reported that these centralised supports were effective and engaging. According to Giddens' theory, centralised support structures will only have relevance when they are instantiated in an individual's situation.

Each set of individuals in the case study has adopted their own approach to the diffusion of technology. These range from top-down directives to specific operational directives (Case, D, B, and E). The findings confirmed the need for the senior management to acknowledge that innovation could originate from individuals and that they need to take into account local innovations by developing strategies to incorporate emerging possibilities within a dynamic context.

7.3 The Role of Halal

Except for Case E, in the other case studies the majority of respondents' view of halal was limited to halal slaughtering and non-contamination with haram. They perceived their operation to be halal since Iran is an Islamic country and it has eliminated the risk of

contamination, and the ingredients they use are also halal. The participants cited regulations from the Jahade Keshavarzi (Ministry of Agriculture) governing the use of antibiotics and the size and number of birds in a cage as animal welfare issues and in compliance with halal. This is a limited and simplistic view of halal, in which important issues such as spirituality and the purpose of halal, which is associated with product integrity, cleanliness and a high standard of production, are overlooked. It is important to draw attention to the unacknowledged conditions and unintended consequences of intentional or unintentional actions of ignoring the role of halal as an Islamic dictum within halal poultry production, which must be examined through the dualism of action and structure. Data analysis also revealed that there are instances of local authorities' inspectors compromising the rules and regulations issued by the ministry, which undermines the effectiveness of these rules and regulations.

The Shia perspective on halal is based on Ali's teachings, which provide a deeper and more comprehensive meaning of halal It is this understanding of halal that Islam tries to embed in the decision-making process, establishing an awareness of how to manage one's worldly activities and give purpose and direction to the seeds of change that exist in every act. The empowering dynamic of this is to generate an intention to do good (halal) and avoid any act that is not halal (forbidden: haram). The majority of the respondents did not view halal from this perspective, although all the veterinary doctors did complain about widespread fraud (haram) and dishonesty (haram) that existed in the value chain. They perceived these threats as directly endangering and interfering with their work. This is in direct contradiction with the concept of halal and its association with trust and integrity. Halal food is to be regarded as an excellent standard of quality, produced with respect for animal welfare, environmentally friendly and socially responsible (Tiemman, 2014).

Tannenbaum (1991) states that there is an understanding that the term animal welfare refers to both scientific aspects of describing the mental and physical status of the animal, and value aspects in terms of moral considerations regarding the animal's quality of life. The study learnt that due to Iran's poultry market conditions, some egg-producing farmers practice forced moulting even up to four times a year; forced moulting is the biggest welfare issue for laying chickens (Kristensen and Wathes, 2000). This is in contradiction with the Quran that emphasises in over two hundred verses the humane treatment of

animals.

Those respondents from all five case studies that had either direct contact or were indirectly involved with ordering or purchasing from the supply chain voiced their concerns about the breakdown of trust, to the extent that it restricted their dealings with people that they had known for a long time or they used unprecedented methods to secure themselves from financial fraud. From the analysis of the study it is evident that the fragmented poultry value chain in Iran has become a breeding ground for opportunistic dealers and not genuine middlemen, who manipulate and use different entities of the supply chain to compete against each other rather than cooperate with one another. This is in direct contradiction with the definition and purpose of a supply chain and has been one of the destabilisers of the poultry supply chain in Iran.

7.4 Summary of the Findings and Implications

The general contribution of this research to theoretical knowledge, as the first study to outline the potential use of structuration theory as the meta-theory in halal poultry supply chain research, includes: the broadening of scope of structuration theory, the enhancement of the understanding of the interplay between agency and structure, contribution to the dynamics between structure and agency in the context of halal. The data analysis and review of the literature have identified the following key influences in managing the adoption and innovation process associated with technology innovation:

- Pragmatic and intrinsic needs of individuals
- Management tolerance in educational needs of individuals
- Sharing and knowledge management
- Increase in motivational (halal) rewards
- Pressures from external factors

In relation to agency and structure in the adoption of technology, the data analysis has shown that the poultry managers need to adopt their approaches from generally mechanical and process driven to more inclusive and engaging approaches to fully realise the importance and dimensions involved in the adoption of technology.

From the literature, for an ideal supply chain management to reach its optimum potential, the business functions and business flows must be coordinated within each company and across the supply chain. These business functions and flows include: Inter-functional Coordination (trust, risk, commitment), Marketing, Sales, Research and Development, Production, Purchasing, Logistics, Information Systems, and Customer Service. Business flows that lead to customer satisfaction and profitability and finally to competitive advantage include: Products, Services, and Information. The findings from the study showed that poultry farms, with help from technology and halal, have managed to coordinate their business functions. But for the supply chain, the study revealed with the consensus of the majority of respondents that the supply chain in Iran can only rebuild the lost trust if the following points are adhered to:

- Integration of a fragmented poultry supply chain according to the available internationally successful models in reducing the cost and improving the quality of the product which would be beneficial to all the entities involved in the value chain
- The government agencies should act as facilitators to create a stable environment and reduce uncertainty in the market
- Proper integration of the supply chain with contractual production arrangements within a framework of vertical coordination reduces transaction costs and secures benefits from market ownership and control over product quality and safety by controlling technical inputs and processes at all levels
- Poultry market price manipulations through interventionist polices are themselves the source of creating uncertainties in the market which must be stopped
- Exports to rich neighbouring countries from reputable farms

7.5 Review of Research Theory

Giddens' structuration theory principally provided the required ontological and epistemological features needed to understand organisation as a process. In this sense, structuration theory is considered a valuable perspective, mainly because it helps to grasp the dynamics of organisational replication and change as the basis for studying the adoption and diffusion of an innovation (technology) in halal operations. Utilising Giddens' structuration theory also helped to overcome the limitations of objectivist and

subjectivist approaches. Objectivist approaches tend to focus on organisational structures as constraining the activities of individuals, whereas subjectivist approaches are primarily concerned with motivations, and individual experiences. Structuration theory provided an alternative to both these approaches by combining the elements of structure and action into an integrated theoretical framework that provides a means to investigate the influence of external factors and the influence of individuals. This concept provided a useful insight into how agents (poultry personnel) made sense of structure (farm's strategy and support structures).

Giddens views the structure as 'virtual existence' and describes resources in terms of material resources and resources of authority, therefore structures are not materials but exist as memory traces (virtual existence) in the minds of individuals orienting the conduct of knowledgeable individual agents, and as instantiation of rules in situations. Foucault (1976) stated that our ideas become the chains that bind us best. Applying this concept of virtual existence was not an easy task in this study.

Critics of Giddens have pointed out that the theory of structuration overemphasises the role and freedom of the agent at the expense of constraining pressures from the social structures. Giddens' theory is not clear on how much freedom individuals have and how different levels of managed and external pressures can impact upon individuals. The study used Giddens' (1989) recommendation that his theory of structure should be viewed as a sensitising device and all the concepts applied explicitly. Giddens also encourages the critical use of his ideas. As noted by Whittington (1992) 'there is no need for theological purity'. The structuration theory made significant contributions to this research.

7.6 Recommendations for Future Work

This research is significant in being the first study to outline the potential use of structuration theory as the meta-theory in the adoption and diffusion of technological innovation in halal poultry farming in Iran. Findings from this study have provided some important pointers to the key elements in understanding the relationships between structure and agency in a presumed halal production; however, these findings need to be tested by empirical methods to provide more generalised findings in the ongoing process of adoption of technology. Future studies may want to explore how structuration varies between different groups of adopters (innovators to laggards).

This study has contributed to ongoing research by exploring some of the fundamental concepts within socially and technologically constructed social systems. There are limited academic studies on the role of halal as a dictum and a fundamental concept in socially and technologically constructed environments. Halal may seem a sensitive issue in relation to race and religion, and perhaps that is one of the reasons it has not generated a great deal of interest in the research community. However, there are many aspects that can be explored through investigating its supply chain. Another area that requires further research is halal certification for poultry products, which could be extended to include the supply chain entities and animal welfare. It is also recommended that future research be conducted on the element of trust and confidence towards the halal supply chain and halal products.

Studies have established a link between animal welfare and human welfare. With the comprehensive definition of halal (presented in this study) that encompasses the whole life cycle of a product, and which is concerned about animal welfare, environmental ethics and human welfare as agents involved in the production process, examining the links between animal welfare, halal and ecological issues may prove beneficial for public health researchers.

These further studies would generate ideas and recommendations for the effective implementation of technology in halal poultry production in local markets and their preparation for integration into a global market.

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APPENDICES

APPENDIX 1: OVERVIEW OF RESEARCH PARADIGMS

APPENDIX 1A: INTERPRETIVIST PARADIGM

Unlike the positivist paradigm, interpretivism assumes that people interpret their environment to give meaning to it, and that people's actions are governed by particular situations and institutions in which they participate. From an ontological viewpoint, interpretivism accepts that reality is constructed for individuals by their own interpretations of their environment. This perspective allows for an understanding of social phenomena to be achieved, since the researcher does not assume the world to be detached when engaged in an interpretivist enquiry, focusing instead on the subjective interpretations of reality (Denzin and Lincoln, 1994).

The interpretivist paradigm was not perceived to be appropriate for this study for the following reasons. The purpose of this study is to explain the conditions (structure) that aid or hinder the adoption of technology, and the study assumes that such adoption is dependent upon the resources, structures and conditions within which the actors operate. Furthermore, the research study aims to investigate meanings of particular actions associated with adoption of technology in relation to the causal factors. However, despite the usefulness of Interpretivism for capturing complex and dynamic social phenomena, interpretivism does not deal with the conditions and structures which give rise to the meanings, interpretations, actions, rules and beliefs (Fay, 1987). As the adoption of innovation is considered to be a social phenomenon (Rogers, 1995), the study aims to compare subjective perspectives of the respondents, but the findings from studies operating within the interpretivist paradigm are too imprecise or inconsistent to allow comparisons between different people or different environments. Furthermore, such findings do not provide a means of showing that one set of factors, rather than another, plays a key role in bringing about particular outcomes. This study is concerned with discovering how different people and different environments influence the adoption and diffusion of technology, and that focus is not easily accommodated by the interpretivist paradigm.

APPENDIX 2A: CRITICAL THEORY PARADIGM

Constructivism and critical theory are the two major alternatives to positivism in the social sciences (Sobh and Perry, 2006), but the epistemological and ontological positions of these two paradigms were not considered to be suitable for this study. The underpinning belief in these two paradigms is that the reality is constructed' by people

and that external entities have little or no influence on the individual's constructed reality. However, the ontological assumption in this study is that whilst the construction of reality is an important factor, this can indeed be influenced by external structures. In fact, the adoption of technology by individuals has been shown to be linked to number of external entities, such as, organisational structure (Roffe, 2004), levels of training, communication of organisational vision (Fish, 2007) benefits and rewards (Moser, 2007; Weston, 2005), and supporting technical and administrative structures (Beetham, 2002).

From an epistemological perspective, critical theory was not perceived to be an appropriate paradigm for this study for a number of reasons. Whilst, the purpose of this study is to examine and understand the adoption and diffusion of technology, the research method does not assume a subjective relationship between the researcher and the respondents through the sharing of knowledge as expected by critical theory (and Constructivist approaches) (Manning, 1997).

Furthermore, this study aims to understand the phenomenon in relation to the adoption of technology, and not to change the social world within which participants live, as expected by critical theory (Guba and Lincoln, 1994). It is concerned with participants' perceptions about how organisational structures aid or hinder the adoption and diffusion, and it does not aim to change their perceptions in that respect. Finally, an important outcome of critical theory is seen as providing a practical guide for transforming society, and this is not a fundamental aim of this study. For these reasons, critical theory was not perceived to be appropriate for this study.

APPENDIX 3A: POSITIVIST PARADIGM

According to Rogers (1995:23), the adoption of an innovation is influenced by the social system within which the potential adopter operates since that "system binds together members of a group that come together for a particular purpose and facilitates or impedes the diffusion of the innovations". Fundamental to the adoption of an innovation are the opinion leaders, change agents, and champions within a social system who have the

ability to influence the diffusion of such change (Rogers, 1995). As noted by Rogers (1995), diffusion is a social change, defined as the process by which alteration occurs in the structure and function of a social system. When new ideas are invented, diffused, adopted or rejected, leading to certain consequences, social change occurs. The purpose of this study is to examine and explain the nature of the relationship between potential adopters (agency) and organisational mechanisms (e.g. management, administration etc,) within a social system to understand how successfully the innovation is adopted. However, the positivist paradigm is not appropriate for explaining social behaviour as it views individuals as independent, non-reflective objects, and these conflicts with the adoption of innovation, which is perceived to be a social phenomenon. Other research has confirmed this picture of positivism's somewhat incomplete handling of social science phenomena (Sobh and Perry, 2006).

Diffusion investigations show that most individuals do not evaluate an innovation on the basis of the scientific studies of its consequences, but rather, depend mainly upon a very subjective evaluation of an innovation that is conveyed to them from other individuals who have already adopted the innovation (Rogers, 2003). Hence, isthe research question is not rooted in a purely objective 'reality' but is more concerned with the subjective perspectives of the potential adopters in relation to the adoption of eLearning. However, researchers operating within the positivist paradigm attempt to eliminate subjective factors by employing explicit and standardised procedures. In positivist ontology, an objective, true reality exists which is governed by unchangeable natural cause-effect laws. The aim of this study which is to examine the subjective perspectives of the respondents, this conflicts with the ontological position of the positivist paradigm.

It is not the goal of this study to produce universal findings through the use of empirical methods or to develop and verify any hypotheses in order to model the findings in a mathematical sense, or to derive law-like generalisations. Instead, the study aims to provide rich accounts of interactions between agency and structure that are embedded within local contexts. The positivist ontology assumes that reality comprises of stable pre-existing patterns or order that are not context-bound and can be discovered. However, this study does not intend to describe the social world in terms of law-like generalisations through the collection of value-free facts. For these reasons it was not perceived to be appropriate to adopt a positivist approach.

Through the use of interviews, the aim of this study is to examine the subjective perspectives of the respondents in relation to the adoption and diffusion of technology. Inevitably, this research method implies some relationship between the researcher and the researched, and consequently there will be some researcher influence on the data collected. Furthermore, it will be impossible to be totally objective and detached from the research phenomenon. However, in terms of this this aspect of the epistemology, positivism fails to recognizethe the role of the researcher in constructing the phenomena portrayed in data and in the findings. From the philosophical point of view the positivist paradigm views the researcher as an objective investigator and interpreter of a tangible social reality. Consequently, the positivist paradigm supports an approach in which the researcher is distanced from his or her subject matter. The researcher and the researched phenomenon are assumed to be independent, so the researcher is regarded as capable of studying the object without influencing or being influenced by it (Guba and Lincoln, 1994). In their discussion of the researcher's role in such a circumstance, Guba and Lincoln (1994:110) observe: "researcher investigates the phenomenon as if viewing through a microscope or a one-way mirror. When influence in either direction is identified, or even suspected, the findings can be assumed to be contaminated and various strategies are followed to reduce or eliminate this influence". Therefore, from an epistemological standpoint, positivism was not considered to be appropriate for this study.

APPENDIX B: Book Chapter

Remembering the Spirit of Halal: An Iranian Perspective

Abstract

Without a doubt in the last decades the world's market has become familiarised with the word Halal with its common understanding of a product, which is "permissible" and "lawful" according to Islamic jurisprudence. The global rise of interest in Halal matters particularly in Europe or the West maybe viewed within the context of individual liberation and modernity where as in the Middle East and other Muslim countries as well as globalisation pressures there exist other underlying factors that have given rise to expansion of Halal products. Research into the concept of Halal supply and consumption is mainly focused on the physical rather than the spiritual realm. In this chapter we explore a qualitative dimension of Halal as a way of life that is represented by the inseparable nature of knowledge and the sacred from a minority Shi'ism Islam point of view. We examine the reasons for phenomenal expansion of Halal poultry production in Iran as a Shi'ite country and the differences between Shi'ism and Sunnism jurisprudence's of Halal and Haram descriptions. Diversities created by the government's policies are examined by studying an exemplary poultry farm in northeastern Iran.

http://eprints.hud.ac.uk/22495/

APPENDIX B: Field Work Diary

Contact	Date
Contact made with responded R1A	17th May 2013
Initial meeting with R1A and R2A	19th May 2013
Interview with R1A	20th May 2013
Interview with R2	24th May 2013
Interview with R3	27th May 2013
Interview with R4	29th May 2013
Interview with R5	6th Jun 2013
Interview with R6	9th Jun 2013
Interview with R7	12th Jun 2013
Interview with R8	14th Jun 2013

Table 4A: Case Study Diary (A)

Contact	Date
Interview with R1B	17th Jun 2013
Interview with R2B	18th Jun 2013
Interview with R3B	20th Jun 2013
Interview with R4B	24th Jun 2013
Interview with R5B	26th Jun 2013
Contact with R5B	29th Jun 2013
Interview with R6B	29th Jun 2013
Interview with R7B	1St July 2013
Interview with R8B	2nd July 2013

Table 4B: Case Study Dairy (B)

Contact	Date
Interview with R1C	5th May 2014
Interview with R2C	6Th May 2014
Interview with R3C	12th May 2014
Interview with R4C	14th May 2014
Contact with R4C	15th May 2014
Interview with R5C	15th May 2014
Contact with R5C	17th May 2014
Interview with R6C	19th May 2014

Table 4C: Case Study dairy (C)

Contact	Date
Interview with R1D	20th May 2014
Interview with R2D	21st May 2014
Interview with R3D	22nd May 2014
Interview with R4D	24th May 2014
Interview with R5D	25th May 2014
Interview with R6D	27th May 2014

Table 4D: Case Study Diary (D)

Contact	Date
Interview with R1E	2nd Jun 2014
Interview with R2E	3rd Jun 2014
Interview with R3E	4th `Jun 2014
Contact with R3E	6th Jun 2014
Interview with R4E	6th Jun 2014
Interview with R5E	7th Jun 2014
Contact with R5E	12th Jun 2014
Interview with R6E	14th Jun 2014

Table 4E: Case Study Diary (E)